1341798/2023/TBG-TBG_ENGG

TECHNICAL PRE QUALIFICATION REQUIREMENT

Name of Project : **Talcher Thermal Power Project Stage-III (2X660 MW)**

Name of Customer : **NTPC Limited**

Name of Consultant : ---

Name of Item : **400kV Gas Insulated Switchgear**

TECHNICAL PRE QUALIFICATION REQUIREMENT
For the purpose of qualification of the bidders, experience shall be reckoned as on 06-June-2022 unless otherwise specified. **Route-I:** 1.0) The bidder 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 400 kV 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. **OR** **Route-II:** 2.0) The Bidder should have established manufacturing facilities for GIS equipment in India based on technological support of an associate (who meets the requirement at 1.0 above) and Bidder should have designed, manufactured and supplied at least 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 and a Deed of Joint Undertaking to this effect jointly executed by Bidder and its Associate as per the format enclosed in the bidding document – Attachment 3K. This Deed of Joint Undertaking should be submitted prior to the placement of order on approved vendor. **NOTE:** a) For the purpose of qualifying requirement, one no. of bay shall be considered as comprising of at least one circuit breaker, two dis-connectors and single phase current transformers. b) For the purpose of qualifying requirement, Bidder should meet any of the above two (2) Routes, i.e. either Route-I (Cl. No. 1.0 above), OR Route-II (Cl. No. 2.0 above).

21.12.22

SUPPORTING DOCUMENTS TO BE ATTACHED		
Sr	**Required Criteria**	**Supporting Documents to be submitted by bidder along with technical bid**
1	Manufacturing	Approved Drawings / GTP / Approved Quality Plan / Factory Inspection Test Report e.t.c
2	Supply	PO / Dispatch clearance / LR / Material Receipt certificate at site / installation or commissioning certificate e.t.c
3	Successful Operation	Performance Certificate from End User

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidder's, if applicable.

2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self- attested English translated document should also be submitted.

3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

4. After satisfactory fulfilment of all the above criteria / requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

21.12.22

PREPARED BY

REVIEWED BY
(RANAJIT DEY)
MANAGER/BHEL

APPROVED BY

EXTRACTS FROM NTPC FORMAT ATTACHMENT-3K

(BIDDER TO SUBMIT THE FILLED-UP FORMAT, AS APPLICABLE AS PER THE TECHNICAL PRE-QUALIFICATION REQUIREMENT FOR THIS TENDER)

ATTACHMENT 3K- DOCUMENT(SWITCHYARD) :

Sub: Sub-Qualifying Requirements for 400kV GIS Switchyard.

Cl. 5.13

A) 5.13.1 :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 second, which should have been in successful operation for minimum two (2) years as per stipulated requirements mentioned under Clause no. 5.13.1 of Sub-Section-IA, Part-A, Section-VI of Bidding documents. The details of above are given below:

We 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 715kV or above voltage class with short circuit current of not less than 50 kA for 1 second, which have been in successful operation for minimum two (2) years as per stipulated requirements mentioned under Clause no. 5.13.1 of Sub-Section-IA, Part-A, Section-VI of Bidding documents. The details of above are given below:

Sl. No.	Item Description	Installation(s)
1	Client name and its address	
2	Name & Location of the GIS equipment installation	
3	Name and designation of the Contact person(s) of client Organization with Address, Telephone, Fax and email etc.	
4	Name of Contract	
5	Order ref. & Date	
6	Scope of work executed by us / sub-vendor for aforesaid Contract includes	

Signature of authorized signatory.....

Sl. No.		Item Description	Installation(s)
:	i)	Design	Yes*/ No*
	ii)	Manufacturing	Yes*/ No*
	iii)	Erection/ supervised erection	Yes*/ No*
	iv)	Testing/ supervised testing	Yes*/ No*
	v)	Commissioning/supervised commissioning	Yes*/ No*
7		Details of 400kV or above Bays	
	a)	Voltage level (in kV)	
	b)	No. of bays	
8		Short Circuit current rating (in kA for 1 Sec.)	
9		Date of Commissioning	
10		Date of commencement of successful operation	
11		No. of years in successful operation	
12		Certificate(s) from the client(s) & copy of LOA/P.O. are enclosed along with the bid at Annexure-... to this Attachment-3K	Yes*/ No*

NOTE :

1. For the purpose of qualifying requirements, one no of bay shall be considered as a comprising of at least one circuit breaker, two disconnectors and single phase current transformers.

2. Bidder may give 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.....

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Cl.No. 5.13.2 (a)

We Bidder/Sub vendor..... confirm that we are meeting the requirements specified in clause no. 5.13.2 (a) of Sub-Section-IA, Part-A, Section-I of Bidding Documents, and in support of same we give the following details:

5.13.2(a) We 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 bays 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:

AND

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.

Sl. No.	Item Description	Installation(s)
1	Client name and its address	
2	Name & Location of the Substation/ Switchyard	
3	Name and designation of the Contact person(s) of client Organization with Address, Telephone, Fax and email etc.	

Signature of authorized signatory.....

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Sl. No.	Item Description		Installation(s)
4	Name of Contract		
5	Order ref. & Date		
6	Scope of work executed by us / our sub-vendor for aforesaid Contract includes :		
	i)	Design	Yes*/ No*
	ii)	Construction/ Erection	Yes*/ No*
	iii)	Testing	Yes*/ No*
	iv)	Commissioning	Yes*/ No*
7	Details of 400kV or above Bays		
	a)	Voltage level (in kV)	
	b)	No. of bays	
	c)	Whether Air Insulated Substation/ Switchyard or not	Yes*/ No*
8	Date of Commissioning		
9	Date of commencement of successful operation		
10	No. of years in successful operation		
11	Certificate(s) from the client(s) & copy of LOA/P.O. are enclosed along with the bid at Annexure-... to this Attachment-3K		Yes*/ No*

NOTE :

1. For the purpose of qualifying requirements, one no of bay shall be considered as a comprising of at least one circuit breaker, two disconnectors and single phase current transformers.
2. Bidder may give 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.....

II) For the Associate, providing technological support, to GIS manufacturer having manufacturing facility in India

Sl. No.	Item Description		Installation(s)
1	Client name and its address		
2	Name & Location of the Switchgear (GIS) equipment installation		
3	Name and designation of the Contact person(s) of client Organization with Address, Telephone, Fax and email etc.		
4	Name of Contract		
5	Order ref. & Date		
6	Scope of work executed by Associate of GIS manufacturer for aforesaid Contract includes :		
	i)	Design	Yes*/ No*
	ii)	Manufacturing	Yes*/ No*
	iii)	Erection / supervised erection	Yes*/ No*
	iv)	Testing/ supervised testing	Yes*/ No*
	v)	Commissioning/ supervised commissioning	Yes*/ No*
7	Details of 715kV or above Bays		
	a)	Voltage level (in kV)	
	b)	No. of bays	
8	Short Circuit current rating (in kA for 1 Sec.)		
9	Date of Commissioning		
10	Date of commencement of successful operation		
11	No. of years in successful operation		

Signature of authorized signatory.....

ATTACHMENT - 3K
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Sl. No.	Item Description	Installation(s)
12	Certificate(s) from the client(s) & copy of LOA / P.O. are enclosed along with the bid at Annexure-.... to this Attachment-3K	Yes*/ No*

Note :

1. For the purpose of qualifying requirements, one no of bay shall be considered as a comprising of at least one circuit breaker, two disconnectors and single phase current transformers.

2. Bidder may give 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.....

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Cl. No. 5.13.3

A) **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 Sub-Section-IA, Part-A, Section-VI 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 Sub-Section-IA, Part-A, Section-VI of Bidding documents. The details of above are as under:

I) **For Bidder/sub-vendor's having GIS Manufacturing facility in India**

Sl. No.	Item Description	Installation(s)
1	Name & Location of the GIS manufacturing facilities	
2	Name and address of the associate providing technological support with Telephone, Fax and email etc.	
3	Whether manufacturing facility for GIS available in India based on technological support of Associate	Yes*/ No*
4	Client name and its address	
5	Name & Location of the GIS equipment installation.	
6	Name and designation of the Contact person(s) of client Organization with Address, Telephone, Fax and email etc.	
7	Name of Contract	
8	Order ref. & Date	

Signature of authorized signatory.....

Sl. No.	Item Description		Installation(s)
9	Scope of work executed by our/our sub-vendor's Associate (GIS manufacturer) for aforesaid Contract includes :		
	i)	Design	Yes*/ No*
	ii)	Manufacturing	Yes*/ No*
	iii)	Erection/ supervised erection	Yes*/ No*
	iv)	Testing/ supervised testing	Yes*/ No*
	v)	Commissioning/ supervised commissioning	Yes*/ No*
10	Details of 400kV or above Bays		
	a)	Voltage level (in kV)	
	b)	No. of bays	
11	Short Circuit current rating (in kA for 1 Sec.)		
12	Date of Commissioning		
13	Certificate(s) from the client(s) & copy of LOA/P.O. are enclosed along with the bid at Annexure-..... to this Attachment-3K		Yes*/ No*

Signature of authorized signatory.....

II) For the Associate, providing technological support, to GIS manufacturer having manufacturing facility in India

Sl. No.	Item Description		Installation(s)
1	Client name and its address		
2	Name & Location of the Switchgear (GIS) equipment installation		
3	Name and designation of the Contact person(s) of client Organization with Address, Telephone, Fax and email etc.		
4	Name of Contract		
5	Order ref. & Date		
6	Scope of work executed by Associate of GIS manufacturer for aforesaid Contract includes :		
	i)	Design	Yes*/ No*
	ii)	Manufacturing	Yes*/ No*
	iii)	Erection / supervised erection	Yes*/ No*
	iv)	Testing/ supervised testing	Yes*/ No*
	v)	Commissioning/ supervised commissioning	Yes*/ No*
7	Details of 715kV or above Bays		
	a)	Voltage level (in kV)	
	b)	No. of bays	
8	Short Circuit current rating (in kA for 1 Sec.)		
9	Date of Commissioning		
10	Date of commencement of successful operation		
11	No. of years in successful operation		

Signature of authorized signatory.....

Sl. No.	Item Description	Installation(s)
12	Certificate(s) from the client(s) & copy of LOA / P.O. are enclosed along with the bid at Annexure-.... to this Attachment-3K	Yes*/ No*

Note :

1. For the purpose of qualifying requirements, one no of bay shall be considered as a comprising of at least one circuit breaker, two disconnectors and single phase current transformers.

2. Bidder may give 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.....

ATTACHMENT - 3K
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SUPPORT FOR SATISFACTORY PERFORMANCE OF 400kV GIS FOR TALCHER-III TPP (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):

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

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

DOCUMENT No.	**TB-419-316-001**	Rev. No.	**01**	Prepared	Checked	Approved
TYPE OF DOC.	**TECHNICAL SPECIFICATION**		SIGN	**Sd/-**	**Sd/-**	**Sd/-**
TITLE			NAME	**PC**	**RD**	**VK**
400kV Gas Insulated Switchgear			DATE	21/12/22	21/12/22	21/12/22
			GROUP	**TBEM**	W.O. No	-
CUSTOMER	**NTPC Ltd.**					
PROJECT	**400kV GIS at Talcher Thermal Power Project Stage-III (2 X 660 MW)**					
NOA NO.	**CS-4540-001A-2-SCNOA-7228 Dated 27-Sep-2022**					
Station	**Talcher, Orissa**					

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
01	06/02/23	PC	RD	VK	TS updated as per Purchase Committee remarks.

Distribution	To	TBEM	TBMM	TBQM	Vendor
	Copies	1	1	-	-

Section – 1

1. SCOPE, SPECIFIC TECHNICAL REQUIREMENT, BILL OF QUANTITIES

This technical specification covers the requirements of design, engineering, manufacturing, testing at works, inspections, packing, loading at works, transportation to site, supervision of unloading and verification of material at site, supervision of erection.

The scope also includes testing and commissioning at site of complete 400kV Gas Insulated Substation (GIS).

This section covers the scope and quantities of 400 kV GIS. The Specific Technical Requirements for the above item as specified by the customer are given in Section-2. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

In case of any discrepancies between the requirements mentioned under Section-1, Section-2 and those specified in the Section-3, the order of precedence shall be as follows:

Statutory Regulations
Section-1: Scope, Specific Technical Requirement, Bill of Quantities
Section -2: NTPC Specification
Section -3: Project Details & General Specification

Note: The terms used in this specification namely, "Employer/Purchaser/Owner" refers to NTPC/ BHEL & "Contractor/ Sub-contractor/Manufacturer/Bidder" refers to successful bidder.

1.1 PROJECT INFORMATION:

a)	Project	**400kV GIS at Talcher Thermal Power Project Stage–III (2X660 MW)**
b)	Customer	**NTPC Ltd.**

The 400 KV GIS shall have three single phase construction, one and half breaker arrangement (I-Type) having the following bays:

a) Two (2) Nos. fully equipped Generator Transformer Bays.

b) Two (2) Nos. fully equipped Station Transformer Bays having controlled switching facility.

c) Four (4) Nos. fully equipped Line Bays.

d) One (1) No. fully equipped Spare Bay (Future Line Bay).

e) One (1) No. fully equipped Bus Reactor Bay having controlled switching facility.

f) Three (3) Nos. fully equipped Tie Bays having controlled switching facility.

g) Two (2) Nos. fully equipped Tie Bays.

h) Two (2) Nos. fully equipped Bus Voltage Transformer Bays with Bus Isolator and Grounding Switches.

i) Two (2) Nos. Bus Surge Arrester Bays.

This is the brief description of 400kV GIS to be supplied, however same is to be supplied as per detailed bill of quantities (BOQ) enclosed as Annexure A of Section 1 & Bidder to ensure completeness in all respect of the offered GIS & GIB system along with auxiliaries & accessories.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

S.No.	Technical Parameter	Unit	Value
1	Type of GIS	Indoor Type	
2	Location	Place: Talcher District: Angul State: Orissa	
3	Design Ambient Temperature	°C	50
4	Design relative humidity	%	95
5	Nominal Voltage Class	kV_{rms}	400
6	Maximum System Voltage	kV_{rms}	420
7	Rated Frequency	Hz	50
8	Number of Phases	Nos	3
9	Lightning Impulse Withstand Voltage	kV_{peak}	±1425
10	Switching Impulse Withstand Voltage	kV_{peak}	±1050
11	Power Frequency Withstand (for 1 min rms) Phase to Earth & Between Phases	kV_{rms}	650
12	Maximum Fault Level (1 second)	kA	63
13	Dynamic Withstand Current	kA_{peak}	157.5
14	Rated Continuous Current Capacity (Bay)	A	3150
15	Rated Continuous Current Capacity (Bus), Minimum	A	3150
16	Leakage Rate of SF_6 Per Annum for Each Compartment Individually as well as Complete Installation, Maximum	%	0.5
17	PD Level for GIS	picoCoulomb	Less Than 5
18	Minimum Total Creepage Distance For Outdoor Equipment	mm	13020
19	Type of Earthing	Solidly grounded	
20	Duty Cycle of Circuit Breaker	O – 0.3 sec – CO – 3 min - CO	
21	Operating Mechanism of Circuit Breaker	Pneumatic/Spring/Hydraulic/ a Combination of These	
22	LT Auxiliary Supply		
22.1	AC	415 V (±10%, 3 Phase, 4 Wire, Solidly Earthed)	
22.2	DC	220 V {(+) 10% to (-) 15%, DC, 2 Wire, Unearthed}	
23	Permissible Frequency Variation	%	+3 to -5
24	Combined Variation of Voltage and Frequency	%	10

Notes:

1. All current carrying components of the equipment specified shall be capable of continuous operation at the specified rated current without exceeding the maximum temperature rise specified in the relevant IEC standards.

2. Thermal calculations shall be based on the climatic conditions as per technical specification.

3. Bidder shall offer their latest type tested compact model to accommodate in the specified & allocated space. In case, bidder fails to meet above requirement, its technical offer is liable for non-evaluation.

4. Bidder shall conduct insulation co-ordination & very fast transient overvoltage (VFTO) studies in line with IEC 60071 for establishing suitability of surge arrester rating, and any other technical requirement for successful operation of GIS. Prices for VFTO study shall be included in the price quoted for Insulation Co-ordination study.

5. 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.

6. Bidder shall submit 3D model (surface model/ light weight model) compatible with primtech/ any other 3D software for complete GIS and its accessories.

7. GIS building shall have an EOT (Electric overhead travel) crane of capacity 8T, which shall be provided by BHEL/ NTPC, however bidder shall provide all the other technical requirements for EOT crane for suitability of crane for installation and maintenance of GIS including EOT crane capacity calculations.

8. 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 equivalent of BPS / BOQ item under head “Gas Insulated Bus Duct” shall be operated for additional length of Main Bus, subject to such shifting is not attributed to bidder.

9. Bidder shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, sending end source reference etc.

10. All supporting structures including foundation bolts/ fixing bolts/ embedded plate/ chemical anchor bolts and hardware etc. required for fixing and erection of GIS and bus duct shall be in bidder scope.

11. Fixing and erection materials of GIB duct including foundation/ fixing bolts/ embedded plate shall be in bidder scope of supply.

12. All hardware and structures required for fixing and erection of GIS on GIS floor including foundation/ fixing bolts/ embedded plate shall be in bidder scope of supply.

13. All supporting structures including foundation bolts/ fixing bolts/ embedded plate/ chemical anchor bolts and hardware etc. for the SF6 duct connections between the SF6 to air bushing and the GIS duct shall be in Bidders' scope.

14. For online continuous partial discharge monitoring system, the requirement of any structure materials, hardware, cabling work and other associated items etc. for completion of complete system shall be in the scope of bidder. The online PD system shall have provision (necessary compatible ports etc.) for integration with Substation Automation System (SAS based on IEC 61850 Edition 2). Tentative distance between GIS room & SAS room shall be 100 meters.

15. Bidder shall ensure supervision of installation, testing and commissioning of all supplied sub-system of GIS, including online gas monitoring/ partial discharge system etc.

16. The quantification including details, supply and supervision of installation of interconnecting cables including cable tags, glands, ferrules, lugs etc. between GIS to LCC and between LCC to LCC shall be in the scope of bidder.

17. GIS shall be designed in such a way that suitable walkways are provided all around the switchgears so that the operators will be able to have free access to all the operating mechanism.

18. 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.

19. Each end of the main bus bars of GIS shall be designed for convenient future extension of the switchgear and related technical details shall be provided by bidder to meet the requirements of other make /GIS supplier.

20. Controlled Switching Device (CSD) shall be supplied for ST/Reactor/associated Tie Bay Circuit breakers. CSD shall be mounted in respective GIS Bay LCC Panels. Special cable, if required for integration is deemed to be included in bidder's scope.

1.3 Other General Requirements

The other general requirements for the equipment (420kV Gas Insulated Switchgear & its accessories) shall be as follows:

1. Schedule
   - Bidder shall submit detailed bar chart for engineering approval, site installation, testing and commissioning activities.
   - In addition to this, packing of GIS & its accessories shall be suitable for long term storage without any deterioration in quality and performance (min. 2 years).
2. Open/ closed store
   - Open/ closed store area shall be provided by BHEL, However, bidder shall provide their tentative space requirement for covered and/ or open store area during tender stage only. In addition to this, bidder shall submit their standard storage instruction manual specifically specifying the item with type of storage.
   - In addition to this, bidder shall also provide their standard recommendations for precautions to be taken during unloading and storage etc. for approval of BHEL/ NTPC.
   - Supervision of unloading of materials at site, supervision for storage in open/ closed store as per requirement shall be in bidder's scope.
   - During storage of materials in BHEL provided open/ closed store, watch and ward shall be provided by BHEL.
3. Office facility at project site
   - Office facilities including sitting arrangement, stationary, printer etc. for OEM/ bidder's staff at project site shall be in BHEL scope.
   - Arrangement of drinking water and electrical supply for official work shall be provided by BHEL, however, personal protective equipment for bidder/ OEM's staff /workers shall be in bidder's scope.
4. Transportation of Special Tools & Tackles, Testing Instruments
   - Transportation of special tools & tackles, testing instruments, special plant including HV test on returnable basis is deemed to be included in bidder's scope, however unloading/ loading, unpacking/ packing and shifting at working place shall be in BHEL scope.
5. Power supply for construction/ testing
   - For construction/ testing requirements, the necessary power supply at site shall be provided by BHEL at suitable point free of cost.
6. Site Installation, Testing & Commissioning
   - Special tools & tackles for installation and testing kits for testing & commissioning shall be in bidder's scope, however, it shall be brought at site on returnable basis only.
   - Bidder shall provide list of general tools, tackle, slings, spanners, gauges, slings and other lifting devices, drills, instruments, testing kits and appliances necessary for the complete assembly, installation, gas filling, maintenance, site testing of the GIS, however, it shall be arranged by BHEL/ its sub-contractor.

- Bidder shall arrange all Consumables as per manufacturer requirement for successful erection, testing & commissioning.
- HV test kit required for HV testing and partial discharge measurement shall be provided with operator along with valid calibration certificate by bidder on returnable basis. HV test kit shall be brought at site multiple times as per site requirements, for reasons not attributable to BHEL/ NTPC.
- Bidder shall depute his qualified testing & commissioning engineer at site for successful testing and commissioning of GIS system.
- Bidder shall submit complete methodology for conduction of site tests for further approval of BHEL/ NTPC before testing & commissioning activities.
- GIS bays may be commissioned at different point of time depending on the site conditions and as per L2 schedule for the project, and hence deployment of the resources at multiple times at site by bidder in line with actual requirement is envisaged and payment for the same shall be made to bidder, for the reasons not attributable to bidder.

7. Earthing of GIS
   - Bidder to submit detailed calculations, sizing and layout drawings for earthing system during detailed engineering stage. Bidder to provide the bill of quantity for entire items required for the earthing of the GIS. However, supply of 40mm MS ROD, 75X12/ 50x6mm GI Flat & erection of earth mat shall be done by BHEL under supervision of bidder/ manufacturer as per manufacturer's design. Any other earthing material except 40mm MS Rod, 75x12/ 50x6mm GI Flat, if required shall be in bidder's scope of supply only & bidder shall quote price for the same against the relevant items of price schedule.
   - Earthing design philosophy shall be submitted by bidder in line with customer technical specification and guidelines of IEEE Std 80 and other applicable standards.
   - If any other special earthing including high frequency earthing etc., if required shall be in bidder's scope of supply.
8. Modular Design
   - The GIS switch gear shall be of modular design offering high degree of flexibility. Each module shall be complete with SF6 gas circuit breaker, disconnectors, Maintenance Grounding switches, fast Earthing switches, voltage transformers, Current transformers, bus sections, Gas Insulated Bus-duct, local control cubicle and all necessary components, as applicable, required for safe & reliable operation and maintenance.
   - The bus enclosure shall be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus.
   - Documents indicating sequence of repair work steps and description of necessary restrictions during work shall be submitted during detailed engineering stage.
   - Each bay module should be equipped with suitable arrangement for easy dismantling and refitting during maintenance without disturbing other units.

- Bus duct lengths shall be taken from the end of bay equipment (VT, LA etc.) to end equipment (SF6 to air bushing/ connection etc.) and Tees/ bends/ elbow required for completion of gas insulated bus duct connection shall be treated as part of the price quoted against gas insulated bus duct only.
- All steel structure members shall be hot-dip galvanized after fabrication. Unless otherwise specified, minimum mass of zinc coating for Galvanizing shall be 610 gm/square meter. All field assembly joints shall be bolted. Field welding shall not be acceptable. Non-corrosive metal or plated steel shall be used for bolts and nuts throughout the work. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, nuts and washers shall be provided to fasten the switchgear base frames to the foundation channels.

9. Future Extension of GIS
   - The GIS system shall be suitable for future extension on either end. The arrangement of gas sections or compartments shall be such as to facilitate future extension without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays.
   - The layout shall ensure that GIS bus link section is provided for future extension of the GIS buses to avoid de-gassing and modification of the existing bus. Prices for the same shall be included in Bidder's offered price.
   - The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for maintenance purposes.
10. Service continuity requirements of GIS
    - The GIS equipment with the given bus switching arrangement is divided into different gas compartments. During the work such as a fault repair or major maintenance, requiring the dismantling of a gas compartment for which more than one compartment may needed to be de-gassed, shall be mentioned in the bid.
    - 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.
    - Working conditions, method statements and procedures are to be furnished by the GIS manufacturer in order to ensure equipment and operating personnel's safety and to achieve following service continuity conditions to the extent possible:
      a) For One & Half Breaker switching scheme during a fault in CB compartment, no bus-bar is permitted out of service during maintenance and repair / replacement.
      b) During a fault in GIS compartment other than CB compartment, maximum one busbar and/or one feeder permitted out of service during maintenance and repair / replacement.

11. GIS will be placed in a non-air conditioned building during service.

12. Bidder shall check and ensure adequacy of the system protection for successful operation of GIS. After checking of system/site by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after commissioning bidder shall replace the part unconditionally within 15 days. Further root cause analysis (RCA) shall be submitted and necessary changes to be done as per the RCA report wherever required.

13. No support structure shall be placed within 3 meters around the GIS building periphery.

14. 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.

15. Any Item not quoted mentioning "Not Applicable" in bid price schedule and found applicable as per technical specification and system requirement shall be supplied free of cost by bidder without any time / cost implication to BHEL /Customer.

16. Length & route of GIB is purely indicative and same shall be finalized during detailed engineering stage.

17. BHEL reserve rights to amend Bay sequence during contract stage, no separate claim shall be admissible in this regards.

18. Main Bus 1 / 2 / Transfer Bus etc. Gas Insulated Bus Bars running across the length of the switchgear to interconnect each of the bay modules (as per layout) and necessary interfaces (as applicable under the technical requirement) is deemed inclusive in the scope. The same may or may not be indicated with break-up in BOQ / BPS.

19. SPECIFIC- EXCLUSIONS (NOT IN BIDDER'S SCOPE)

The following items are specifically excluded from the bidder's scope of supply & services:

1. Any scope of supply / services mentioned in Section-2 or Section-3 of technical specification but not having any relationship with GIS, LCC & its Accessories and not covered in Section-1 or BPS / BOQ shall be deemed excluded from bidder's scope.

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

3. Cable laying & terminations, however supervision work & termination of special cables shall be in bidder's scope.

4. Open & Closed stores at site. (Bidder to provide space requirement in tech bid).

5. Local transportation/ conveyance for bidder's engineers shall be arranged by BHEL between local stay and site.

6. Office assistance shall be provided by BHEL including sitting facility etc.

7. Receipt & unloading of material at site except supervision work

8. Terminal connector for SF6 to Air Bushing to conductor or any other interfacing equipment.

9. Watch & Ward of GIS material at BHEL Store

10. Civil Works i.e. GIS Hall, civil works requirement for GIS System.

11. EOT crane, Air Conditioning & Ventilation System, Illumination System & Fire detection & alarm system, however complete input shall be provided for EOT and other system.

12. Control Relay & Protection Panels/ Merging Unit/SCU/Process Bus Panels, Numerical Relays, Bus Bar Protection Panel, SAS & DCS system, ACDB, DCDB, Battery & Charger.

13. 40 mm MS Rod, 50X6 GI Flat & 75X12 GI Flat for earthing.

14. Outdoor AIS Equipments

15. Power & Control cable beyond LCC (except any special cables, if required).

16. BHEL / Customer / BHEL appointed 3rd party inspector travel, lodging & boarding charges during testing / inspection.

1.4 BILL OF QUANTITIES:

Schedule of quantities for supply & services for the equipment (420kV Gas Insulated Switchgear & its accessories) shall be as per ANNEXURE-A for 420kV GIS & its Accessories. However, any supply/ service not appearing herein but required for completeness of the work is deemed to be included in bidder's scope.

1.5 SITE INFORMATION: Refer Section-3 for site information and meteorological data.

1.6 EARTHING/GROUNDING OF GIS:

The earthing of the GIS shall be carried out considering the safety requirements as per relevant standards. All parts to which access is required for maintenance work shall have provision for earthing. In addition after opening of enclosure it shall be possible to have continuity of earth for the duration of work. The continuity of earthing shall be ensured considering electrical and thermal stresses caused by current they may have to carry.

1.6.1 The grounding system shall be designed and provided as per IEEE-80-2013 and CIGRE-44 to protect operating staff against any hazardous touch voltages and electro-mechanical interferences.

1.6.2 The Bidder shall define clearly what constitutes the main grounding bus of the GIS. The Bidder must supply, commission the entire grounding work of GIS viz conductor, clamps, joints, bimetallic strips (for connection between different type of earthing materials), operating and safety platforms etc.

1.6.3 The enclosure of the GIS shall be grounded at several points so that there shall be grounded cage around all the live parts. A minimum of two nos. of grounding connections should be provided for each of circuit breaker, transformer terminals, cable terminals, surge arrestors, earth switches and at each end of the bus bars. The grounding continuity between each enclosure shall be effectively interconnected with links or straps to bridge the flanges. Subassembly-to-subassembly bonding shall be provided to provide gap & safe voltage gradients between all intentionally grounded parts of the GIS assembly & between those parts and the main grounding bus of the GIS.

1.6.4 The enclosure grounding system shall be designed to minimize circulating currents and to ensure that the potential rise is kept to an acceptable level. Each marshalling box, local control panel, power and control cable sheaths and other non-current carrying metallic structures shall be connected to the grounding system of GIS via connections that are separated from GIS enclosures.

1.6.5 The Bidder shall provide suitable measure to mitigate transient enclosure voltage caused by high frequency currents caused by lightning strikes, operation of surge arrester, phase/earth fault and discharges between contracts during switching operation. The grounding system shall ensure safe touch & step voltages in all the enclosures. The Bidder shall provide suitable barrier of non-liner resistor/counter discontinued SF6/Transformer and SF6/ HV cable bushing etc. to mitigate transient enclosure voltage.

1.6.6 Only supply of MS Rod (40mm diameter for outdoor below ground earth mat)

and GI Flat of 75x12 or, 50x6 mm, as recommended by bidder (for earth mesh on floor), shall be in BHEL's scope. Any other earthing material, if required, shall be in bidder's scope of supply and erection.

GIS earthing mesh shall be extended suitably to enable connection to the outdoor switchyard earthmat.

Details of earthing system:

Item	Size	Material
Main Earthing conductor	40mm dia rod	Mild steel
Conductor above ground & earthing leads (for equipment)	75 x 12/ 50 x 6	G.S. Flat Galvanized steel
Rod Electrode	40mm dia, 3000mm	Mild steel
G.I. Earthwire	7/8 SWG	GI

Copper Flat (if required) as per requirement – In Bidder's scope

For Step and Touch Potential the following parameters shall be considered

- Current distribution factor – 1 (one)
- Duration of fault current – 0.5 sec
- Human body weight – 50kg

Grid resistance shall be less than 1(one) ohm.

1.7 TECHNICAL PRE QUALIFYING REQUIREMENTS:

For the purpose of qualification of the bidders, experience shall be reckoned as on 06-June-2022 unless otherwise specified.

Route-I:

1.7.1 The bidder 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 400 kV 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.

OR

Route-II:

1.7.2 The Bidder should have established manufacturing facilities for GIS equipment in India based on technological support of an associate (who meets the requirement at 1.7.1 above) and Bidder should have designed, manufactured and supplied at least 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 and a Deed of Joint Undertaking to this effect jointly executed by Bidder and its Associate as per the format enclosed in the bidding document – Attachment 3K. This Deed of Joint Undertaking should be submitted prior to the placement of order on approved vendor.

NOTE:

a. For the purpose of qualifying requirement, one no. of bay shall be considered as comprising of at least one circuit breaker, two dis-connectors and single phase current transformers.

b. For the purpose of qualifying requirement, Bidder should meet any of the above two (2) Routes, i.e. either Route-I (Cl. No. 1.7.1 above), **OR** Route-II (Cl. No. 1.7.2 above).

1.8 TYPE TESTING:

a. The Bidder 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 only for the test(s) actually conducted successfully under the contract and upon certification by the Customer's engineer.
b. The type tests shall be carried out in the presence of the Customer's representative, for which minimum 30 days' notice shall be given by the Bidder. The Bidder shall obtain the Customer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set up, instrument to be used, procedure, acceptance norms, recording of various parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
c. In case the Bidder has conducted such specified type test(s) according to the relevant standard and / or specification not earlier than **Ten (10) years prior to 06-June-2022**, he may submit the type test reports to the Customer 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 Customer. The Customer 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 Bidder. However if any type test report is found not meeting the specification requirements, bidder shall conduct all such type tests successfully according to relevant standards without any cost and delivery implication to BHEL.

1.9 COMMON REQUIREMENTS FOR TYPE TESTS – FOR GIS:

a. The Customer will have the right of getting any test of reasonable nature carried out on any component or completely assembled equipment at Bidder'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. Bidder 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 hardwares, 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.

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.)

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

The components forming parts of the GIS which are covered by other standards shall comply with and shall be type tested according to those standards.

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

Surge Arresters (As per IEC 60099-4)

i. Insulation withstand test on housing
ii. Residual Voltage Test
iii. Long duration current impulse withstand test
iv. Pressure Relief Test (if applicable)
v. Operating duty test
vi. Partial Discharge Test
vii. Leakage Test

Bus VT (As per IEC 60044-2/ Latest IEC Standard)

i. Temperature rise test
ii. Lighting Impulse test
iii. Switching Impulse
iv. Determination of errors
v. Short circuit withstand capability
vi. Chopped lighting impulse test

1.10 INSPECTION & TESTING

All the equipment, apparatus, materials and supplies provided by the Bidder under the contract shall be subjected to tests in the shop and at the field in the presence of Customer for conformity with the requirements of the specifications. Be as specified for the particular item or shall be in conformity with the applicable recognized standards for making such test. The details of the test procedures and test equipment to be used should be intimated to the Customer well in advance i.e. no less than 30 days before these tests are conducted. Unless otherwise specified, the Bidder shall perform all shop and field tests.

Refer Section-2 for further details.

1.11 TRAINING

GIS manufacturer shall provide training to the Customer/BHEL's personnel as per the details given below:

Sl. No	Description of Training	Training Duration (Days)	Place of Training	Number of Trainees	Boarding & Lodging
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 (Customer) + 2 (BHEL)	To be provided by bidder for Customer's Engineers only.
b)	Operation, Maintenance , Site Testing and Trouble shooting for GIS	5 days	Site	6 (Customer) + 2 (BHEL)	

1.12 QUALITY PLAN

The bidder shall carry out the works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Bidder shall submit detailed Manufacturing Quality Assurance Plan (MQP) and Field Quality Plan for BHEL / customer's approval.

1.13 DRAWINGS ENCLOSED FOR REFERENCE

Sl. No.	Ref. Drawing No.	Drawing Title	Rev
1.	4540-001-230-PVE-P-001	400kV GIS Switchyard Single Line Diagram	01
2.	4540-001-230-PVE-F-023	400kV GIS Switchyard Layout Drawings	00

The above drawings are for reference only and the customer approved drawing will be provided for detailed design of Bidder's equipment/system. There will be no price implication on the account of same.

1.14 INFORMATION TO BE FURNISHED BY THE BIDDER

1. Technical Information/ documents to be furnished at the TENDER STAGE shall be as per Section-6.

2. Bidder to submit list of tools, tackle, slings, spanners, gauges, slings and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL.

1.15 DRAWINGS / DOCUMENTS REQUIRED FOR TECHNICAL CLEARANCE FOR MANUFACTURING

Drawings/ documents detailed as per Annexure B- Details for Lot wise Technical Clearance for Manufacturing shall be used for providing technical clearance for manufacturing of the equipment (420kV Gas Insulated Switchgear & its accessories), which shall be used for delay analysis, if applicable for respective group.

The technical clearance for manufacturing shall be provided Lot wise, however, lot item can be clubbed together subject to condition of approval of drawing/ documents. Technical clearance for manufacturing shall be issued after approval of drawings in category-I (approval without any comments)/ category-II (approval with comments) from customer/ BHEL, however it shall be sole discretion of BHEL engineering department to include/ exclude the drawing/ document earmarked for consideration for any particular Lot. In case drawing/ document are not duly stamped in category-1/ category-2 by customer, BHEL stamp/ confirmation shall be treated final to proceed further.

Date of Submission of drawings/ documents shall be counted only from the date of submission of reasonably correct drawings/ documents.

The successful bidder shall have to extend all possible supports like timely submission/ re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end customer/ NTPC approval.

1.16 FIELD TESTING & COMMISSIONING

1. Bidder/ OEM shall carry out field testing and commissioning of 420kV GIS & its Accessories, however for installation, only supervision of installation shall be done by bidder. Further appropriate test and commissioning reports along with as-built documentation as necessary shall be submitted.
2. Bidder shall also submit site acceptance testing (SAT) procedures and get them approved from BHEL/ NTPC before carrying out the activities at site.
3. Bidder shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
4. In general, field testing and commissioning shall be as per section-2, technical specification.

1.17 MAKES OF EQUIPMENT/ COMPONENTS

Bidder while ordering shall ensure the availability of spare parts and maintenance support services for the offered equipment for at least for 15 years from the date of supply. Bidder shall give a notice of at least one year to the BHEL/ NTPC before phasing out the products/ spares to enable the owner for placement of order for spares and services.

1.18 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.
2. The SF6 equipment 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.

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. Hence, packing of the equipment shall be suitable for long storage (minimum 2 years).
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. Either dry nitrogen/air or dry SF6 gas 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, `O' 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.
7. Bidder to furnish to BHEL complete list of consignments for QR-code generation & shall ensure to affix QR codes of RFID tags/Trackers on the item & punch the same before dispatch.

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
A	**Supply Item - 400kV GIS as per enclosed SLD with One and Half Breaker scheme comprising of Items A1-A17**	The 400 KV, 3150A, 63kA/1s SF6 gas insulated switch gear shall have three single phase construction, one and half breaker arrangement (I-Type) having the following bays:- a) Two (2) Nos. fully equipped Generator Transformer Bays. b) Two (2) Nos. fully equipped Station Transformer Bays having controlled switching facility. c) Four (4) Nos. fully equipped Line Bays. d) One (1) No. fully equipped Spare Bay (Future Line Bay). e) One (1) No. fully equipped Bus Reactor Bay having controlled switching facility. f) Three (3) Nos. fully equipped Tie Bays having controlled switching facility. g) Two (2) Nos. fully equipped Tie Bays. h) Two (2) Nos. fully equipped Bus Voltage Transformer Bays with Bus Isolator and Grounding Switches. i) Two (2) Nos. Bus Surge Arrester Bays. The Switchgear shall be complete with all necessary terminal boxes, inspection window, SF6 gas filling, inter-connecting wiring, grounding connections, gas monitoring equipment and piping, support structures etc. The scope of supply shall also include all erection and mounting hardwares and interconnecting power and control cables between GIS to LCC and between LCC to LCC including cable tray, glands, lugs, ferrules etc.	Header Item; Unit & Quantity as per A1 to A17 below.	
A1	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: GT bay Module**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed GT bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 2-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) d) ONE set of 3x1-phase, 1-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) e) THREE sets of 3x1-phase, group operated Disconnector switches, complete with manual and motor driven operating mechanisms. f) THREE sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. g) Gas monitoring System, pressure switches etc. as required. h) Barriers and other items as required.	Set	2

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
A2	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: STATION TRANSFORMER bay Module - With CSD**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed Station Transformer bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism **and contolled switching device** b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 2-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) d) ONE set of 3x1-phase, 1-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) e) THREE sets of 3x1-phase, group operated Disconnector switches, complete with manual and motor driven operating mechanisms. f) THREE sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. g) Gas monitoring System, pressure switches etc as required. h) Barriers and other items as required.	Set	2
A3	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: LINE bay Module**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed LINE bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism (suitable for 1 & 3 phase auto reclose) b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 2-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) d) ONE set of 3x1-phase, 4-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) e) THREE sets of 3x1-phase group operated Disconnector switches, complete with manual and motor driven operating mechanisms. f) TWO sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. g) ONE set of 3x1-phase, group operated high speed earthing switches, complete with manual and motor driven operating mechanisms. h) Gas monitoring System, pressure switches etc as required. i) Barriers and other items as required.	Set	4

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
A4	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: Spare Bay (Future Line Bay) Module**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed Spare (Future LINE) bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism (suitable for 1 & 3 phase auto reclose) b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 2-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) d) ONE set of 3x1-phase, 4-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) e) THREE sets of 3x1-phase group operated Disconnector switches, complete with manual and motor driven operating mechanisms. f) TWO sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. g) ONE set of 3x1-phase, group operated high speed earthing switches, complete with manual and motor driven operating mechanisms. h) Gas monitoring System, pressure switches etc as required. i) Barriers and other items as required.	Set	1
A5	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: BUS REACTOR bay Module - With CSD**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed BUS REACTOR bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism and **controlled switching device** b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 2-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage). d) ONE set of 3x1-phase, 1-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage). e) THREE sets of 3x1-phase group operated Disconnector switches, complete with manual and motor driven operating mechanisms. f) THREE sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. g) Gas monitoring System, pressure switches etc as required. h) Barriers and other items as required.	Set	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
A6	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: TIE bay Module - With CSD**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed TIE bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism (suitable for 1&3 phase auto reclose) and **controlled switching device** b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) d) TWO sets of 3x1-phase, group operated Disconnector switches, complete with manual and motor driven operating mechanisms. e) FOUR sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. f) Gas monitoring System, pressure switches etc as required. g) Barriers and other items as required.	Set	3
A7	**Fully equipped 400kV, 63kA for 1 second, SF6 GIS: TIE bay Module**	400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed TIE bay module. Each set shall be complete & shall comprise of but not limited to: a) ONE set of 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism (suitable for 1&3 phase auto reclose) b) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) c) ONE set of 3x1-phase, 3-core, multi ratio, current transformers as per single line diagram. (Core details shall be finalised at detail engg. stage) d) TWO sets of 3x1-phase, group operated Disconnector switches, complete with manual and motor driven operating mechanisms. e) FOUR sets of 3x1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. f) Gas monitoring System, pressure switches etc as required. g) Barriers and other items as required.	Set	2
A8	**Bus VT Modules for Main Buses**	400kV, 3150A, 63kA for 1 sec, SF6 gas insulated Bus VT bay module, Disconnector module with Earth switches connected to Main Bus Bars, each comprising of but not limited to: a) ONE set of 1-phase, 3150A group operated Disconnector switches, complete with manual and motor driven operating mechanisms. b) One no. single phase Voltage transformers c) TWO set of 1-phase, group operated maintenance earthing switches, complete with manual and motor driven operating mechanisms. d) Gas monitoring devices, barriers, pressure switches, etc. as required.	No.	6
A9	**LA/ Surgre arrester Module**	1 Set = One no. single phase LA/Surge Arrester with enclosure. (Note : Number of LA/ Surge arrester and their rating shall be decided based on insulation co-ordination / transient analysis studies for the GIS system. Insulation Coordination study is in bidder scope.However the LA indicated in SLD are the minimum numbers of LA to be provided by bidder).	No.	6

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
A10	**BusBar Modules**	One set of three single phase (isolated), 3150A, 63kA for 1 sec, SF6 gas-insulated metal enclosed bus bars, each comprising of but not limited to: a) Three individual 3150A bus bars enclosures running across the length of the switchgear to inter connect each of the circuit breaker bay modules in one and half breaker bus system. b) Gas monitoring systems, pressure switches, telescopic enclosure etc. as required. c) Barriers Length of bus bar to be indicated by bidder.	Set	2
A11	**Single Phase Isolated, 400kV, 63kA for 1 second, SF6 Gas-Insulated Metal enclosed Bus Bars for Tie Bay Interconnection**	Isolated phase, 400kV, 3150A, 63kA for 1 second, SF6 gas-insulated metal enclosed bus bars, each set comprising of but not limited to: (a) Three (3) nos. single phase (isolated) bus bars to inter connect the Tie Bay circuit breaker bay modules with Circuit breaker bay Modules of Line/GT/ST/Bus Reactor/Spare bays in one and half breaker bus system. (b) Gas monitoring System, barriers, pressure switches, etc. as required.	Set	10
A12	**400kV, 3150A GIS duct from GIS GT/Outgoing Lines/ Station transformer/Bus reactor/ Spare Bay Modules to SF6 to Air bushing**	400kV, 3150A, 63kA for 1 sec, SF6 gas insulated GIS duct shall be complete & shall comprise of but not limited to: a) Single phase (isolated) SF6 ducts along with all accessories to connect 400kV GIS with 400kV side GT/Outgoing Lines/ST/Reactor/ Spare Bay. b) Gas monitoring devices, barriers, pressure switches, etc. as required. Length of GIS duct to be indicated by the bidder with break up.	Meter	1800
A13	**400kV, 3150A SF6 to Air Bushing**	400kV, 3150A, 63 kA for 1 sec, 31mm/kV creepage, SF6 gas insulated, SF6 to Air Bushing for Over head connection of Line/GT/ST/REACTOR/Spare Bay with GIS.	No.	30
A14	**Local Control Cubicles**	Bay Control Cabinet for GT/BUS REACTOR/LINES/ STATION TRANSFORMER/ TIE/ SPARE BAYS/ BUS VT/ including cables between GIS & LCC.	No.	17
A15	**First Filling of SF6 gas including extra for Compensating Losses for 10% of total Gas Quantity.**	First filling of SF6 gas for the equipment supplied plus an additional quantity sufficient for conducting all tests on equipment at site before placing it into successful operation.	MT	20

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
A16	**Supply of structure work for Installation of GIS including support structure for GIS ducts, SF6 to air bushings, supports, platforms, ladders, foundation bolts, embedded parts in floors etc., which are required for installation of GIS as per the specification. (The civil works will be done based on supplier design & drawings).**	Supply of structure work for Installation of GIS including support structure for GIS ducts, SF6 to air bushings, supports, platforms, ladders, foundation bolts, embedded parts in floors RAILS etc., which are required for installation of GIS as per the specification. (The civil works will be done based on supplier design & drawings). Bidder to indicate estimated weight in the bid (in MT) alongwith support documents & unit prices per MT in their offer. Bidder to quote in units as MT. Addition/deletion shall be on unit rate basis but only if there is any change in input.	MT	65
A17	**Supply of Earthing material for GIS including High frequency earthing material, if required. The quantity shall be estimated & provided by bidder.**	Bidder shall define clearly what constitutes the main grounding bus of the GIS. Bidder must supply, commission the enire grounding work of GIS viz conductor, clamps, joints, bimetallic strips (for connection between different type of earthing materials), operating and satety platforms etc. Bidder shall provide suitable measure to mitigate trasient enclosure voltage caused by high frequency currents caused by lightning strikes, operation of surge arrester, phase/earth fault and discharge between contracts during switching operation.	Lot	1
B	**Supply Item - Mandatory Spares (B1 to B6)**	These prices will also be used for addition/deletion/replacement (shall be considered as initial spares)	Header Item; Unit & Quantity as per B1 to B6 below.	
B1	**400 KV GIS (as applicable)**		Header Item	
B1.1	**SF6 gas pressure Relief Devices** **(3 nos of each type)**	SF6 gas pressure Relief Devices (1 Set = 3 nos of each type)	Sets	2
B1.2	**SF6 pressure gauge with coupling device cum switch or density monitors and pressure gauge, as applicable** **(1 no. of each type)**	SF6 pressure gauge with coupling device cum switch or density monitors and pressure gauge, as applicable (1 Set = 1 no. of each type)	Set	1
B1.3	**Rubber gaskets, ''o'' Rings and seals for SF6 gas, including Circuit Breaker, Disconnector and other GIS equipments** **(6 no. of each type)**	Rubber gaskets, ''o'' Rings and seals for SF6 gas for GIS Enclosure (including Circuit Breaker, Disconnector and other GIS equipments) (1 Set = 6 no. of each type)	Set	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
B1.4	**Molecular filter for SF6 gas with filter bags** **(1 set = 20 % of total supply quantity of absorber bags used in GIS)**	Molecular filter for SF6 gas with filter bags (1 set = 20 % of total supply quantity of absorber bags used in GIS)	Set	1
B1.5	**SF6 gas in cylinders of 50kg/cylinder**	SF6 gas in cylinders (non-returnable cylinders) of 50kg/cylinder (Total quantity shall be 20% of total gas used in complete GIS system offered)	MT	4
B1.6	**Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of the compartment: For 1 phase enclosures** **(3 nos. of each type)**	Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of the compartment: For 1 phase enclosures (1 Set = 3 nos. of each type)	Set	1
B1.7	**Locking device to keep Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (if applicable)**	Locking device to keep Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (if applicable)	Nos.	3
B1.8	**Bus support insulator of each type for single phase enclosure** **(6 nos. of each type)**	Bus support insulator of each type for single phase enclosure (1 Set = 6 nos. of each type)	Set	1
B1.9	**SF6 to air bushing for 1 phase enclosure**	SF6 to air bushing for 1 phase enclosure	Nos.	2
B1.10	**Spares for Local control cabinet including MCB, fuses, timers, Aux. Relay of each type & rating, terminals of each type**	Spares for Local control cabinet including MCB, fuses, timers, Aux. Relay of each type & rating, terminals of each type	Set	1
B1.11	**All types of Corona shield** **(3 Nos. of each type)**	All types of Corona shield (1 Set = 3 Nos. of each type)	Set	1
B1.12	**Windowscope/ Observing window, if applicable** **(3 Nos. of each type)**	Windowscope/ Observing window, if applicable (1 Set = 3 Nos. of each type)	Set	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
B2	**Circuit Breaker**		Header Item	
B2.1	**Complete Circuit Breaker 1 phase pole of each type & rating complete with interrupter, main circuit and enclosure with operating mechanism**	Complete Circuit Breaker 1 phase pole of each type & rating complete with interrupter, main circuit and enclosure, marshalling box with operating mechanism	Sets	3
B2.2	**Trip Coil assembly with resistor as applicable.** **(3 nos. of each type)**	Trip Coil assembly with resistor as applicable. (1 Set = 3 nos. of each type)	Sets	2
B2.3	**Closing Coil assembly with resistor as applicable.** **(3 nos. of each type)**	Closing Coil assembly with resistor as applicable. (1 set = 3 nos. of each type)	Sets	2
B2.4	**Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating, as applicable**	Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating, as applicable	Set	1
B2.5	**Closing assembly/ valve (if applicable)** **(3 nos. of each type)**	Closing assembly/ valve (if applicable) (1 Set = 3 nos. of each type)	Sets	2
B2.6	**Trip assembly/ valve (if applicable)** **(3 nos. of each type)**	Trip assembly/ valve (if applicable) (1 Set = 3 nos. of each type)	Sets	2
B2.7	**Aux. switch assembly** **(3 Nos. of each type)**	Aux. switch assembly (1 set = 3 Nos. of each type)	Set	1
B2.8	**Opeartion counter** **(3 nos. of each type)**	Opeartion counter (1 set = 3 nos. of each type)	Set	1
B2.9	**Rupture disc (if applicable)** **(3 Nos. of each type)**	Rupture disc (if applicable) (1 Set = 3 Nos. of each type)	Set	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
B2.10	**Set of spares for pneumatic/spring/ hydraulic operated mechanism (as applicable as per main supply)** **(1 set for each type of Circuit breaker)**	Set of spares for pneumatic/spring/ hydraulic operated mechanism (as applicable as per main supply) (1 set for each type of Circuit breaker) 1) Spare for pneumatic operated mechanism (complete) a. Motor for compressor - one no. b. Pressure switch and valve etc. - one no. of each type 2) Spare for spring operated mechanism (complete) a. Motor - one no. b. Limit switch etc.- one no. of each type 3) Spare for hydraulic operated mechanism (complete) a. Motor - one no. b. Limit switch - one no. of each type	Lot	1
B3	**Disconnector**		Header Item	
B3.1	**Complete set of 3 nos. of single phase disconnector inculding main circuit, enclosure and driving mechanism**	Complete set of 3 nos. of single phase disconnector including main circuit, enclosure and driving mechanism & support insulator	Set	1
B3.2	**High speed/ fast acting fault making grounding switch, 3 nos. of single phase of each rating, including main circuit, enclosure and driving mechanism**	High speed/ fast acting fault making grounding switch, 3 nos. of single phase of each rating, including main circuit, enclosure and driving mechanism	Set	1
B3.3	**3 nos. of single phase Earthing switch including main circuit, and driving mechanism**	3 nos. of single phase Earthing switch including main circuit, enclosure and driving mechanism	Set	1
B3.4	**Open/close contactor assembly, timers, key interlock for one complete (3 phase) disconnector and earthing switch of each type & rating, as applicable**	Open/close contactor assembly, timers, key interlock for one complete (3 phase) disconnector and earthing switch of each type & rating, as applicable	Set	1
B3.5	**Limit switches and Aux. switches for complete 3-phase equipment: for Disconnector**	Limit switches and Aux. switches for complete 3-phase equipment: for Disconnector	Set	3
B3.6	**Limit switches and Aux. switches for complete 3-phase equipment: for Earth switch**	Limit switches and Aux. switches for complete 3-phase equipment: for Earth switch	Set	1
B3.7	**Limit switches and Aux. switches for complete 3-phase equipment: for high speed earth switch**	Limit switches and Aux. switches for complete 3-phase equipment: for high speed earth switch	Set	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
B3.8	**Relay, Power contactors, resistors, fuses,push buttons, timers & MCBs as applicable (Complete for one 3 phase equipment): for Disconnector**	Relay, Power contactors, resistors, fuses,push buttons, timers & MCBs as applicable (Complete for one 3 phase equipment): for Disconnector	Set	3
B3.9	**Relay, Power contactors, resistors, fuses,push buttons, timers & MCBs as applicable (Complete for one 3 phase equipment): for Earth Switch**	Relay, Power contactors, resistors, fuses,push buttons, timers & MCBs as applicable (Complete for one 3 phase equipment): for Earth Switch	Set	1
B3.10	**Relay, Power contactors, resistors, fuses,push buttons, timers & MCBs as applicable (Complete for one 3 phase equipment): for high speed earth switch**	Relay, Power contactors, resistors, fuses,push buttons, timers & MCBs as applicable (Complete for one 3 phase equipment): for high speed earth switch	Set	1
B4	**Current Transformer**		Header Item	
B4.1	**Complete CT, as applicable, with enclosure, as applicable**	Complete CT, as applicable, with enclosure, as applicable (1 Set = 1 no. of each type & rating for 1x3 phase complete CT, i.e. 3 Nos. Single Phase CTs of each type & rating)	Set	1
B5	**Voltage Transformer**		Header Item	
B5.1	**Gas Insulated complete VT with enclosure**	Gas Insulated complete VT with enclosure (1 Set = 1 no. of each type & rating for 1x3 phase complete VT, i.e. 3 Nos. Single Phase VTs of each type & rating)	Set	1
B6	**SF6 Gas Insulated Surge Arrester with Enclosure**	SF6 Gas Insulated Single Phase Surge Arrester with Enclosure	No.	3
C	**Supply Item - Mandatory Maintenance Equipment (C1 to C5)**		Header Item; Unit & Quantity as per C1 to C5 below.	
C1	**SF6 Gas filling and evacuating plant (portable)**	SF6 Gas filling and evacuating plant (portable)	No.	1
C2	**SF6 Gas Filtering, Drying, Storage and Recycling Plant**	SF6 Gas Filtering, Drying, Storage and Recycling Plant	No.	1
C3	**SF6 Gas leak detector**	SF6 Gas leak detector	No.	1
C4	**Operational analyser with DCRM kit**	CB Operational analyser with DCRM kit	No.	1
C5	**Hydraulic portable type ladder**	Hydraulic portable type ladder	No.	1
D	**Supply Item - Mandatory Monitoring Equipments (D1 to D4)**		Header Item; Unit & Quantity as per D1 to D4 below.	

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
D1	**Dew Point Meter**	Dew Point Meter	No.	1
D2	**Portable PD Monitoring System for Gas Insulated Switchgear**	Portable PD Monitoring System for Gas Insulated Switchgear (with all necessary accessories & PD sensors)	No.	1
D3	**SF6 gas analyzer**	SF6 gas analyzer	No.	1
D4	**Online PD Monitoring System (with all necessary accessories & auxiliaries) for Gas Insulated Switchgear & Busducts**	Online PD Monitoring System (with all necessary accessories & auxiliaries & PD sensors & SAS interfacing as per Section-1 & 2) for Gas Insulated Switchgear & Busducts	Set	1
E	**Services: Supervision of Erection, commissioning & site testing including earthing and training (E1 to E9)**	GT Bays, Station Transformer Bays, Line bays, Spare Bays, Bus Reactor Bays, Bus VT Bays, LA/Surge arrester Bays, Tie Bay etc. will be commissioned seperately at diffferent stages.	Header Item; Unit & Quantity as per E1 to E9 below.	
E1	**Insulation co-ordination studies**	Insulation co-ordination studies in scope of GIS supplier.	Lot	1
E2	**Site visit for supervision of unloading, storage & verification of material at site**	Site visit for supervision of unloading, storage & verification of material at site	Lot	1
E3	**Supervision of Erection of GIS**	Supervision of Erection of Complete GIS including Busbar, GT bays, Station Transformer Bays, Line bays, Spare Bays, Bus Reactor Bays, Bus VT Bays, LA/Surge Arrester Bays, Tie Bays, etc alongwith accessories/equipments/LCCs supplied. Consumables required for successful erection is included in bidder's scope & bidder to include price for the same against this line item. In case, complete GIS bays with LCC is not installed, due to reasons not attributable to vendor, Payment shall be made on prorata basis.	Lot	1
E4	**Supervision of Erection of GIS Duct - GIS to SF6 to Air Bushings**	Supervision of Erection of Complete GIS ducts (Single Phase) of all rating. Consumables required for successful erection is included in bidder's scope & bidder to include price for the same against this line item. In case, complete Gas Insulated Busduct is not installed, due to reasons not attributable to vendor, Payment shall be made on prorata basis.	Meter	1800
E5	**Supervision of Erection of complete SF6 to Air Bushing**	Supervision of Erection of SF6 to Air Bushings (Single Phase) complete in all respect. Consumables required for successful erection is included in bidder's scope & bidder to include price for the same against this line item. In case, complete SF6-to-Air Bushing is not installed, due to reasons not attributable to vendor, Payment shall be made on prorata basis.	Set	30

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
E6	**Testing & Commissioning of GIS**	Testing & Commissioning as per customer approved SAT procedure of Complete GIS including Busbar, GT bays, Station Transformer Bays, Line Bays, Spare Bays, Bus Reactor Bays, Bus VT Bays, LA/Surge Arrester Bays, Tie Bays, GIB, SF6-to-Air Bushing and all other accessories/equipments/LCCs supplied under this contract. Testing & commissionng spares/ consumables are included in bidder's scope. In case, complete GIS bays with LCC is not tested and commissioned, due to reasons not attributable to vendor, Payment shall be made on prorata basis.	Lot	1
E7	**Final successful Testing of GIS including HV test and its accessories**	HV Test kit shall be arranged by the bidder on returnable basis. (GT Bays, Station Transformer Bays, Line bays, Spare Bays, Bus Reactor Bays, Bus VT Bays, Tie Bays, etc. may be commissioned seperately at diffferent stages). Final testing as per IEC for complete GIS including Busbar, GT Bays, Station Transformer Bays, Line bays, Spare Bays, Bus Reactor Bays, Bus VT Bays, Tie Bays, GIS Ducts, SF6 to Air Bushing etc.	Lot	1
E8	**Training for GIS to NTPC Engineers**	Training for GIS shall cover following parts and mandays: a) GIS equipments including system description, basic Design and engineering, Quality Assurance concepts, Erection and operational aspects for the offered equipments, Training duration= 5 days, place of training = Manufacturers works, No. of Trainess = 8. b) Operation, Maintenance, Site Testing and Trouble shooting for GIS, Training duration = 5 days, place of training = Talcher Site, No. of Trainess = 6. The cost of Boarding and lodging expenses of the NTPC training participant have to be borne by the bidder. This includes training in India and foreign countries as applicable.	Lot	1
E9	**Training for GIS to BHEL Engineers**	Training for GIS shall cover following parts and mandays: a) GIS equipments including system description, basic Design and engineering, Quality Assurance concepts, Erection and operational aspects for the offered equipments, Training duration= 5 days, place of training = Manufacturers works, No. of Trainess = 2 b) Operation, Maintenance, Site Testing and Trouble shooting for GIS, Training duration = 5 days, place of training = Talcher Site, No. of Trainess = 2 Lodging and Boarding of Training Participants shall be in BHEL scope.	Lot	1
F	**Supply: Unit Prices of Individual Item/Equipment (F1 to F24)**	Unit Prices of Individual Equipment included here or in manadatory spares 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 (Bay, Busbar etc). Quoting for unit prices is mandatory and shall be considered for evaluation.	Header Item; Unit & Quantity as per F1 to F24 below.	

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
F1	**400kV, 3150A Circuit breaker (1 pole complete without enclosure without operating mechanism)**	400kV, 3150A Circuit breaker (1 pole complete without enclosure without operating mechanism)	No.	1
F2	**400kV, 3150A Circuit breaker with PIR (1 pole complete without enclosure without operating mechanism)**	400kV, 3150A Circuit breaker with PIR (1 pole complete without enclosure without operating mechanism)	No.	1
F3	**400kV, 3150A Isolator (1 pole) without operating mechanism**	400kV, 3150A Isolator (1 pole) without operating mechanism	No.	1
F4	**400 kV Maintenance Earthing switch without operating mechanism**	400 kV Maintenance Earthing switch (1 pole) without operating mechanism	No.	1
F5	**400kV High speed earth switch without operating mechanism**	400kV High speed earth switch (1 pole) without operating mechanism	No.	1
F6	**400kV Current transformer of Class PS (1 No. of each type) (Individual prices to be furnished).**	400kV Current transformer (1 pole) of Class PS (1 No. of each type) (Individual prices to be furnished).	No.	1
F7	**400kV Current transformer of Class 0.2s (1 No. of each type) (Individual prices to be furnished).**	400kV Current transformer (1 pole) of Class 0.2s (1 No. of each type) (Individual prices to be furnished).	No.	1
F8	**400kV Voltage transformer (1 of each type) (Individual prices to be furnished).**	400kV Voltage transformer (1 pole) (1 no. of each type) (Individual prices to be furnished).	No.	1
F9	**Operating Mechanism box for 400kV, 3150 A Circuit Breaker**	Operating Mechanism box for 400kV, 3150 A Circuit Breaker	No.	1
F10	**Operating Mechanism box for 400kV, 3150 A Isolator**	Operating Mechanism box for 400kV, 3150 A Isolator	No.	1
F11	**Operating mechanism for 400kV, Maintenance Earthing Switch**	Operating mechanism for 400kV, Maintenance Earthing Switch	No.	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
F12	**Operating Mechanism for 400kV, High Speed Earthing Switch**	Operating Mechanism for 400kV, High Speed Earthing Switch	No.	1
F13	**Single Phase Bus bar (Any type)**	Complete single phase 400kV, 3150A, 63 kA for 1s Bus Bar including Gas monitoring systems, barriers, pressure switches etc.	Meter	1
F14	**Conductor for Single phase Bus bar/ bus duct (any type)**	Conductor for Bus Bar, Bus Duct, GIB, Interconnecting conductors of any type with interconnecting parts as required.	Meter	1
F15	**GIS metallic enclosure (any type)**	Enclosure for Bus Bar, Bus Duct, GIB, Straight Cast Enclosure etc. with fixing hardware as required.	Meter	1
F16	**Epoxy resin insulators for bus support with holes for gas flow (of each type and rating)**	Epoxy resin insulators for bus support with holes for gas flow (of each type and rating) Bidder to inform details at tender stage	Set	1
F17	**Gas barrier insulators (of each type and rating)**	Gas barrier insulators (of each type and rating) Bidder to inform details at tender stage	Set	1
F18	**Density switch**	Density switch	No.	1
F19	**Gas monitoring system devices**	Gas monitoring system devices (1 Lot =1 no of each type)	Lot	1
F20	**PD sensor**	PD sensor (UHF TYPE)	No.	1
F21	**Optical indicator for CB, Isolator**	Optical indicator for CB, Isolator	No.	1
F22	**Elbow/Angle/ T-bends**	Elbow/Bend/Cross/Angle/ T-bends	No.	1
F23	**Expansion joints for bellows**	Expansion joints/ Flexible Connections/bellows	Set	1

Sl. No.	Description	Remarks_Detailed_Description	Unit	Quantity
F24	**Controlled Switching Device for ONE set of 3150A, 3x1-phase, SF6 insulated circuit breaker, complete with operating mechanism (suitable for 1 & 3 phase auto reclose)**	Controlled Switching Device for ONE set of 3150A, 3x1-phase, SF6 insulated circuit breaker without PIR, complete with operating mechanism (suitable for 1 & 3 phase auto reclose)	Nos	1
G	**Services: Unit Prices of Individual Item (G1 to G6)**	Reference unit prices for service of Individual Item/ Equipment for any addition/ deletion of equipment, due to damage, theft, additional requirement by customer, any other reasons not attributable to vendor during detailed engineering/ contract execution. The reference prices shall be considered for evaluation. Total charges for one visit of engineer/ HV test kit operator = (respective unit rates of item G1/ G2, as applicable) * (Manday) + (unit rate of G6).	Header Item; Unit & Quantity as per G1 to G6 below.	
G1	**Supervision Services of manpower for erection per day (excl. travel time)**	Supervision Services of manpower for erection per day (excl. travel time)	Manday	1
G2	**Services of manpower for Testing & commissioning per day (excl. travel time)**	Services of manpower for Testing & commissioning per day (excl. travel time)	Manday	1
G3	**Hiring charges of HV test kit**	Additional HV test kit charges including charges of operator/manpower, HV test kit, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). HV test kit charges include one or more bay at site.	Lot	1
G4	**Training for GIS to NTPC Engineers at manufacturer's work.**	Travelling cost to Manufacturer's works shall be borne by NTPC. Training Charges including Lodging and Boarding of Training Participants shall be in bidder's scope.	Manday	1
G5	**Type Tests (If Required)**	Bidder to refer clause 1.8 and 1.9 of Section-1 of TS TB-419-316-001 Rev 0. Bidder to furnish individual price break-ups for repetition of Type Tests as per TS.	Lot	1
G6	**To and fro travelling charges of vendor's engineer from the vendor's office/ factory to project site**	To and fro travelling charges of vendor's engineer from the office/ factory to project site	No. of Visit	1

Notes:
1) CT & VT core details given in single line diagram/TS are tentative and may change at contract stage. Changes to be incorporated by bidder without any cost and delivery implication to BHEL/ NTPC.

2) BHEL reserves the right for quantity variation due to any reason upto ±20% of total value at same unit rate and terms during execution of contract. The quantity of individual items may however vary upto any extent.

3) While quoting against individual line items of Tender BOQ, bidder to carefully read and quote as per the descriptions & detailed descriptions mentioned in this Annexure-A of Section-1.

Annexure B- Details for Lot wise Technical Clearance for Manufacturing

PROJECT NAME 400kV GIS at Talcher Thermal Power Project Stage-III (2X660 MW)

CUSTOMER M/s NTPC Limited

Sl. No.	Vendor Drawing/ Doc. No	Document Title	Approval Category (A- approval, I-Information)	Applicable for GIS items	Submission date	Remarks
1	--	GIS Gas Single Line Diagram (SLD) and Gas Schematics	A	GIS Bays, GIB ducts and cable connection, LCC with gas monitoring system, CSD & PD monitoring system etc.		1. BHEL shall provide all the technical inputs requirements (e.g. Title Block, Master Drawing list, SLD, CT VT Parameters, Layout Plan & Section Drawings, interfacing drawings etc. as applicable) required for submission of drawings/ documents during detailed engineering stage within time line mentioned in activity schedule, pendancy of any input from BHEL, if required, bidder shall inform within one week time. Subsequent to this Bidder shall provide all drawing/ document within time line mentioned in Activity Schedule. However it is to be noted that total submission time for all drawing/ documents of particular lot shall not exceed time line mentioned in activity schedule of NIT. 2. Submisison date furnished by bidder shall be used for any of contractual requirements/ purpose.
2	--	GIS Layout, Plan & Section and Isometric view (overall GIS)	A	GIS Bays, GIB ducts and cable connection etc.		
3	--	GIS Guaranteed Technical Particulars (GTP)	A	GIS Bays, GIB ducts and cable connection etc.		
4	--	GIS Manufacturing Quality Plan	A/ I	GIS Bays, GIB ducts and cable connection, LCC with gas monitoring system, CSD & PD monitoring system, Maintenance Equipment etc.		
5	--	GIS Type Test Reports	A/ I	GIS Bays, GIB ducts and cable connection etc.		
6	--	GIS Interface Drawing for SF6-TO-Air connection module	A	Cable connection module etc.		
7	--	GIS Secondary Engineering base Design (LCC Overview drawing and Interlock Logic Drawing)	A	LCC with gas monitoring system etc.		
8	--	CSD Manual/ Catalog	I	CSD etc.		
9	--	GIS LCC Schematics for Typical Trafo/ Reactor Bay	A	LCC with gas monitoring system etc.		
10	--	GIS LCC Schematics for Typical Line/ Spare Bay	A	LCC with gas monitoring system etc.		
11	--	GIS LCC Schematics for Tie Bay	A	LCC with gas monitoring system etc.		
12	--	GIS GA Drawing, GTP, Schematics of Gas Monitoring System	A	LCC with gas monitoring system etc.		
13	--	GIS GA Drawing, GTP, Schematics of PD Monitoring System	A	PD monitoring system etc.		
14	--	GIS Maintenance Equipment Catalouge & GTP	A	GIS Maintenance Equipment etc.		
15	--	Insulation co-ordination study	A/ I	Surge Arrester etc., if applicable		
16	--	GIS Quantification of Mandatory Spares	A	Mandatory Spares etc.		
17	--	GIS Earthing Layout Drawing with BOM and Design	A/ I	**Earthing materials etc.***		
18	--	GIS Support Structure Layout Drawing with BOM and Design	I	**Structure & harwares etc.***		
19	--	GIS Civil Work Specification along Foundation loading and other interfacing details	I	**Input for civil engineering activities***		
20	--	GIS O&M Manual	I	**GIS Manual***		
21	--	GIS General and Special Tool List	I	**GIS general & special tools list, as applicable***		
22	--	GIS Quantification of SF6 gas	I	**SF6 gas***		

GIS PO	Item Sl. No. as per BOQ	Remarks
PO-1	A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.10, A.11, A.12, A.13, A.14, A.15, A.16, A.17 and/ or any other item not covered in PO 2 & PO 3	Based on engineering approval of drawing/ documents, as applicable, technical clearance for part/ full quantity shall be provided.
PO-2	B	Based on engineering approval of drawing/ documents, as applicable, technical clearance for part/ full quantity shall be provided.
PO-3	C, D	Based on engineering approval of drawing/ documents, as applicable, technical clearance for part/ full quantity shall be provided.

Notes:

1 Drawing/ document marked **"*"** shall not be considerd for Engineering Delay Analysis.

2 Materials such as SF6 gas, Earthing Material, Structures & hardware, Consumables shall not be considered for Engineering Delay Analysis, However, bidder shall ensure timely supply, availability and completeness of work at site without any delay.

3 Drawings/ documents, not mentioned above but required for completeness of work shall be submitted for approval/ Information, if required. However, bidder/ vendor shall ensure that manufacturing of any GIS materials are not getting affected/ put on-hold.

4 In case drawing/ document are not duly stamped in category-1/ category-2 by customer/NTPC, BHEL stamp/ confirmation shall be treated final to proceed further.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No.

INDEX

REFERENCE DRAWING: 4540-999-POE-J-001 REV A - TENDER DRAWING.
400kV GIS SWYD SINGLE LINE DIAGRAM (STATION TRANSFORMER SCHEME)

COMPUTER DRG. PAYS NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
01	12.12.22	ALTERED PC / CHECKED RD / APPROVED VK	SLD REVISED TO INCORPORATE ADDITIONAL CT & CSD AS PER CUSTOMER COMMENTS.

CA NO.

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT: NTPC TALCHER SUPER THERMAL POWER PROJECT PHASE-III (2x660 MW)

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	PC	-SGD-	15.10.22
चेक्ड CHECKED	RD	-SGD-	15.10.22
स्वीकृत APPROVED	VK	-SGD-	15.10.22

विभाग DEPT. | कोड CODE | स्केल / SCALE | कार्ड कोड CARD CODE

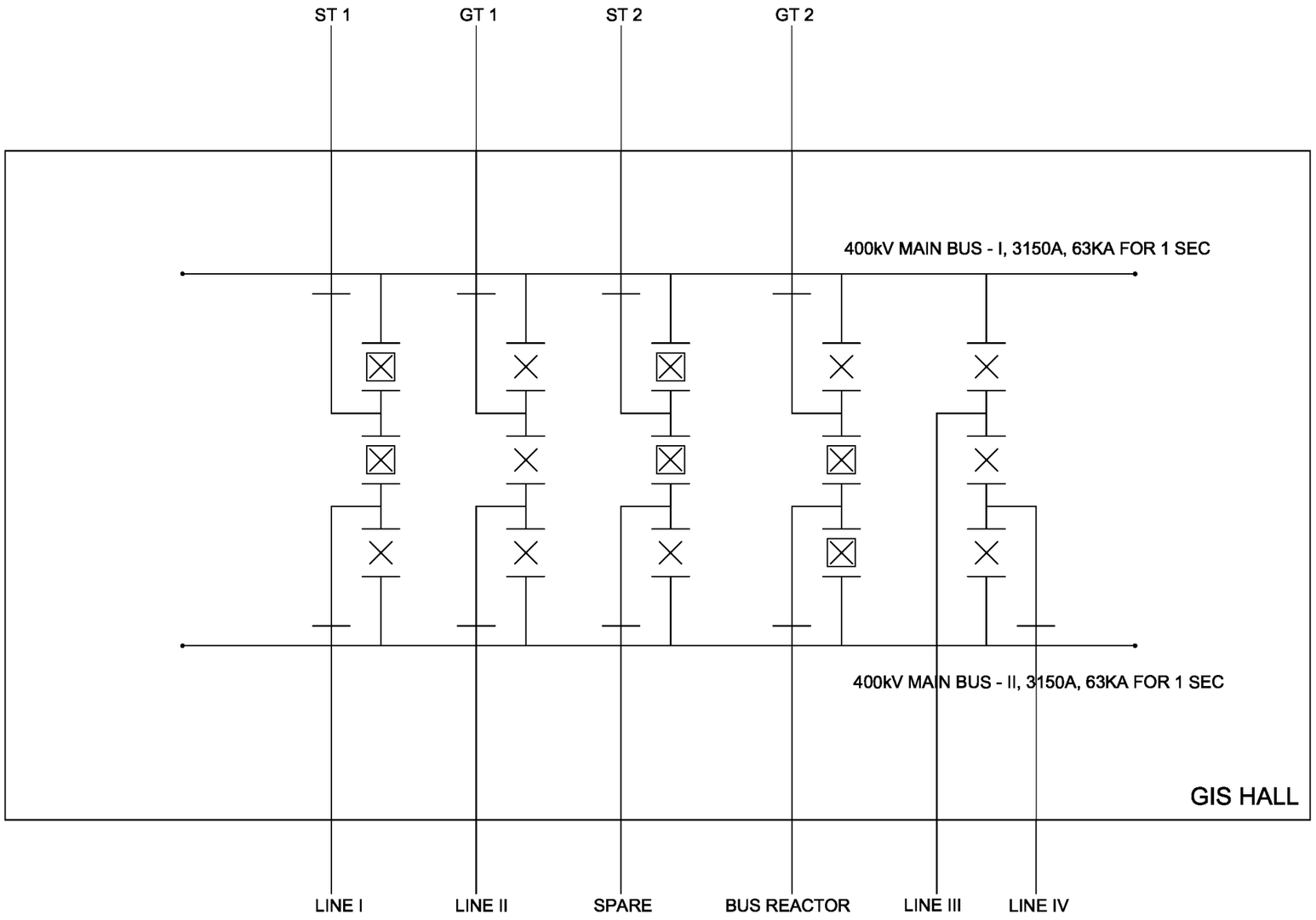
शीर्षक/TITLE: 400kV GIS SWITCHYARD SINGLE LINE DIAGRAM

दुर्ग.सं./DRAWING NO.
NTPC DWG NO. 4540-001-220-POE-P-001
BHEL DWG NO.

पुनरा/REV. 01

पृष्ठ सं./SHEET No. 01 | अगला पृष्ठ/NEXT SHEET 02

1341798/2023/TBG-TBG_ENGG



BREAKER WITH CONTROLLED SWITCHING

BREAKER WITHOUT CONTROLLED SWITCHING

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
01	12.12.22	ALTERED PC / CHECKED RD / APPROVED VK	SLD REVISED TO INCORPORATE ADDITIONAL CT & CSD AS PER CUSTOMER COMMENTS.

CA NO.

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ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT: NTPC TALCHER SUPER THERMAL POWER PROJECT PHASE-III (2x660 MW)

BHEL भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

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स्वीकृत/APPROVED	VK	-SGD-	15.10.22

विभाग DEPT. | कोड CODE | अनुपात / SCALE | कार्ड कोड CARD CODE

शीर्षक/TITLE: 400kV GIS SWITCHYARD SINGLE LINE DIAGRAM

ड्रा.सं./DRAWING NO.
NTPC DRG NO. 4640-001-330-PVE-P-001
BHEL DRG NO.

पुनरी./REV. 01

पृष्ठ सं./SHEET No. 02 | अगला पृष्ठ/NEXT SHEET 03

COMPUTER DRG. PATH NAME :

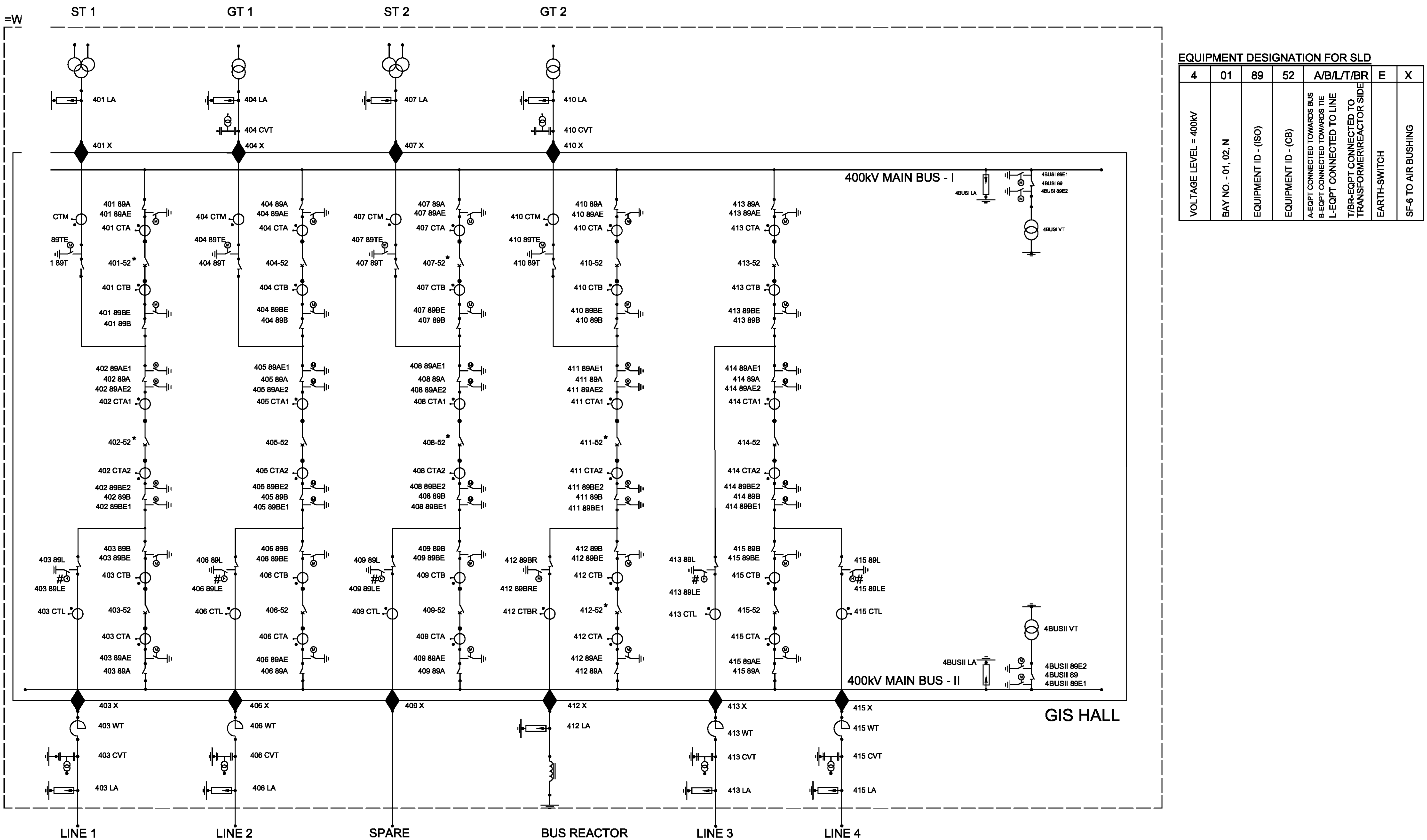
REF. DRG. No.

SIGN. & DATE

INVENTORY No.

1341798/2023 G-TBG ENGG

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



NOTES:

1. EARTHING SWITCHES WITH # ARE HIGH SPEED EARTHING SWITCHES.
2. CIRCUIT BREAKERS WITH * ARE BREAKERS HAVING CONTROLLED SWITCHING FACILITY.
3. GT STANDS FOR GENERATOR TRANSFORMER.
4. ST STANDS FOR STATION TRANSFORMER.
5. **CSD FOR TIE BAY NO. 411 AND ADDITIONAL 2 NOS. OF GIS CT CORES IN EACH MAIN BAY & 3 NOS. OF GIS CT CORES IN EACH TIE BAY i.e. TOTAL 35 NOS. OF GIS CT CORES & ASSOCIATED EQUIPMENTS ARE ADDITIONAL REQUIREMENTS OF NTPC & SHALL BE SUPPLIED SUBJECT TO COMMERCIAL SETTLEMENT.**

REV.	DATE	ALTERED	CHECKED	APPROVED	ZONE
01	12.12.22	PC	RD	VK	SLD REVISED TO INCORPORATE ADDITIONAL CT & CSD AS PER CUSTOMER COMMENTS.

CA NO.

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम / NAME OF CUSTOMER/PROJECT: NTPC TALCHER SUPER THERMAL POWER PROJECT PHASE-III (2x660 MW)

भारत हेवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
DRAWN	PC	-SGD-	15.10.22
जाँचा CHECKED	RD	-SGD-	15.10.22
स्वीकृत APPROVED	VK	-SGD-	15.10.22

विभाग DEPT.
कोड CODE
अनुपात / SCALE
कार्ड कोड CARD CODE

शीर्षक/TITLE: 400kV GIS SWITCHYARD SINGLE LINE DIAGRAM

ड्राइंग.क्र./DRAWING NO.
NTPC DRG NO. 4540-001-230-PVE-P-001
BHEL DRG NO.
पुनः/REV. 01

पृष्ठ क्र./SHEET No. 03 अगला पृष्ठ/NEXT SHEET 04

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COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE
INVENTORY No.

1341798/2023/TBG-TBG ENGG

DRAWING No.

400kV OUTDOOR EQUIPMENT

S.NO.	DESCRIPTION	SYMBOL	BAY NO./LOCATION	UNIT	QUANTITY
1	3X1PH, 3X275 MVA, 420/SQRT(3)/21kV GENERATOR TRANSFORMER		404, 410	NOS.	2
2	144* MVA, 400/11.5/11.5 kV STATION TRANSFORMER		401, 407	NOS.	2
3	125 MVAr, 400kV SHUNT REACTOR - 3PH		412 BR	NOS.	1
4	336 kV LIGHTNING ARRESTER - 1PH		401 LA, 403 LA, 404 LA, 406 LA, 407 LA, 410 LA, 412LA, 413 LA, 415 LA	NOS.	27
5	400kV, 8800pF LINE CAPACITIVE VOLTAGE TRANSFORMER - 1PH.		403 CVT, 406 CVT, 413 CVT, 415 CVT	NOS.	12
6	400kV, 4400pF CAPACITIVE VOLTAGE TRANSFORMER FOR GT BAYS - 1PH		404 CVT, 410 CVT	NOS.	6
7	400kV, 3150A 0.5mH PEDESTAL MOUNTED WAVE TRAP - 1PH		403 WT, 406 WT, 413 WT, 415 WT	NOS.	8

400kV INDOOR GIS

S.NO.	DESCRIPTION	SYMBOL	BAY NO./LOCATION	UNIT	QUANTITY
1	400kV, 3150 A, 63kA FOR 1 SEC, CIRCUIT BREAKER WITH CONTROLLED SWITCHING - 3PH		401-52, 402-52, 407-52, 408-52, 411-52, 412-52	SETS	6
2	400kV, 3150 A, 63kA FOR 1 SEC, CIRCUIT BREAKER WITHOUT CONTROLLED SWITCHING - 3PH		403-52, 404-52, 405-52, 406-52, 409-52, 410-52, 413-52, 414-52, 415-52	SETS	9
3	400kV, 3150 A, 63kA FOR 1 SEC, DISCONNECTOR WITH ONE EARTH SWITCH - 3PH		401-89A, 401-89B, 401-89T, 403-89A, 403-89B, 404-89A, 404-89B, 404-89T, 406-89A, 406-89B, 407-89A, 407-89B, 407-89T, 409-89A, 409-89B, 410-89A, 410-89B, 410-89T, 412-89A, 412-89B, 412-89BR, 413-89A, 413-89B, 415-89A 415-89B	SETS	25
4	400kV, 3150 A, 63kA FOR 1 SEC, DISCONNECTOR WITH TWO EARTH SWITCHES - 3PH		402-89A, 402-89B, 405-89A, 405-89B, 408-89A, 408-89B, 411-89A, 411-89B, 414-89A, 414-89B	SETS	10
5	400kV, 3150 A, 63kA FOR 1 SEC, DISCONNECTOR WITH ONE HIGH SPEED EARTH SWITCHES -3PH		403-89L, 406-89L, 409-89L, 413-89L, 415-89L	SETS	5
6	400kV, 3000A, 63kA FOR 1 SEC, CURRENT TRANSFORMER - 1PH		401-CTA, 401-CTB, 402-CTA1, 402-CTA2, 403-CTA, 403-CTB, 403-CTL, 404-CTA, 404-CTB, 405-CTA1, 405-CTA2, 406-CTA, 406-CTB, 406-CTL, 407-CTA, 407-CTB, 408-CTA1, 408-CTA2, 409-CTA, 409-CTB, 409-CTL, 410-CTA, 410-CTB, 411-CTA1, 411-CTA2, 412-CTA, 412-CTB, 413-CTA, 413-CTB, 413-CTL, 414-CTA1, 414-CTA2, 415-CTA, 415-CTB, 415-CTL	NOS.	105
7	400kV, 3000A, 63kA FOR 1 SEC, METERING CURRENT TRANSFORMER - 1PH		401-CTM, 404-CTM, 407-CTM, 410-CTM, 412-CTBR	NOS.	15
8	400kV BUS VOLTAGE TRANSFORMER - 1PH		4BUSI VT, 4BUSII VT	NOS.	6
9	400kV, 3150 A, 63kA FOR 1 SEC, DISCONNECTOR FOR BUS VT WITH TWO EARTH SWITCHES - 3PH		4BUSI 89, 4BUSII 89	SETS	2
10	BUS SURGE ARRESTER - 1PH		4BUSI LA, 4BUSII LA	NOS.	6
11	400kV SF6 TO AIR BUSHING - 1PH		401-X, 403-X, 404-X, 406-X, 407-X, 409-X 410-X, 412-X, 413-X, 415-X	NOS.	30

NOTES:
1. WAVETRAPS SHALL BE PROVIDED IN TWO PHASES.
2. RATING OF LA SHALL BE DECIDED BASED ON INSULATION COORDINATION AND TOV RESULTS.
3. ST RATING IS SUBJECT TO APPROVED SIZING CALCULATION
4. EARTHING SWITCHES MARKED WITH # ARE HIGH SPEED EARTHING SWITCHES.
4. CIRCUIT BREAKERS WITH * ARE BREAKERS HAVING CONTROLLED SWITCHING FACILITY.
5. GT STANDS FOR GENERATOR TRANSFORMER.
7. ST STANDS FOR STATION TRANSFORMER.
8. NOMENCLATURE MAY CHANGE AFTER FINALIZATION OF VENDOR.

MAIN SYSTEM PARAMETERS

1. NOMINAL VOLTAGE	-	400kV
2. HIGHEST SYSTEM VOLTAGE	-	420kV
3. RATED FREQUENCY	-	50 HZ
4. RATED SHORT TIME CURRENT	-	63kA FOR 1 SEC
5. POWER FREQUENCY WITHSTAND VOLTAGE	-	650 kVrms
6. LIGHTNING IMPULSE WITHSTAND VOLTAGE	-	± 1425 kVpeak
7. SWITCHING IMPULSE WITHSTAND VOLTAGE	-	± 1050 kVpeak
8. CREEPAGE	-	31mm/kV (13020 MM)

COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE
01	12.12.22	ALTERED: PC / CHECKED: RD / APPROVED: VK	SLD REVISED TO INCORPORATE ADDITIONAL CT & CSD AS PER CUSTOMER COMMENTS.

CA NO.

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT: NTPC TALCHER SUPER THERMAL POWER PROJECT PHASE-III (2x660 MW)

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	PC	-SGD-	15.10.22
जाँचा CHECKED	RD	-SGD-	15.10.22
स्वीकृत APPROVED	VK	-SGD-	15.10.22

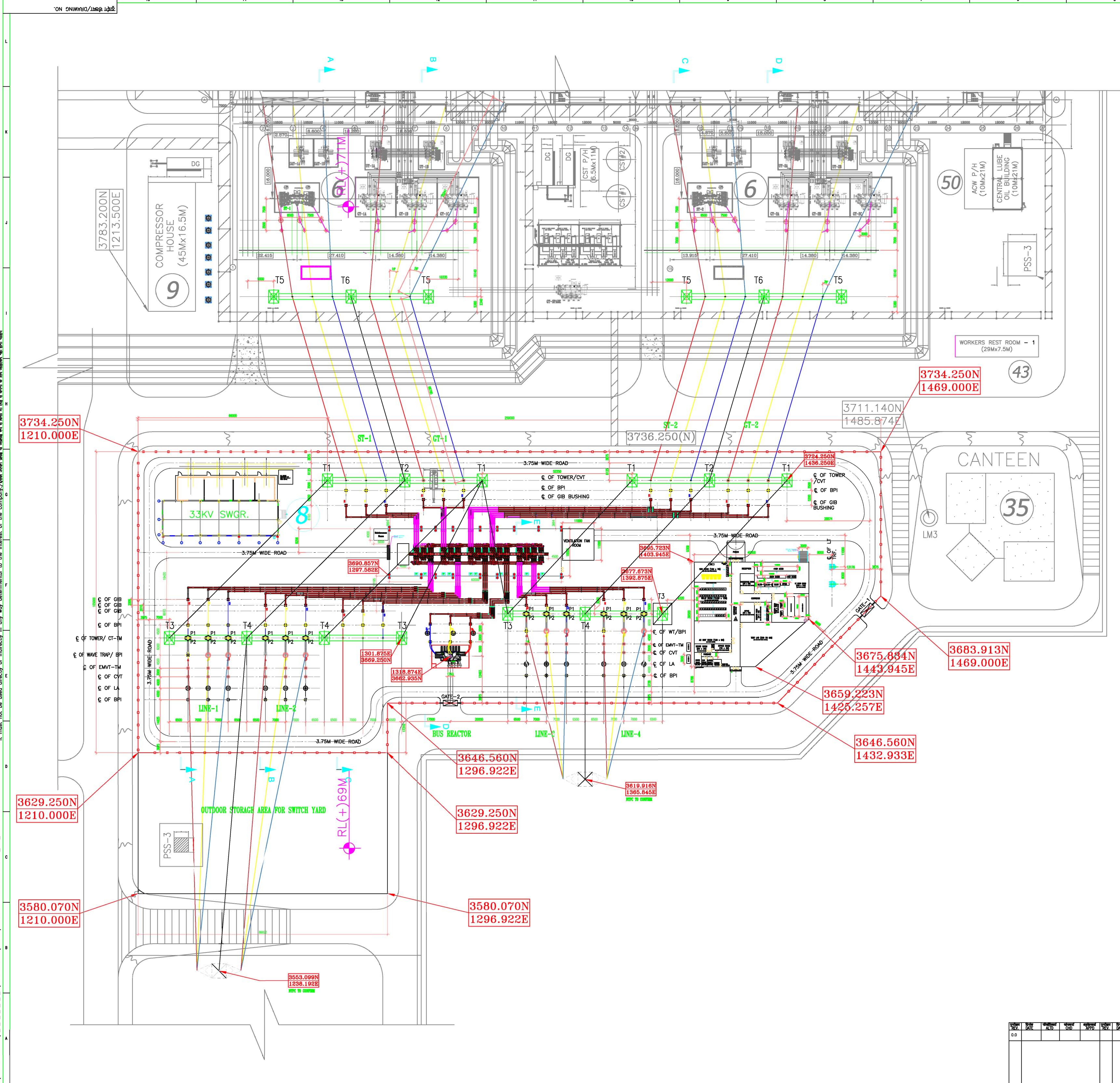
विभाग DEPT. / पेज CODE / अनुपात / SCALE / कार्ड कोड CARD CODE

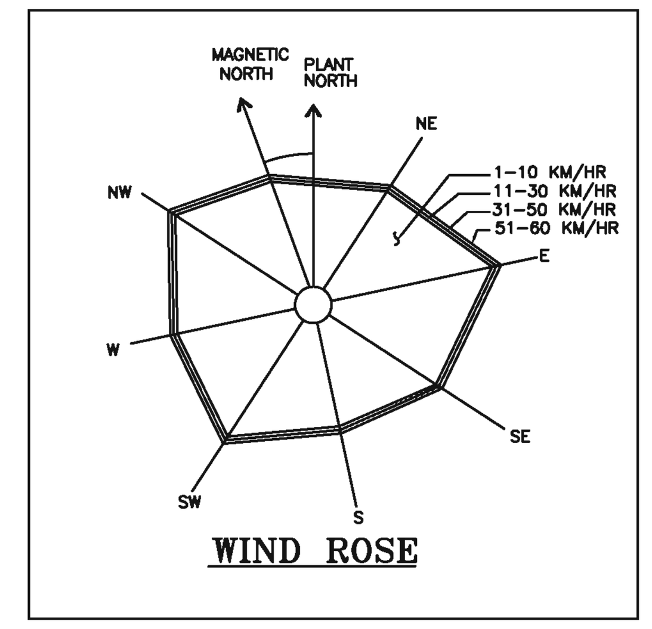
शीर्षक/TITLE: 400kV GIS SWITCHYARD SINGLE LINE DIAGRAM

ड्रा.सं./DRAWING NO.: NTPC DRG NO. 4040-001-330-PVE-P-001; BHEL DRG NO.

पृष्ठ/REV.: 01

पृष्ठ सं./SHEET No. 04 / अगला पृष्ठ/NEXT SHEET 05





400kV SYSTEM PARAMETERS

Sl.No.	DESCRIPTION OF PARAMETER	
1	SYSTEM OPERATING VOLTAGE	400kV
2	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV
3	RATED FREQUENCY	50Hz
4	NO. OF PHASES	3
5	RATED INSULATION LEVELS	
	i) FULL WAVE IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)	± 1425kVp
	ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.)	± 1050kVp
	iii) ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE (rms)	630kV (rms)
6	CORONA EXTINCTION VOLTAGE (MIN)	320kV (rms)
7	MAX. RADIO INTERFERENCE VOLTAGE FOR FREQUENCY BETWEEN 0.5MHz & 2MHz AT 266KV rms	1000 microV
8	MIN. CREEPAGE DISTANCE	31 mm/kV (13020 mm)
9	MIN. CLEARANCE	
	i) PHASE TO PHASE	4000MM
	ii) PHASE TO EARTH	3500MM
	iii) SECTIONAL CLEARANCE	6500MM
10	RATED SHORT CIRCUIT CURRENT FOR 1SEC DURATION	63kA
11	SYSTEM NEUTRAL EARTHING	EFFECTIVELY EARTHED
12	SUB CONDUCTOR SPACING	450MM
13	CONDUCTOR STATIC TENSION	
	400kV TWIN	7T PER PHASE
	400kV QUAD	6T PER PHASE

CONDUCTOR & STRINGING DETAILS :-

SL.NO.	DESCRIPTION	400kV	
		CONDUCTOR DETAIL	CONNECTION HEIGHT (ABOVE PLINTH LEVEL)
1.	EQUIPMENT INTERCONNECTION	4.0" IPS (EH) AL. TUBE/ MOOSE CONDUCTOR	10mtr.
2.	JACK BUS ON GT/ST - IN GT YARD	TWIN ACSR MOOSE CONDUCTOR	22 mtr. FROM GT YARD FGL
3.	JACK BUS TOWARDS GT/ST - IN SWYD	TWIN ACSR MOOSE CONDUCTOR	22 mtr.
4.	LINE SIDE DEAD-END STRINGING	*QUAD ACSR MOOSE CONDUCTOR	22 mtr.
5.	EARTHWIRE	7/3.66mm SHIELD WIRE	30.5 mtr
6.	DROPPER ON CVT, LA	TWIN ACSR MOOSE CONDUCTOR	-

LEGEND:

— - — - — - —	FUTURE/ NOT IN BHEL SCOPE.
————————	PRESENT/ BHEL SCOPE

NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. ALL STRUCTURE/CONDUCTOR HEIGHTS ARE ABOVE PLINTH LEVEL. PLINTH LEVEL IS 300 MM ABOVE F.G.L.
3. WAVE TRAP FOUNDATION SHALL BE PROVIDED FOR ALL THREE PHASE OF THE LINE AND SHALL BE SUITABLE FOR BPI ALSO. HOWEVER WAVE TRAP SHALL BE INSTALLED ON TWO PHASES ONLY. STRING INSULATR SHALL BE PROVIDED FOR ONE PHASE WHEREVER WAVETRAP IS NOT INSTALLED.
4. TYPE OF GANTRY STRUCTURES SHALL BE AS PER APPROVED STRUCTURAL LAYOUT DRAWING.
5. SWITCHYARD LIGHTNING PROTECTION IS ACHIEVED THROUGH SHIELD WIRES AS PER APPROVED DSLP.
6. SA PRESSURE RELIEF VALVE SHALL NOT BE TOWARDS TRANSFORMER SIDE / ANY EQUIPMENT KEPT NEAR LIGHTING ARRESTER AND BHEL SHALL ENSURE THE SAME DURING ERECTION AT SITE.
7. FOR SECTION DETAILS, REFER SHEET No. 02.
8. SIZE OF GIS AND CONTROL ROOM BUILDING IS AS PER RESPECTIVE APPROVED LAYOUTS.
9. DEAD END TOWERS LOCATION SHALL BE CONFIRMED BY NTPC AS PER THIS LAYOUT.
10. SUPPLY AND STRINGING OF 400kV LINE CONDUCTOR, SHIELD WIRE, INSULATOR AND HARDWARE BETWEEN 400kV DEAD END TOWER AND SWITCHYARD TERMINAL GANTRY ARE NOT IN BHEL SCOPE. HOWEVER, JUMPERING FOR THE RESPECTIVE EQUIPMENT, JUMPERS & HARDWARE REQUIRED FOR JUMPERS ARE IN SCOPE OF BHEL.
11. TARIFF METERING CT-TM & EMVT-TM SHOWN FOR SPACE PROVISION ONLY; ACTUAL SUPPLY OF THESE EQUIPMENTS SHALL BE SUBJECT TO COMMERCIAL SETTLEMENT.

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO. 4540-001-230-PVE-F-023

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड / N T P C LIMITED

कार्य संख्या- JOB NO.: 419
स्थिति STATUS: CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE

परियोजना PROJECT: TALCHER THERMAL POWER PROJECT STAGE-III (2X660MW)

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD
TRANSMISSION BUSINESS GROUP
नोएडा (उ॰प्र॰)/NOIDA (U.P.)

DEPT CODE: M

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN			
डिजाइनकर्ता/DESN			
जांचकर्ता/CHD			
अनुमोदनकर्ता/APPD			

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
0.0				

शीर्षक/TITLE: 400kV GIS SWITCHYARD LAYOUT PLAN AND SECTION

विभाग DEPT. | स्केल SCALE- | हस्ताक्षर SIGN | दिनांक DATE

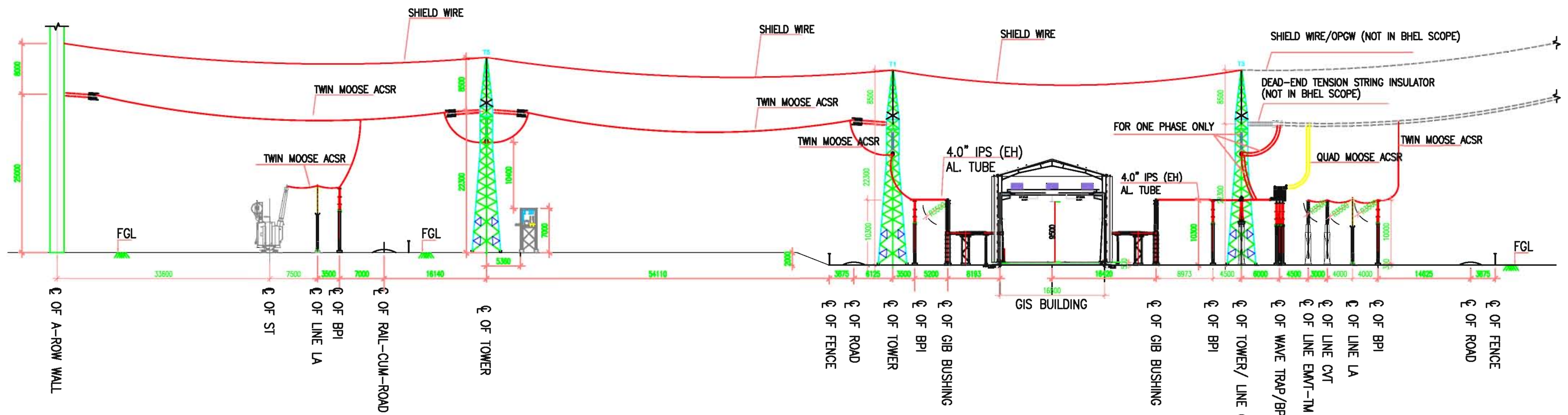
ड्राइंग संख्या/ DRAWING NO. 4540-001-230-PVE-F-023

शीट SHEET 1 OF 2 | पुनरीक्षण REV.

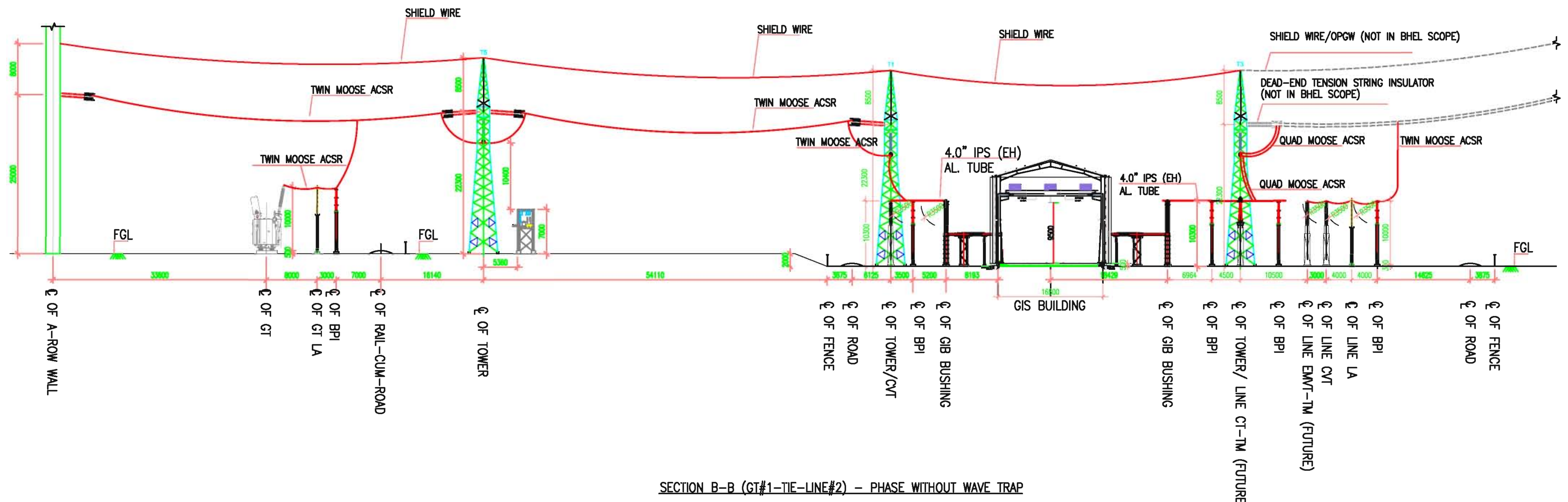
फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि मी में है/ALL DIMENSIONS ARE IN MM

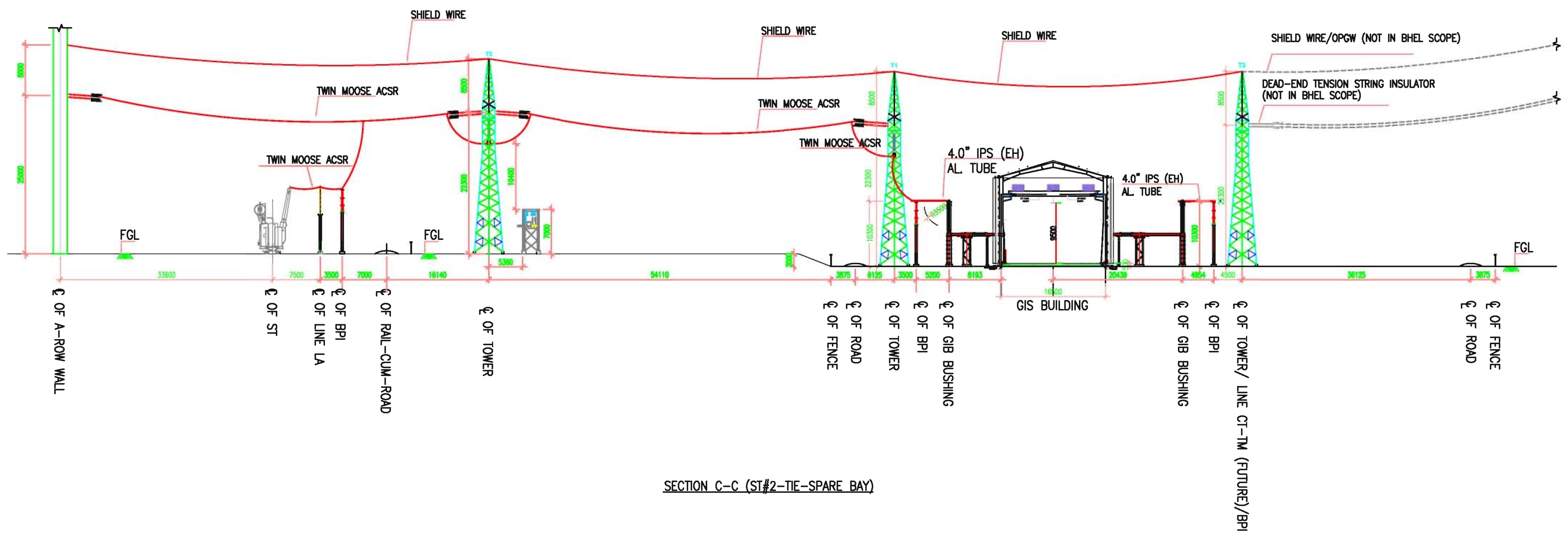
400kV SWITCHYARD ELEVATION VIEW



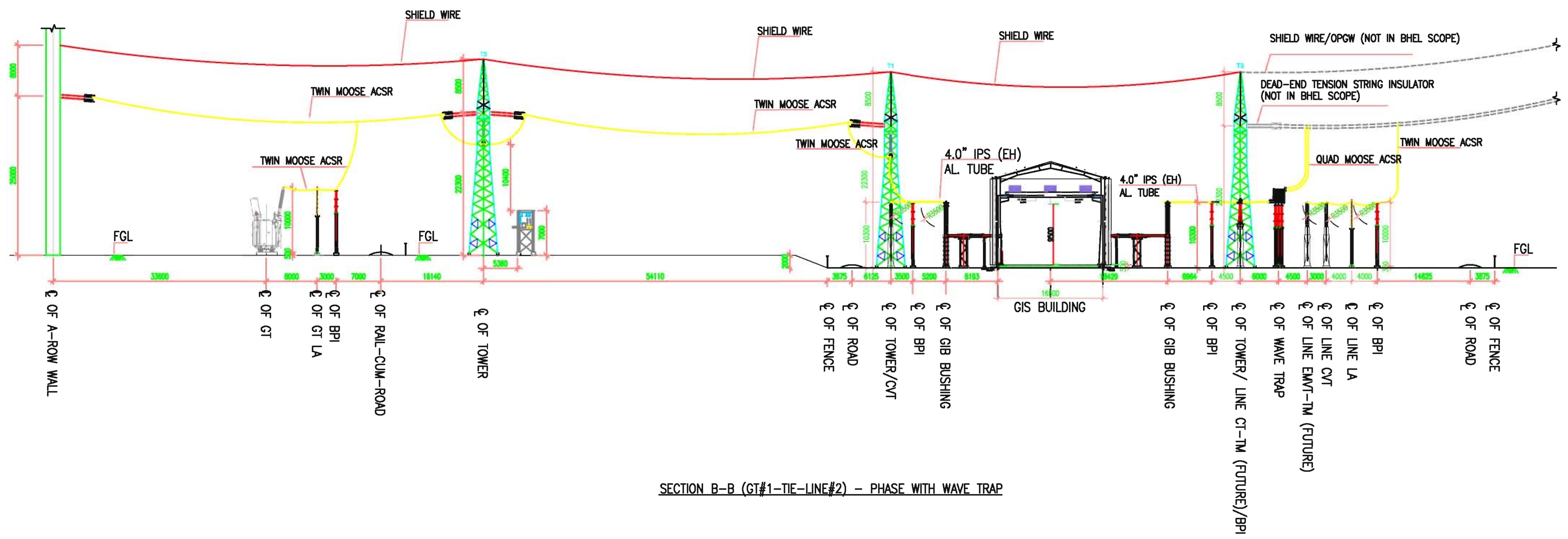
SECTION A-A (ST#1-TIE-LINE#1)



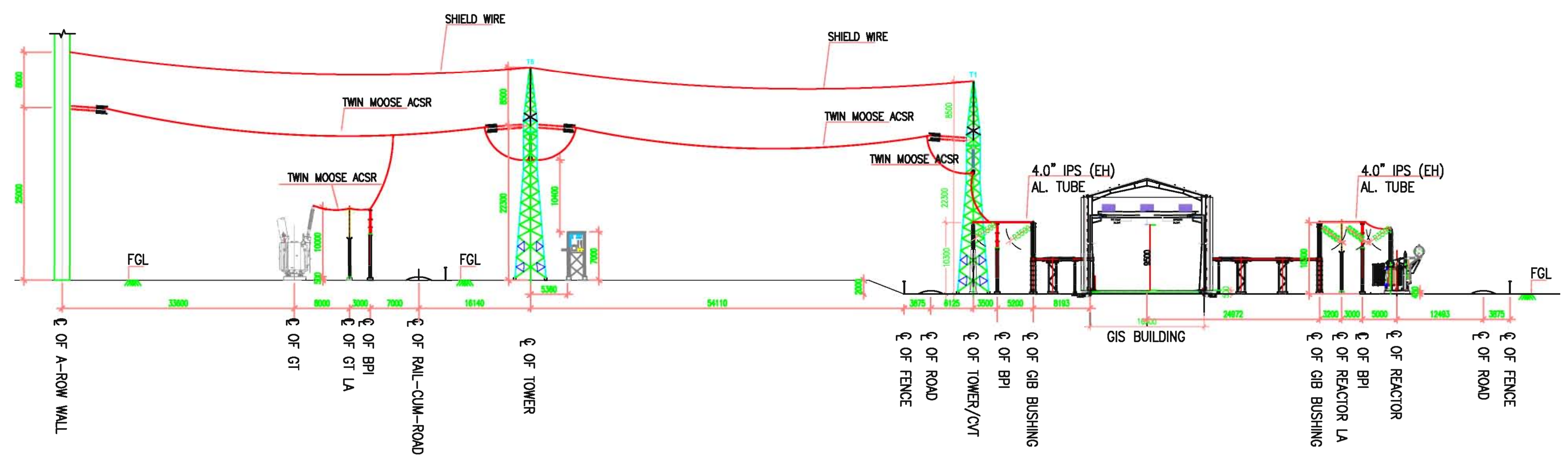
SECTION B-B (GT#1-TIE-LINE#2) - PHASE WITHOUT WAVE TRAP



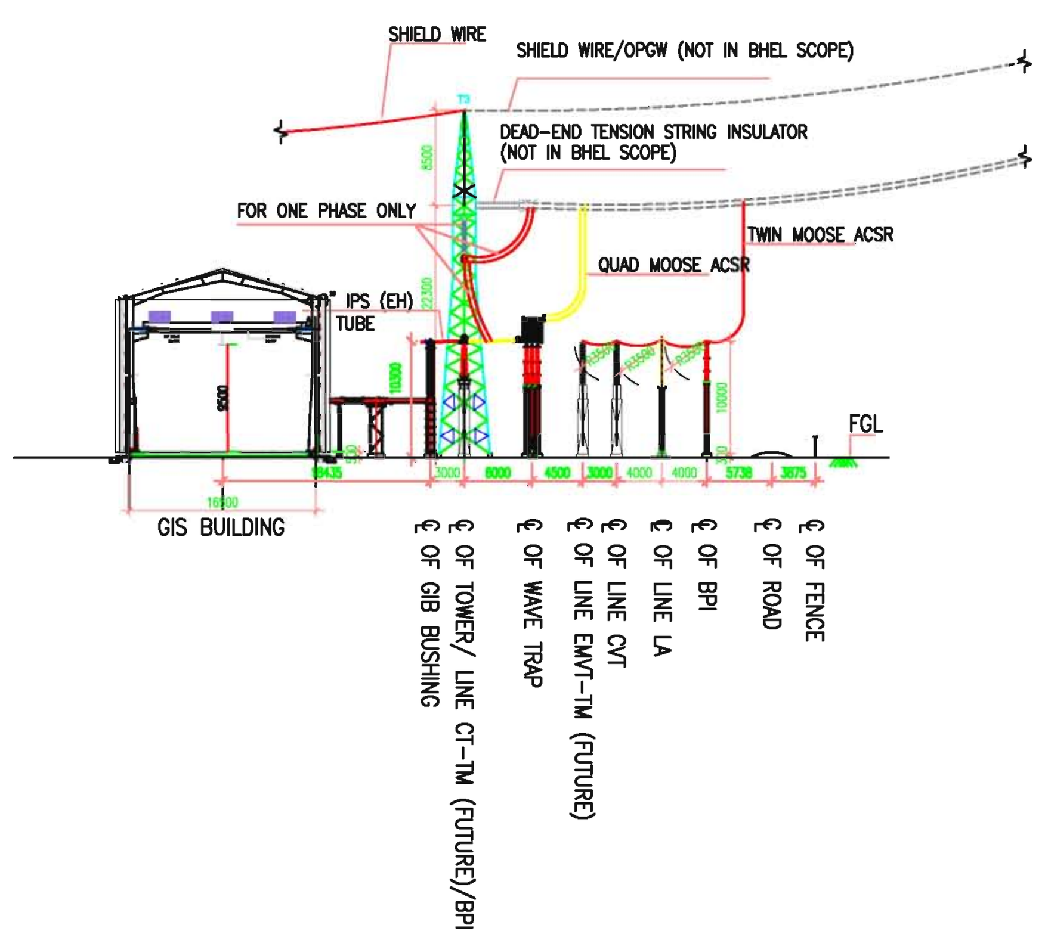
SECTION C-C (ST#2-TIE-SPARE BAY)



SECTION B-B (GT#1-TIE-LINE#2) - PHASE WITH WAVE TRAP



SECTION D-D (GT#2-TIE-BUS REACTOR)



SECTION E-E (LINE#3)

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.	4540-001-230-PVE-F-023
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
कार्य संख्या- JOB NO.	419
स्थिति STATUS	CONTRACT
परियोजना PROJECT	TALCHER THERMAL POWER PROJECT STAGE-III (2X660MW)
	भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP नोएडा (उ.प्र.)/NOIDA (U.P.)
DEPT CODE	M
शीर्षक/TITLE	400kV GIS SWITCHYARD LAYOUT PLAN AND SECTION
ड्राइंग संख्या/ DRAWING NO.	4540-001-230-PVE-F-023
शीट SHEET	2 OF 2
स्केल SCALE	-

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

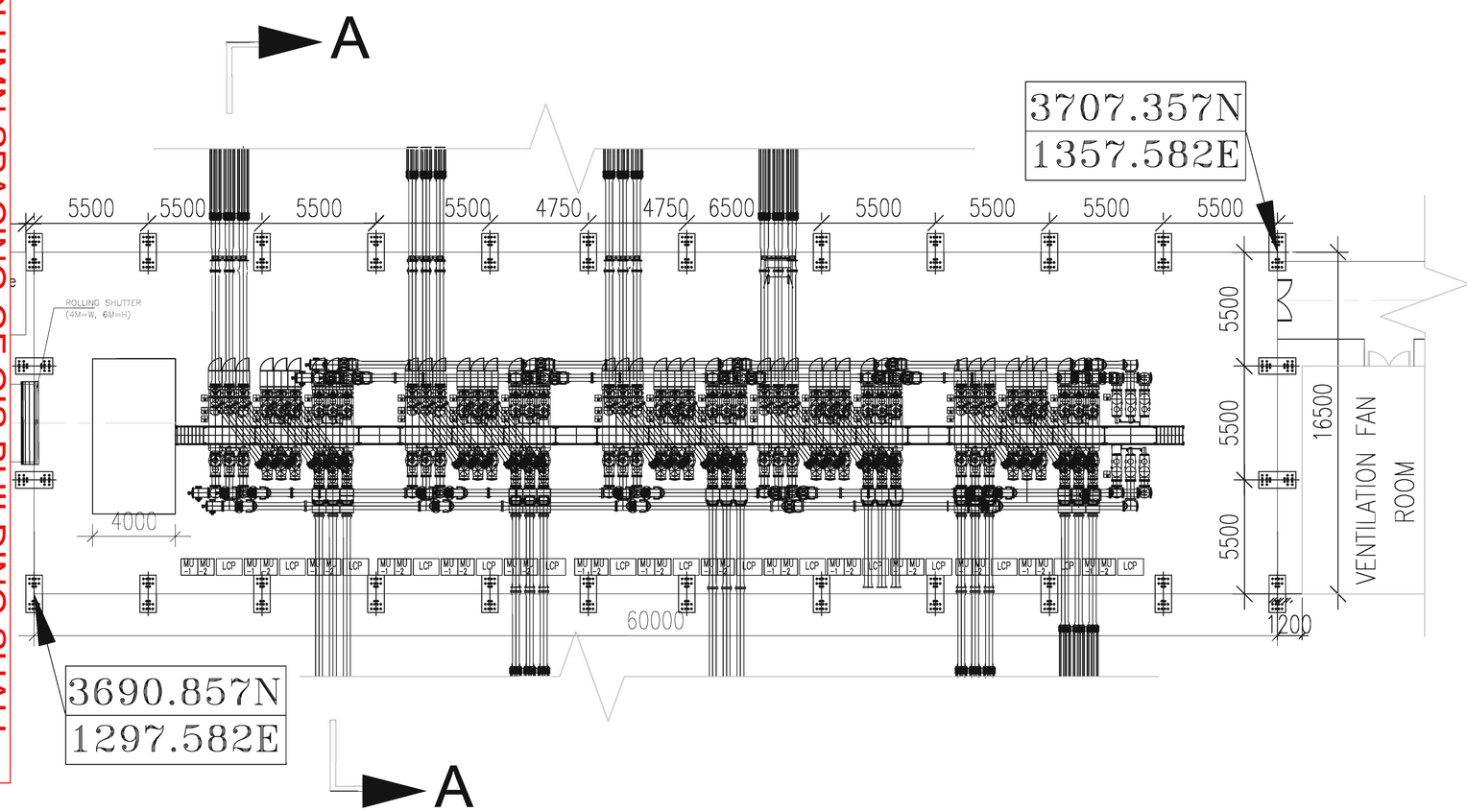
फॉर्मेट साइज A0 FORMAT SIZE A0

D:\PROJECT FOLDER\P_R_O_J_E_C_T_S\NTPC TALCHER\LAYOUT\SWITCH YARD PLAN AND SECTION_R00_2023-01-31

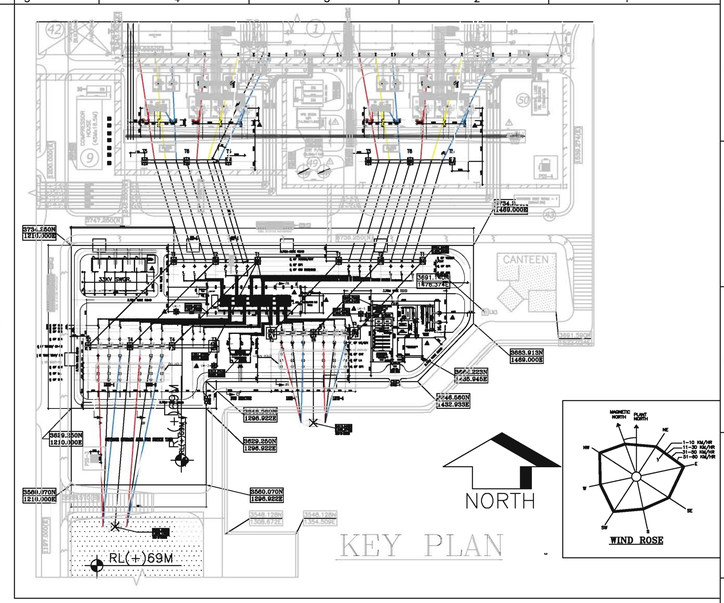
1341798/2023/

COLUMN SPACING OF GIS BUILDING SHALL BE AS PER THIS DRAWING. BIDDER TO OFFER GIS SYSTEM COMPATIBLE WITH THIS COLUMN SPACING & BUILDING DIMENSIONS.

ELECTRONIC FILE NAME:



PLAN



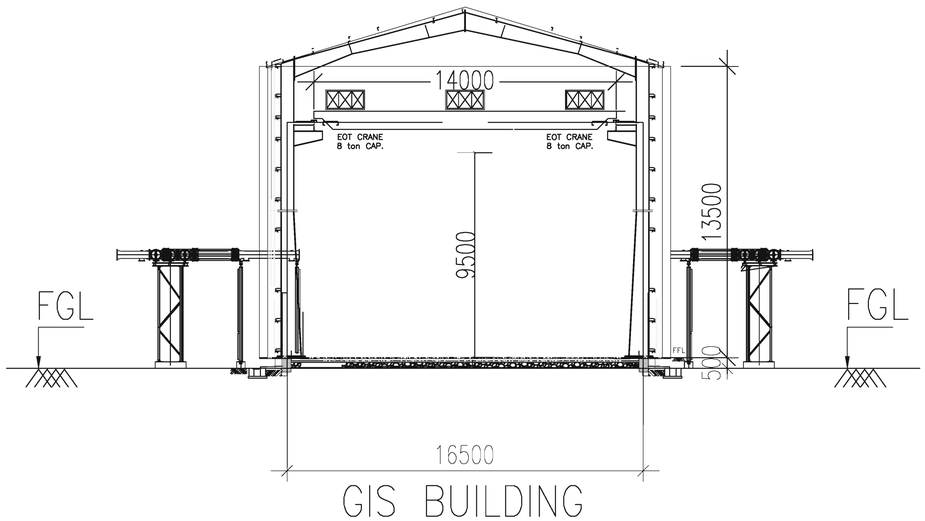
NOTES:

1. ALL DIMENSION ARE IN MM UNLESS NOTED OTHERWISE.
2. DETAILED CIVIL/ STRUCTURAL DRAWING WILL BE SUBMITTED SEPARATELY.
3. THE SIZE, LOCATION AND QTY. OF ALL GIS EQUIPMENTS ARE INDICATIVE & ACTUAL DIMENSIONS, LOCATION, QTY, GIB DUCT OPENING DETAILS & ARRANGEMENT SHALL BE INCORPORATED AFTER APPROVAL OF GIS VENDOR DRAWINGS.
4. WALL THICKNESS, ROOF TYPE, BEAM AND COLUMN LOCATION SHALL BE SUBMITTED AS PART OF DETAILED CIVIL ENGINEERING DRAWINGS.
5. INDIVIDUAL DIMENSIONS AS INDICATED HERE SHOULD BE TREATED AS MINIMUM CLEAR DIMENSIONS OF ROOMS DURING DETAILED ENGINEERING, ALL REQUIREMENTS OF SPECIFICATION WRT CIVIL AND ARCHITECTURAL ARE TO BE TAKEN CARE OF.
6. DETAILS OF CABLE TRAY/TRENCH ARRANGEMENT SHALL BE FURNISED IN A SEPARATE DRAWING.

LEGENDS:

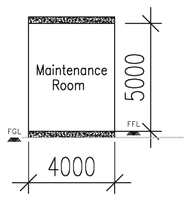
—— PART OF OTHER DRAWINGS

—— PRESENT SCOPE



GIS BUILDING

SECTION A-A



SECTION B-B

W.O. NO.	419			
STATUS	CONTRACT			
DISTRIBUTION				
TO				
No. OF				
REV.	DATE	ALTD	CHD	APPD

NTPC DRG. No. 4540-001-230-PVE-F-023B

PROJECT: TALCHER THERMAL POWER PROJECT STAGE-III (2X660MW)

OWNER: NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)

BHARAT HEAVY ELECTRICALS LTD
TRANSMISSION BUSINESS GROUP
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	PC	–sd–	01.03.23
	CHD	RD	–sd–	01.03.23
	APPD	VK	–sd–	01.03.23

TITLE: CONCEPTUAL GIS BUILDING LAYOUT

DEPT. / SIGN / DATE

SCALE

DRAWING NO. 4540-001-230-PVE-F-023B

SHEET 01 OF 01 REV. 01

FORMAT SIZE A3

SECTION-2

EQUIPMENT SPECIFICATION

CLAUSE NO.	TECHNICAL REQUIREMENTS
	CHAPTER: SWITCHYARD ELECTRICAL
1.00.00	**SCOPE AND GENERAL INFORMATION**
1.01.00	In addition to the detailed scope and other requirements specified in SECTION-1 ~~Part-A~~, the intent of the specifications for various electrical equipments shall also cover the following scope
1.01.01	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.
1.01 02	The basic design shall include, but not limited to, the following: a) Development of general arrangement. b) Development of detailed layout (plan & section/elevation) drawings. c) Development of single line diagram with parameters of equipment and details of protection. d) Protection and control philosophy and selection of protection, control and annunciation schemes. e) Development of interlocking schemes. f) ~~Development of switchyard structure loading details~~. g) Development of earthing system. h) ~~Development of direct stroke lightning protection system~~. i) Insulation coordination of the EHV equipment. j) Calculation of static and dynamic force load, and selection of spacer spans and equipment terminal loading. k) Development of clearance diagrams. l) ~~Lighting design, Lux level calculation and conduit wiring diagram~~. m) Development of power & control cable laying and termination schedules. n) ~~Relay setting calculations~~. o) Development of erection key diagram with bill of material. p) Foundation design and construction drawings. q) Development of cable trench layout and sections and construction drawings.
1.01.03	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 Owner.~~
1.01.04	All equipment shall be supplied with suitable terminal connectors. The spacing for quadruple and twin conductor shall be 450 mm.
1.01.05	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.
1.01.06	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, ~~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.
1.01.07	The minimum sizing criteria of the ~~control room and~~ GIS building shall be as given below:

CLAUSE NO.	TECHNICAL REQUIREMENTS
	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. 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..
1.01.08	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	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.
1.01 10	~~All overhead stringing shall be carried out by minimum double tension string insulator assembly.~~
1.01.11	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	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. 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. 27m or as required to meet the specified clearances. Various minimum heights of the 400KV AIS switchyard shall be as given below from plinth level: Equipment level/1st level :8000mm 2nd level 16000mm
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.
1 01.16	CVT JB shall have fuses for each core of the CVT. Further separate lockable CVT with TTBs for ABT metering cores (0.2S class) / owners supplied meters shall also be provided by the contractor.

CLAUSE NO.	TECHNICAL REQUIREMENTS

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 Lightning Masts/ High lighting masts only. Specification of lighting is provided elsewhere in the specification.

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.

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.

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)

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

Phase to earth clearance :3500 mm
Phase to phase clearance :4000 mm
Section clearance :6500 mm

The Contractor shall supply the structures suitable to meet the above clearances.

1.03.00 **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.

1.03.01 **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.

1.04.00 **Insulation Co-Ordination and Selection of Surge Arrestor**

1.04.01 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~~. supplied by bidder.

1.05.00 **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

1.05.01 **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 equipments of GIS & AIS. For other Parameters bidder to refer respective chapter.

1.06.00 **TYPE TEST REQUIREMENTS**

1.06.01 **TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN GIS & 400KV AIS CIRCUIT BREAKER :**

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

CLAUSE NO.	TECHNICAL REQUIREMENTS

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.

1.06.02 **TYPE TEST REQUIREMENTS FOR GIS ~~& 400KV AIS 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 No. 1.23.00- Sl. No.-2.~~ SECTION - 1 .

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.

1.06.03 **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.
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.

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)

CLAUSE NO.	TECHNICAL REQUIREMENTS

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

d) 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) / Latest IEC Standard

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

1.07.00 **Type tests to be conducted on 400KV AIS Circuit Breaker** (N. A.)

a) Dieelctric tests	b)Radio interference voltage test
c) Temperature rise test	d) shor time withstand current, peak with stand test. short circuit test duties , short line fault test
e) Mechanical endurance	f)out of phase making & breaking test
g)Line charging current breaking test	h) Coronal test for 400kV
i) IP: 55test on each type of box	j)Seismic with stand test with structure for 400kV
k) Test for reactor switching duty for 400kV CB(for Bus reactor)	

1.08.00 **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).

CLAUSE NO.	TECHNICAL REQUIREMENTS

2.0 **Test Methods for RIV:**

2.1 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.

2.2 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.

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)

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

b.) 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

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	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.
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 shall be provided for access to the equipment for 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.
2.03.15	Arrangement shall be provided to visually observe the contact position of disconnecting

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switches and earth switches.

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) Gas Insulating System

a) Loss of gas density b) Loss of heater power (if required)

c) Low gas pressure d) Any other alarm necessary to indicate deterioration of the gas insulating system

II) Operating System

a) Low operating pressure .b) Loss of Heater Power. c) Loss of operating power.

d) Loss of control e) 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:

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	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 T he 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. Calibration: 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 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. 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. 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. 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,

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	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 equipments shall be mounted on the cabinet door - Remote/local control transfer switch for the circuit breakers and disconnector switches. - Normal operation/maintenance control transfer switch for disconnector of remote electrical controls. - 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.
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)

a) 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) Check of wiring.x) Power frequency voltage dry tests

xi) Voltage tests on auxiliary and control circuits xii) Fluid leakage tests (where applicable).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 clause No.1.06.02 & 1.06.03.

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
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** 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.

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

The sensing probe shall be such that it can reach all the points on the GIS where leakage is to be sensed. 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 penpheral 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.

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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
- 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**

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 thebreaker.

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.

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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 O - 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 clause no 1.06.02 & 1.06.03.

~~b) 400KV AIS circuit breaker shall confirm to type tests as per IEC in accordance with the requirement stipulated under clause no. 1.06.02.~~

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.

3.08.02 **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

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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.
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)

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	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
4.01.03	The isolators and earth switches shall be A. C / D.C. motor operated.
4.02.00	**DUTY REQUIREMENTS**
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.
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.
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.
4.03.00	**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.

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 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.

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.

4.04.00 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 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.

m) 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

n) 400KV GIS disconnector, Earth, Grounding/ safety / high speed earth switches shall be type tested in accordance with the requirement stipulated under clause no 1.06.02 & 1.06.03.

4.11.00 **PARAMETERS: General**

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

5.00.00 INSTRUMENT TRANSFORMER : CODES AND STANDARDS

Current transformers	IEC 61869-2, BS: 3938, IS. 2705
Voltage transformers	IEC 60044-2&5, IEC 60358, IS: 3156
Insulating oil	IS: 335

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)

(a	One minute power frequency Withstand voltage between Secondary terminal and Earth is	5kV
(b	Partial discharge level	10 pico Coulombs max.
(c)	Type of insulation	Class A
(d	Number of cores	Details are given in Table-I below
(e	Number of terminals in	All terminals of control circuits wired

	box	marshalling up to marshalling box plus 20 terminals 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 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.

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5.04.02 The Instrument transformer shall be with Polymer Insulator. For CVT cantilever strength shall not be less than 250kg No oil shall come into direct contact with Zinc galvanized surface.

5.05.00 VOLTAGE TRANSFORMERS (CVTs) (AIS).

5 05.01 Voltage transformers shall be of capacitor voltage divider type with electromagnetic unit.2The 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.

5.05 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. The protection cores shall not saturate at about 1.5 times the rated voltage for a min. duration of 30 secs.

5 06.00 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

5.07.00 **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)

5.0.04 **TESTS**

a) 400KV GIS Instrument transformer shall be type tested in accordance with the requirement stipulated under clause no 1.06.02 & 1.06.03.

b) The 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:

i) Radio Interference and Corona test
ii) Seismic withstand test along with structure (for 400kV only)

iii) 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)

iv) Multiple chopped impulse test on Primary winding.

TABLE-I REFER ATTACHED ANNEXURE 3 FOR GIS CT-VT CORE PARAMETERS

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/ 500/1 , BCU & Synchronising	20/0/20/20/20	0.2S		---	---

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.

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

Physical arrangement of CTs shall be as per Protection SLD.

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

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)	20/0/20/20/20	0.2S			

Physical arrangement of CTs shall be as per Protection SLD.

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

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	20/0/20/20/20	0.2S		----	----
4	3000/ 2000/ 1000/ 500/1 ABT Metering (EM-Main, Check)	20/0/20/20/20	0.2S		----	----

Physical arrangement of CTs shall be as per Protection SLD.

CORE DETAILS OF 400kV VT(GIS) & 400KV CVT — **TABLE – II**

Secondary Core	Application	Rated Secondary Voltage (V)	Accuracy	Output Burden – Minimum
I	Protection	110/√3	3P	75 VA
II	Protection	110/√3	3P	75 VA
III	Metering	110/√3	0.2	75 VA
IV	Metering	110/√3	0.2	75VA (Additional core#IV for AIS CVT only)

The accuracy of 0.2 on secondary III should be maintained through the entire burden range up to total simultaneous burden 150 VA on all the three windings without any adjustments during operation.

* This is minimum burden specified, however bidder to consider VA burden to suit the requirement of the offered system. The supporting calculation to be furnished during detail engineering.

6.00.00 SURGE ARRESTOR

6.01.00 **GENERAL** : The 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.

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6.03.00 **CONSTRUCTIONAL FEATURES (FOR AIS)**

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 surge arrestor shall be minimum 500kg 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.

6.04.00 **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. 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)

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 clause no. 1 06.02 & 1.06.03. 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 be accepted. Height of post insulator shall be preferably as given under parameters of this part. The other requirements of insulator as given under auxiliary requirements shall also be applicable.

7.03 00 **TESTS**

7.03.01 In accordance with the stipulations elsewhere the post insulators shall conform to type tests and acceptance, sample and routine tests as per IS 2544, IEC-60168 shall be carried out

7.03 02 In addition to acceptance/sample/routine tests as per IS. 2544, IEC-60168, the following tests shall also be carried out.

a) Ultrasonic tests on all cut shells as routine check.
b) Visual examination and magna flux test on all flanges prior to fixing.

c) Check for uniformity of thickness and weight of zinc coating as a sample test from each lot of flanges prior to fixing.
d) Bending load test shall be carried out at 50% minimum failing load in four directions as a routine test.
e) Bending load in four directions at 100% minimum bending load guaranteed on samples as per clause-2.3 of IEC. Subsequently this post insulator shall not be used.
f) Tests for deflection measurement at 20, 50, 70% of specified minimum failing load on sample.

7.04.00 **PARAMETERS**

7.04.01 **400 kV class Post Insulators**

Sl.no	Description	
a)	Type	Solid core
b)	Dry and wet one min.power frequency voltage	680kV rms
c)	Dry impulse withstand positive and negative(kVp)	1550rms
d)	Wet switching surge withstand (kVp)	1175 rms
e)	Total min.cantilever strength(kg)	800
f	Min. torsional moment(kg- m)	600
g	Total height of insulator(mm)	3650

Note: If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the bidder without any price implication.

8.00.00 WAVE TRAP : GENERAL:

The Wave Trap covered under the package shall conform to IEC 353 or IS 8792, IS.8793 and relevant IEC/IS Specifications except to the extent modified by the specification.

8.01.00 **LOCATION OF EQUIPMENT :**

8.01.01 Wave Traps as specified under this section shall be installed at the respective transmission line bays as indicated in single line diagram.

8.02.00 **TECHNICAL REQUIREMENTS**

8.02.01 Wave Trap shall be inserted into high voltage transmission line to prevent undue loss of carrier signal for all power system conditions. Its impedance shall be negligible at power frequency (50 Hz) so as not to disturb power transmission but shall be relatively high over the frequency band appropriate to carrier transmission.

8.02.02 Wave trap shall consist of a main coil designed to carry continuously the rated current without exceeding the limit of temperature rise. It shall be supplemented with a protective device and tuning device. Wave trap shall be Broad Band tuned for its entire carrier frequency range. Resistive component of impedance of the Wave trap within its carrier frequency blocking range shall not be less than 570 ohms.

8.02.03 Wave trap shall be provided with a protective device in the form of lightning arrestor which shall be designed and arranged such that neither significant alternation in its protective function nor physical damage shall result from either temperature rise or the magnetic field of the main coil at continuous rated current or rated short time current. The protective device shall be shunt connected to the main coil and tuning device. The lightning arrestor provided shall have a rated discharge current of 10 kA. Coordination, however, shall be done by taking 20 kA discharge current into account.

8.02.04 The lightning arrestor provided with the Wave trap of each rating shall fully comply with the requirements of IS-3070-Part-I (1974)/IEC-60099. It shall conform to type tests as applicable and type test certificate for the same shall be submitted by the Bidder.

CLAUSE NO.	TECHNICAL REQUIREMENTS	NTPC

8.02.05 The lightning arrester provided with the Wave trap shall be subject to routine and acceptance tests as per IEC – 60099. The Wave trap on 400 kV lines shall show no visual corona at extinction voltage of 320 kV rms. Suitable corona rings shall be incorporated in the line trap for 400 kV. Wave trap shall be equipped with bird barriers.

8.02.06 Wave trap shall preferably be spray painted with light admiralty Grey paint (shade 697 of IS-5) or may have its natural epoxy colour.

8.02.07 Wave trap shall conform to IEC - 60353 fulfilling the following technical particulars.

Sl.no	Description	
a)	Nominal discharge current of protective device	10kA
b)	Type of tunning	Broad band
c)	Rated Blocking band width	90-500KHZ
d)	inductance	1.0 mH / 0.5 mH
e)	Radio intergerence voltage level at 266kVTotal min.cantilever strength(kg)	Not > than500micro volts

8.02.08 In accordance with the requirements stipulated elsewhere, the Wave Trap shall confirm to following type tests and shall be subjected to routine and acceptance tests as per IEC-60353.

a) Measurement of inductance of the main coil
b) Measurement of temperature rise
c) Insulation tests
d) Short time current tests
e) Corona Extinction Voltage Measurement
f) Radio Interference Voltage measurement

8.03.00 **WAVE TRAP MOUNTING**

8.03.01 The Wave Trap for 400kV shall be suitable for outdoor pedestal mounting and shall be mechanically strong enough to withstand the stresses due to maximum wind pressure of 195 kg/square meter. For pedestal mounting, each Wave trap shall be mounted on a lattice structure formed by three solid core type insulators

9.00.00 REQUIREMENT OF AUXILIARY ITEMS

9.01.00 **ALUMINIUM TUBULAR CONDUCTOR**

9.01.01 The aluminium tube shall be grade 63401 WP (range2) as per IS 5082.There shall be no negative tolerance on OD and thickness of the tube. Other tolerances shall be as per IS 2678 and 2673.

9.01.02 Tests: In accordance with stipulations of specification routine tests shall be conducted on tubular conductor as per IS:5082. Also, the wall thickness and ovality shall be measured by ultrasonic method. In addition, 0.2% proof tests on both parent material and aluminium tube after welding shall be conducted.

a)	size	4"IPS(EH Type)
b)	Outer diameter	114.20mm with no negative tolerance
c)	Thickness of tube	8.51 mm with no negative tolerance
d)	Cross-sectional area	2825.61 sq. mm.
e)	weight	7.7kg/m

9.02.00 **ACSR CONDUCTOR**

a)	Code and standard & Name	IS.398, MOOSE ACSR
b)	Overall diameter	31.77mm

c)	Strands and wire diameter of	
	a) Aluminium	54/3.53mm
	b)steel	7/3.53mm

9.03.00 **CLAMPS AND CONNECTORS**

9.03.01 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case equipment terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetal.

9.03.02 The material of clamps and connectors shall be Galvanised mild steel for connecting to G.S. shield wire.

9.04.00 **INSULATOR STRING HARDWARE**

9.04.01 The insulator hardware shall be of bolted type and shall be of forged steel except for insulator cap, which can be of malleable cast iron. It shall also generally meet the requirements of clamps and connectors as specified above. In one span, Tension string assembly at one end shall be supplied with suitable turn buckle.

9.04.02 Disc Insulator for porcelain type insulator

The disc insulator shall meet the following parameters.

a)	Type	Antifog type insulator
b)	Size of insulator	255X145
c)	Electro mechanical strength	120KN
d)	Leakage distance(mm)	Min.430 or as required to meet the total creepage
e)	Power frequency voltage- dry & wet	80kV, 50kV

9.04.03 Insulator string (400KV) : **Porcelain type / composite long rod type)**

a)	Creepage distance size	Min.13020mm
b)	One Minute Power frequency voltage	680KV
c)	Lightning impulse	+/- 1550 KV
d)	Switching impulse	+/- 1050 KV
e)	No of disc.insulator (for porcelain)	25nos
f)	Eelctromechanical strength	120KN (porcelain)

9.05.00 **SPACERS** : Spacers shall conform to IS:10162. They shall be of non-magnetic material except nuts and bolts, which shall be of hot dip galvanised mild steel.

9.05.01 Spacers shall generally meet the requirements of clamps and connectors as specified above. Its design shall take care of fixing and removing during installation and maintenance.

9 05.02 In addition to the type tests as per IS.10162, clamp slip test should have been conducted In this test the sample shall be installed on test span of twin/quad bundle string at a tension of 44.2 kN (4500 kg). One of the clamps when subjected to a longitudinal pull of 2.5 kN (250 kg) parallel to the axis of conductor shall not slip, i.e. permanent displacement between conductor and clamp after the test shall not exceed 1.0 mm. This test should have been performed on all other clamps of the sample.

9.06.00 **EARTHING CONDUCTOR**

a) The main conductor buried in earth shall be 40mm dia rod for main and auxiliary mat. The earthing conductors over the ground shall be of 75x12 mm GS flat. The earthing leads for columns and auxiliary structures, cable trenches shall be of 75x12 mm GS flat. The earthing of the lighting fixtures shall be carried out by 16 SWG wire.

b) All earthing conductors above the ground level shall be galvanised steel only.

9.07.00 **Earthwire for Lightning Protection**

a) Number of strands 7 of steel

	b) Strand diameter	3 66 mm
	c) Overall diameter	10.98 mm
	d) Weight	583 kg/km approx
	e) Ultimate tensile strength	68.4 kN minimum
	f) Total cross-sectional area	73.65 sq.mm.
	g) Calculated d.c. resistance	2.5 ohms/km at 20 deg.C.
	h) Direction of lay of outer layer	Right hand

9.08.00 **BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS, AND DISC INSULATORS**

9.08.01 Bushings shall be manufactured and tested in accordance with IS 2099 & IEC 60137 while hollow column insulators shall be manufactured and tested in accordance with IEC 62155/IS 5284. The support insulators shall be manufactured and tested as per IS.2544 / IEC 60168/IEC 60273. The insulators shall also conform to IEC 60815 as applicable having alternate long and short sheds.

Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used

9.09.00 **CABINETS, BOXES, KIOSKS, PANELS, ETC.**

9.09.01 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes. Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC. 60439 as applicable They shall meet all other requirements specified elsewhere in the specification.

9.10.00 **BAY MARSHALLING BOX**

9.10.01 Bay Marshaling Box located at a convenient location to receive and distribute cables shall be provided as required. It shall meet all the requirements as specified for cabinets/boxes.

9.10.02 It shall have three separate distinct compartments for following purposes:

- To receive two incoming 415V, three phase AC supplies controlled by 100A four pole MCBs with auto changeover provision and to distribute five (5) three phase ac supplies controlled by 32A four pole MCBs. It shall also be provided with 63A, 3 phase 4 pin industrial grade receptacle with rotary switch.
- To receive three phase incoming from first compartment and to distribute ten (10) single phase ac supplies controlled by 16A two pole MCBs.
- 150 nos. terminal blocks in vertical formation for interlocking facility.

9.11.00 **Type tests**

All equipment with their terminal connectors, control cabinets, main protective relays, etc. as well as insulators, insulator strings with hardwares, clamps and connectors, marshalling boxes, etc., shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with the requirements stipulated under respective equipment sections.

10.00.00 INSTALLATION

10.01.00 **EARTHING:** The earthing shall be done in accordance with requirements given in **Annexure-II** of this section and drawing enclosed with the specifications. Earthing of panels shall be done in line with the requirements given in respective equipment section of this specification

10.02 00 **CIVIL WORKS** :The civil works shall be done in accordance with requirements stipulated elsewhere in the specification.

10.03.00 **STRUCTURAL STEEL WORKS** :The structural steel works shall be done in accordance with requirements stipulated elsewhere in the specification.

10.04 00 **LIGHTNING PROTECTION**

10.05.01 Direct stroke lightning protection (DSLP) shall be provided in the switchyard by lightning masts (at least 50 m high) and shield wires.

CLAUSE NO.	TECHNICAL REQUIREMENTS

10.05.02 Lightning protection System down conductors shall not be connected to other conductors above ground level. Also no intermediate earthing connection shall be made to Surge arrester, Voltage Transformer, earthing leads for which shall be directly connected to rod electrode.Every down conductor shall be provided with a test joint at about 150mm above ground level. The test joint shall be directly connected to the earthing system. The lightning protection system shall not be in direct contact with underground metallic service ducts and cables.

10.06.00 **EQUIPMENT ERECTION NOTES**

a) All support insulators, circuit breaker interrupters and other fragile equipment shall be handled with cranes with suitable booms and handling capacity. The contractor shall strictly follow manufacturer's recommendations for handling and erection of equipment.

b) The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc. Handling equipment, sling ropes etc. should be tested before erection and periodically thereafter for strength.

c) Bending of piping should be done by a bending machine and through cold bending only. Bending shall be such that inner diameter of pipe is not reduced. The pipes shall be thoroughly cleaned before installation.

10.07.00 **CABLING**

10.07.01 Cabling shall be on cable racks, in trenches, vertical shafts, excavated trenches for direct burial, pulled through pipes and conduits run clamped on steel structures etc. in accordance with the requirements specified elsewhere in the specification.

10.07.02 Cables inside the switchyard shall be laid on bolted GI angle supports at 600mm spacing with separate tiers for control and power cables. The GI angles shall be bolted / welded to galvanized insert plates inside RCC trenches

10.07.03 Cabling in the control room shall be done on ladder type cable trays with supports at an interval of 2000mm.All interpole cables (both power & control circuit) for equipments shall be laid in cable trenches/G.I. Conduit Pipe of NB 50/100mm which shall be buried in the ground at a depth of 300mm.

ANNEXURE-II

a) **EARTHING NOTES FOR SWITCHYARD**
GENERAL

i) Earthing of operating boxes, cubicles shall be done by 50 X 6 mm GS flat while cable trenches and structure by 75 X 12 mm GS flat. Neutral points of systems of different voltages, metallic enclosures and frame works associated with all current carrying equipments and extraneous metal works associated with electric system shall be connected to a single earthing system unless stipulated otherwise.i. Earthing system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.

b) **EARTHING OF GIS**

i) The grounding system shall be designed and provided as per IEEE-80-2000 and CIGRE-44 to protect operating staff against any hazardous touch voltages and electro-mechanical interferences.

ii.) The GIS contractor shall define clearly what constitutes the main grounding bus of the GIS. The GIS contractor must supply, commission the entire grounding work of GIS viz conductor, clamps, joints, bimetallic strips (for connection between different type of earthing materials), operating and safety platforms etc.

iii.) The enclosure of the GIS shall be grounded at several points so that there shall be grounded cage around all the live parts. A minimum of two nos. of grounding connections should be provided for each of circuit breaker, transformer terminals, cable terminals, surge arrestors, earth switches and at each end of the bus bars. The grounding continuity between each enclosure shall be effectively interconnected with links or straps to bridge the flanges. Subassembly-to-subassembly bonding shall be provided to provide gap & safe voltage gradients between all intentionally grounded parts of the GIS assembly & between those parts and the main grounding bus of the GIS.

iv) The enclosure grounding system shall be designed to minimize circulating currents and to ensure that the potential rise is kept to an acceptable level. Each marshalling box, local control panel, power and control cable sheaths and other non-current carrying metallic structures shall be connected to the grounding system of GIS via connections that are separated from GIS enclosures.

v) The contractor shall provide suitable measure to mitigate transient enclosure voltage caused by high frequency currents caused by lightning strikes, operation of surge arrester, phase/earth fault and discharges between contracts during switching operation. The grounding system shall ensure safe touch & step voltages in all the enclosures. The contractor shall provide suitable barrier of non-liner resistor/counter discontinued SF6/Transformer and SF6/ HV cable bushing etc. to mitigate transient enclosure voltage.

c) **DETAILS OF EARTHING SYSTEM**

Item	Size	Material
Main Earthing conductor	40mm dia rod	Mild steel
Conductor above ground & earthing leads (for equipment)	75 x 12 G.S. Flat 50 x 6	Galvanized steel Galvanised steel
Rod Electrode	40mm dia. 3000mm	Mild steel
G.I. Earth wire	7/8 SWG	GI
Copper Flat (if required)	as per requirement	

d) For Step and Touch Potential the following parameters shall be considered
i) Current distribution factor – 1 (one)
ii) Duration of fault current – 0.5 sec
iii) Human body weight – 50kg

e) Grid resistance shall be less than 1(one) ohm.

f) **EARTHING CONDUCTOR LAYOUT**

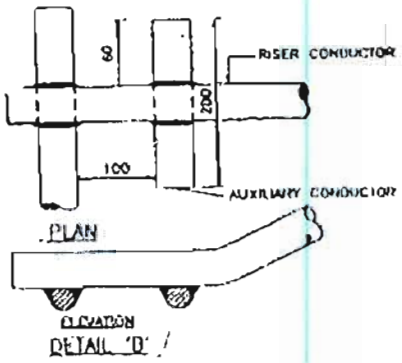
i. Earthing conductors in outdoor areas shall be buried at least 600mm below finished grade level unless stated otherwise.

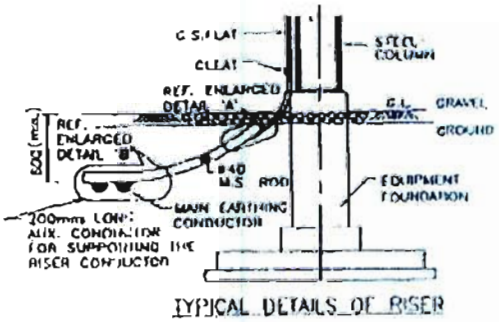
ii. Minimum 6000mm or higher spacing between rod electrodes shall be provided based on the earth mat design calculations.

iii. Wherever earthing conductors cross cable trenches, underground service ducts, pipes, tunnels, railway tracks etc., it shall be laid at least 300mm below them and shall be re-routed in case it fouls with equipment/structure foundations.

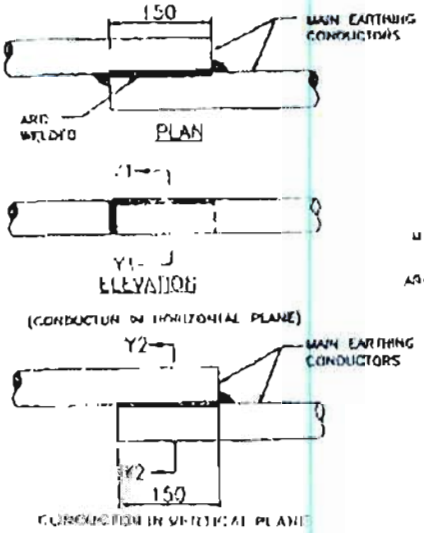
CLAUSE NO.	TECHNICAL REQUIREMENTS
iv.	Earthing conductor along their run-on cable trench ladder columns, beams, walls, etc. shall be supported by suitable welding/cleating at intervals of 750mm. Wherever it passes through walls, floors etc. galvanized iron sleeves shall be provided for the passage of the conductor. Both ends of the sleeves shall be sealed to prevent the passage of water through the sleeves.
v.	Earthing conductor around the building shall be buried in earth at a minimum distance of 1500mm from the outer boundary of the building. In case high temperature is encountered at some location, the earthing conductor shall be laid minimum 1500mm away from such location.
vi.	In outdoor areas, tap connections shall be brought 300mm above ground level for making connections in future in case equipment is not available at the time of grid installations.
vii.	Earthing conductors crossing the road shall be either installed in Hume pipes or laid at greater depth to suit the site conditions.
viii.	Earthing conductors embedded in the concrete fibre shall have approximately 50mm concrete cover.
ix.	Contractor shall also provide interconnection (two interconnection per Unit) of Switchyard Earth mat with the Plant earth mat.
g)	**EQUIPMENT AND STRUCTURE EARTHING**
i.	The connection between earthing pads and the earthing grid shall be made by short and direct earthing leads free from kinks and splices.
ii.	Metallic pipes, conduits and cable tray sections for cable installation shall be bonded to ensure electrical continuity and connected to earthing conductors at regular interval
iii.	Metallic conduits shall not be used as earth continuity conductor.
iv.	A separate earthing conductor shall be provided for earthing lighting fixtures, lighting poles, receptacles, switches, junction boxes, lighting conduits, etc.
v.	Wherever earthing conductor crosses or runs along metallic structures such as gas, water, steam, conduits, etc. and steel reinforcement in concrete it shall be bonded to the same.
vi.	Cable and cable boxes/glands, lockout switches etc. shall be connected to the earthing conductor running along with the supply cable which, in turn, shall be connected to earthing grid conductor at minimum two points, whether specifically shown or not.
vii.	Railway tracks within switchyard area shall be bonded across fish plates and connected to earthing grid at several locations.
viii.	Earthing conductor shall be buried 2000mm outside the switchyard fence. Every post of the fence and gates shall be connected to earthing loop by one lead.
ix.	Flexible earthing connectors shall be provided where flexible conduits are connected to rigid conduits to ensure continuity.
h)	**JOINTING: shall be as per enclosed drawing equipment earthing standard drawing details shown in this specification.**
i)	**POWER CABLE EARTHING** Metallic sheaths and armour of all multi core power cables shall be earthed at both equipment and switchgear end. Sheath and armour of single core power cables shall be earthed at switchgear end only.
j)	**SPECIFIC REQUIREMENT FOR EARTHING SYSTEMS**

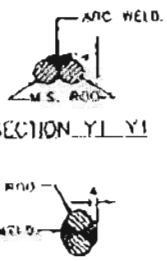
CLAUSE NO.	TECHNICAL REQUIREMENTS
i.	Earthing terminal of each surge arrester, capacitor voltage transformer and lightning down conductors shall be directly connected to rod electrode which in turn, shall be connected to station earthing grid.
ii.	Auxilliary earthing mat of 1500mm X 1500mm size comprising of closely spaced conductors at (300mm x 300mm) spacing and at 300mm below ground shall be provided below the operating handles of the isolators. Operating handle shall be directly connected to earthing mat.
k)	**SPECIFIC REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEM**
i.	Conductors of the lightning protection system shall not be connected with the conductors of the safety earthing system above ground level.
ii.	Down conductors shall be cleated on the structures at 2000mm interval.
iii.	Connection between each down conductor and rod electrodes shall be made via test joint located approximately 150mm above ground level.
iv.	Lightning conductors shall not pass through or run inside G.I. conduits.
v.	Lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.

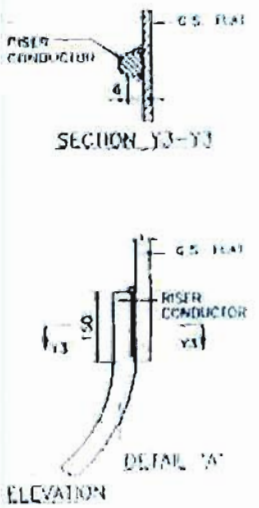




TYPICAL DETAILS OF RISER







NOTE : WELDING OF EARTHING CONDUCTOR SHALL BE CONDUCTED IN VERTICAL PLANE WHEREVER POSSIBLE

EQUIPMENT EARTHING DETAILS

STANDARD DRAWING

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.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	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.

11.10.00 **CONDUCTOR STRINGING AND POWER CONNECTORS**

a) Physical check for finish
b) Electrical clearance check
c) Testing of torque by torque-by-torque wrenches on all bus power connectors and other accessories.
d) Sag and tension check on conductors.

11.11.00 **INSULATORS**

Visual examination for finish damage, creepage distance, etc.

11.12.00 **WAVE TRAP**

a) Insulation resistance Test
b) Visual check

12.00.00 33kV System : GENERAL INFORMATION

In addition to the scope of work given in part-A of this specification, the following is the scope of work for associated 33kV overhead Transmission line . Contractor shall design the 33 KV line termination arrangement with Isolators, and surge arrestors.

12.01.00 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 Electric Inspection agencies and obtaining clearance certificate from them, rests with the contractor.

12.02.00 The minimum phase to earth, phase to phase and section clearance for 33kV system are given below:

a)	**Phase to earth**	**320mm**
b)	**Phase to phase**	**400mm**
c)	**Sectional clearance**	**2800mm**

Parameters of 33kV System:

Rated Voltage	33kV
Highest system voltage	36kV
Impulse withstand voltage(Dry & Wet)	± 170 kVp
Power frequency with stand voltage(wet)	70kV(rms)
Total creepage distance	31mm/kV, very Heavy
Rated short circuit current	25kA(rms) (for 3sec)

12.03.00 All equipment shall be supplied with suitable terminal connectors. The terminal connected shall be well coordinated with the type/size of conductor and equipment to be connected. The conductor terminations for equipment shall be either rigid or expansion type suitable for tube or horizontal or vertical take off suitable for conductor used.

13.00.00 33 KV SWITCH ISOLATORS

13.01.00 **GENERAL**

13.01.01 The isolators and accessories shall conform in general to IEC600129 / IS 9921 except to the extent explicitly modified in specification. Earth switches shall be provided on isolators wherever called for. The isolators and earth switches shall be manually operated type.

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400kV GIS CT DETAILS

400kV GIS CT-A/ CT-A1/ CT-A2

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	3000-2000-1000/1 A	-	6000-4000-2000	20-30-60	15-10-5	PS	Protection
2	3000-2000-1000/1 A	-	6000-4000-2000	20-30-60	15-10-5	PS	Protection
3	3000-2000-1000-500/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering

400kV GIS CT-B

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	3000-2000-1000/1 A	-	6000-4000-2000	20-30-60	15-10-5	PS	Protection
2	3000-2000-1000/1 A	-	6000-4000-2000	20-30-60	15-10-5	PS	Protection

400kV GIS CT-C CTM/ CTBR (GT/ ST/ BUS REACTOR SIDE)

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	3000-2000-1000-500/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering

400kV GIS CT-C CTL (400KV LINE SIDE)

Core No.	Current Ratio	Output Burden (VA) at lowest Tap	Minimum KPV (Volts)	Max Ie (mA) at KPV	Maximum Rct (Ohms)	Accuracy Class	Purpose
1	3000-2000-1000/1 A	-	6000-4000-2000	20-30-60	15-10-5	PS	Protection
2	3000-2000-1000/1 A	-	6000-4000-2000	20-30-60	15-10-5	PS	Protection
3	3000-2000-1000-500/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering
4	3000-2000-1000-500/1 A	20	-	-	-	0.2s, ISF ≤ 5	Metering

400kV GIS VT DETAILS

Winding No.	Ratio	Accuracy Class	Rated Burden (VA)	Purpose
1	(400 kV/√3) / (110V/√3)	3P	50	Protection
2	(400 kV/√3) / (110V/√3)	3P	50	Protection
3	(400 kV/√3) / (110V/√3)	0.2	50	Metering

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT DETAILS

	Particular	Details
a)	Customer	NTPC Ltd.
b)	Project Title	Talcher Thermal Power Project Stage – III (2X 660MW) – 400kV GIS Switchyard at Talcher TPP
c)	Project Location	Place: Talcher District: Angul State: Orissa
d)	Latitude & Longitude	**Latitudes and Longitudes of the site are as follows:** Latitude-20°55' N Longitude-85°25' E
e)	Nearest Railway Station	Talcher – At a distance of about 4 km on Talcher-Cuttack section of North-Eastern Railway.
f)	Distance of project location from the Railway station	4 km (approx.)
g)	Nearest Major Town	Bhubaneswar
h)	Distance of the town from the project site	150 km by Road
i)	Nearest commercial airport	Biju Patnaik International Airport, Bhubaneswar
j)	Distance of airport from the project site	150 km by Road
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000meter
d)	Pollution Severity	Heavily polluted
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3)
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	50m/sec
g)	Category of terrain	Category-II
h)	Risk Coefficient "K1"	1.08
i)	Seismic Zone	III

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV
1	Highest system voltage	420 kV rms
2	Lightning Impulse voltage	±1425kVp
3	Switching impulse voltage	±1050kVp
4	Power frequency withstand for 1 min (rms)	630 kV(rms)
5	Max. fault level (1 sec.)	63 kA
6	Minimum creepage distance (31mm/kV)	13020 mm

3.1.2 **AUXILIARY POWER:**

Sl.No.	Nominal Connection Voltage	Variations in Voltage	Frequency	Phase	Neutral
1	415V	±10%	50 (+3% -5%)	3Phase, 4 Wire	Solidly Earthed
2	240V	±10%	50 (+3% -5%)	1 phase	Solidly Earthed

Combined variation of voltage and frequency shall be + 10%. Design fault level of 415V system shall be restricted to 50kA rms for 1 second.

The operational limits for variation of DC voltage are (+) 10% to (-) 15%.

3.1.3 The various minimum heights of the AIS switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level	Line Take Off Gantry Height	Peak
400kV	8000mm	22000mm (for GT intermediate gantry)/ 16000mm (for other bays)	8500mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

The minimum height of intermediate gantry tower for 400kV wherever required shall be 22 m and the peak (s) shall be of 8.5 m. The gantry width for 400kV AIS shall be minimum 27m or as required to meet the specified clearances.

3.1.4 The minimum clearances for 400kV switchyards shall be as given below:

	400kV
Phase to earth clearance	3500 mm
Phase to phase clearance	4000 mm
Section clearance	6500 mm

3.2 INSTRUCTION TO BIDDERS:

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

The supplier should be approved by Employer. If not, it is the responsibility of the vendor to be assessed and approved Employer, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Purchaser. Sufficient amount of information for justifying such proposals shall be furnished to Purchaser alongwith the bid to enable the Purchaser to determine the acceptability of these proposals.

Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood to be indicative of the function and quality desired and not restrictive. Other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well asof the locality where they will be installed, including the following:

a) Indian Electricity Act

b) Indian Electricity Rules

c) Indian Explosives Act

d) Indian Factories Act and State Factories Act

e) Indian Boiler Regulations (IBR)

f) Regulations of the Central Pollution Control Board, India

g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

h) Pollution Control Regulations of Department of Environment, Government of India

i) State Pollution Control Board.

(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996

(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998

(m.) Explosive Rules, 1983

(n.) Petroleum Act, 1984

(o.) Petroleum Rules, 1976,

(p.) Gas Cylinder Rules, 1981

(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981

(r.) Workmen's Compensation Act, 1923

(s.) Workmen's Compensation Rules, 1924

(t.) NTPC Safety Rules for Construction and Erection

(u.) NTPC Safety Policy

(v.) Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening: 06-June-2022), of the codes and standards given below shall also apply:

a) Bureau of Indian standards (BIS)

b) Japanese Industrial Standards (JIS)

c) American National Standards Institute (ANSI)

d) American Society of Testing and Materials (ASTM)

e) American Society of Mechanical Engineers (ASME)

f) American Petroleum Institute (API)

g) Standards of the Hydraulic Institute, U.S.A.

h) International Organization for Standardization (ISO)

i) Tubular Exchanger Manufacturer's Association (TEMA)

j) American Welding Society (AWS)

k) National Electrical Manufacturers Association (NEMA)

l) National Fire Protection Association (NFPA)

m) International Electro-Technical Commission (IEC)

n) Expansion Joint Manufacturers Association (EJMA)

o) Heat Exchange Institute (HEI)

p) IEEE standard

q) JEC standard

Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

As regards highly standardized equipment such as Steam Turbine and Generator, National/ International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.

In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

In case of any change in codes, standards & regulations between 06-June -2022 and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being 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.

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow (not applicable for this project), short circuit etc for the equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

All drawings submitted by the supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the bidder (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

After the approval of the drawings, further work by the bidder shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these document/data/drawings by the purchaser will cover only general conformance of the document/data/drawings to the specification and contract, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect plan layout. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. The review and/or approval by the purchaser shall not be considered by the bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing, fabrication and execution of work in connection with the equipment/system prior to the approval of the drawings shall be at the bidder's risk. The bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Purchaser. However, if some changes are necessitated in the design of the equipment/system at a later date, the bidder may do so, but such changes shall promptly be brought to the notice of the Purchaser indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. Approval of bidder’s drawing or work by the Purchaser shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity with technical specification, unless otherwise expressly requested by the purchaser in writing.

3.5.2 Bidder’s Drawing Submission and Approval Procedure

The following procedure for submission and review/approval of the drawings, data reports, information, etc. shall be followed by the bidder:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for Employer’s information/interface and/or review and approval are referred by the general term “drawings”.

b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be furnished by the bidder. This list shall be updated if required at suitable interval during detailed engineering.

c. All drawings (including those of sub-vendor) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The bidder shall furnish this format to his sub-vendor along with his purchase order for sub-vendor's compliance.

d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. Upon review of each drawing, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved, subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Bidder shall resubmit the drawings approved under Category II, III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.).

g. In case Bidder does not agree with any specific comment, he shall furnish the explanation for the same to Employer for consideration. In all such cases Bidder shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

h. It is the responsibility of the Bidder to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

i. Bidder shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Bidder shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**

j. As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Bidder will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per clause 3.5.5.

k. Approval of drawings will not in any way relieve the Bidder of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

3.5.3 Erection Drawings

a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc. The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.

b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.5.4 Instruction Manual

a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least sixty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, commissioning, operation and maintenance procedures, etc. separately for each component/equipment along with log record format. These instruction manuals shall be submitted in five (5) copies for approval.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted.

c. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall have sufficient details to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment, including erection, testing, commissioning, operation, maintenance dismantling and repair. Each manual shall also include a complete set of approved drawings together with performance/rating curves of the equipment and test certificates, wherever applicable. The contract shall not be considered completed for purpose of taking over until such instructions and drawings have been supplied to the Employer.

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets.

e. The manuals shall include the following
a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

f. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.

g. A collection of the manufacturer's standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

The Instruction Manuals shall comprise of the following:

3.5.4.1 Erection Manuals

The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

a) Erection strategy.

b) Sequence of erection.

c) Erection instructions.

d) Critical checks and permissible deviation/tolerances.

e) List of tool, tackles, heavy equipments like cranes, dozers, etc.

f) Bill of Material

g) Procedure for erection and General Safety procedures to followed during erection/installation.

h) Procedure for initial checking after erection.

i) Procedure for testing and acceptance norms.

j) Procedure / Check list for pre-commissioning activities.

k) Procedure / Check list for commissioning of the system.

l) Safety precautions to be followed in electrical supply distribution during erection.

3.5.4.2 Operation and Maintenance Manuals

a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.

b) The arrangement and contents of O & M manuals shall be as follows:

1) Chapter 1 - Plant Description: To contain the following sections specific to the equipment/system supplied

(a) Description of operating principle of equipment / system with schematic drawing / layouts.

(b) Functional description of associated accessories / controls. Control interlock protection write up.

(c) Integrated operation of the equipment along-with the intended system. (This is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers).

(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment along-with its accessories and auxiliaries.

(e) Design data against which the plant performance will be compared.

(f) Master list of equipment, Technical specification of the equipment/ system and approved data sheets.

(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).

(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).

2) Chapter 2 - Plant Operation: To contain the following sections specific to the equipment supplied

(a) Protection logics provided for the equipment along-with brief philosophy behind the logic, Drawings etc.

(b) Limiting values of all protection settings.

(c) Various settings of annunciation/interlocks provided.

(d) Start-up and shut down procedure for equipment along-with the associated systems in step mode.

(e) Do's and Don'ts related to operation of the equipment.

(f) Safety precautions to be taken during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.

(g) Parameters to be monitored with normal value and limiting values.

(h) Equipment isolating procedures.

(i) Trouble shooting with causes and remedial measures.

(j) Routine testing procedure to ascertain healthiness of the safety devices along-with schedule of testing.

(k) Routine Operational Checks, Recommended Logs and Records

(l) Change over schedule if more than one auxiliary for the same purpose is given.

(m) Preservation procedure on long shut down.

(n) System/plant commissioning procedure.

3) Chapter 3 - Plant Maintenance: To contain the following sections specific to the equipment supplied

(a) Exploded view of each of the equipments. Drawings along-with bill of materials including name, code no. & population.

(b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment.

(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.

(d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.

(e) Preventive Maintenance schedules linked with running hours/calendar period along-with checks to be carried out.

(f) Overhauling schedules linked with running hours/calendar period along-with checks to be done.

(g) Long term maintenance schedules

(h) Consumables list along-with the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.

(i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement.

(j) Tolerance for fitment of various components.

(k) Details of sub vendors with their part no. in case of bought out items.

(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.

(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.

(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.

(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.

After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in table below. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer. If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in table below:

S.No.	Description of Drgs/Docs	No. of Prints	No. of CD ROMs/DVDs/Portable Hard Disk
1	Erection Manual	4 Sets	2
2	Operation & Maintenance manual i) First Submission	1 Set	1
	ii) Final Submission	4 Sets	2

3.5.5 Final Submission of drawings and documents:

The Bidder shall furnish the following after approval of all drawings /documents and test reports:

a. List of drawings bearing the Employer's and Contractor's drawing number.
b. Six (6) bound sets along-with two (2) sets of CD-ROMs/ DVD/Portable hard disk of all final drawings/documents.
c. Bidder shall also furnish six (6) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.
d. The Bidder shall also furnish four (4) copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of instruction/ operations & maintenance manuals (after approval) for all the equipments.

3.5.6 TEST REPORTS

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval six (6) bound copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of all type and routine test reports shall be submitted to Employer.

3.6 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.
The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.7 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity' heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

SPACE HEATERS

The heaters shall be suitable for continuous operation at 240 V as supply voltage. On –off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

Control cubicles installed in air-conditioned area need not be provided with space heaters. These cubicles shall, however, have space heaters in case of storage of cubicles for long duration.

FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

Degree of Protection

The enclosure of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a. Installed outdoor: IP- 55
b. Installed indoor in air conditioned area: IP-32
c. Installed in covered area: IP-52
d. Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e. For LT Switchgear (AC & DC distribution Boards) : Indoor:IP-52, Outdoor: IP-54

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

PRESERVATIVE SHOP COATING

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.

Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.

Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Bidder after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.

3.8 RATING PLATES, NAME PLATES AND LABELS

3.8.1 Each equipment shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer’s name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.

3.8.2 Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.

3.8.3 Each equipment shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.

3.8.4 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.8.5 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.8.6 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.8.7 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

3.8.8 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.

3.9 GALVANISING:

3.9.1 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, clean, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at bidder's cost.

3.9.2 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area or a minimum of 30 microns. The threads shall have extra deposit of zinc which shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have the required deposits of zinc on them as specified.

3.10 PAINTING

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:
Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However, in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

3.11 QUALITY ASSURANCE PROGRAMME

3.11.1 The Bidder shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Bidder's works or at his subcontractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS- 14001.

A quality assurance programme of the contractor shall generally cover the following:

i. His organisation structure for the management and implementation of the proposed quality assurance programme.
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process controls and fabrication and assembly controls.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.

ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing quality plans for manufacturing detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed as Annexure-I.

3.12 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.12.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Bidder for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the Bidder's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval.

3.12.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Bidder's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

3.12.3 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.

3.12.4 These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.

3.12.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Dispatch Clearance Certificate (MDCC).

3.12.6 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

3.12.7 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer.

3.12.8 All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.

3.12.9 All brazers, welders and welding operators employed on any part of the contract either in Bidder's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.

3.12.10 Test results or qualification tests and specimen testing shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.

3.12.11 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipments/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.

3.12.12 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

3.12.13 No welding shall be carried out on cast iron components for repair.

3.12.14 Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

3.12.15 All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40mm shall be ultrasonically tested.

3.12.16 The Bidder shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the subcontractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Bidder and finalised with the Employer, shall be subject to Employer's approval. The Bidder's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified subcontractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the Bidder from any obligation, duty or responsibility under the contract.

3.12.17 For components/equipment procured by the Bidders for the purpose of the contract, after obtaining the written approval of the Employer, the Bidder's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control

organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

3.12.18 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their sub-contractor's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

3.12.19 The Bidder shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Bidder shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

3.12.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Bidder in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

3.12.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

3.12.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.12.23 Environmental Stress Screening

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the Bidder / sub – contractor should meet the following.

1. The Bidder / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

In case the Bidder / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.

In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

Burn In Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.

The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Bidder / Sub-contractor shall carry out routine test on 100% item at Bidder's / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.

3.13 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identified in respective quality plan with tick (√) mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However, CD-Rom may be issued not later than three weeks.

3.13.1 Typical contents of Quality Assurance Document are as below: -

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.

iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
iv) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
v) Heat Treatment Certificate/Record (Time- temperature Chart)
vi) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).
vii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
viii) Certificate of Conformance (COC) whoever applicable.
ix) MDCC

3.13.2 Before dispatch/ commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
iii) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.14 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer on release of QA Documentation by Inspector. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.
For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery similarly as stated above.

3.15 INSPECTION, TESTING & INSPECTION CERTIFICATE

3.15.1 The word ‘Inspector’ shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

3.15.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection

and if part of the works is being manufactured or assembled on other premises or works, the Bidder shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works.

3.15.3 The Bidder shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Bidder's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the Bidder may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

3.15.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Bidder, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

3.15.5 When the factory tests have been completed at the Bidder's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Bidder from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

3.15.6 In all cases where the contract provides for tests whether at the premises or works of the Bidder or any sub-contractor, the Bidder, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Bidder and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

3.15.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.

3.15.8 To facilitate advance planning of inspection in addition to giving inspection notice, the Bidder shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

3.15.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.

3.16 PACKAGING & TRANSPORTATION

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Bidder shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.

Bidder shall ensure to affix RFID tags/Trackers on the item & punch the same before dispatch with RFID reader/BLE beacon & enter details of item associating with RFID tag no./Tracker no. For low value items QR code-based solution shall also be acceptable. Exact selection of type of tagging based on type & size of equipment/consignment/package will be decided during detail engineering.

Bidder to provide RFID tags/Trackers/QR code for all items being supplied to the Contractor under the contract of this project.

a) Each item identifiable with KKS / PGMA-DU / other identification scheme of the bidder/OEM/OES shall have a RFID/QR.
b) Even if the BOQ is identified in tonnage/ cumulative of multiple items, unique identification shall be provided for each item as mentioned above (Eg – GIS Duct, Gis bay module, Panels etc., however each sub item shall have its own RFID/equivalent).
c) For items which are interchangeable and dispatched together (eg Foundation bolts in a box / Identical beams in a single consignment), the entire consignment can be tagged with a single RFID if the software system has the capability to track partial consumption (eg 100 bolts consumed from a package of 1000 bolts) from a consignment.

3.17 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.17.1 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetallic liner.

3.17.2 The material of clamps and connectors shall be Galvanised mild steel for connecting to G.S.shield wire.

3.17.3 Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

3.17.4 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

3.17.5 They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

3.17.6 Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

3.17.7 Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.

3.18 SPACERS

3.18.1 Spacers shall conform to IS: 10162. They shall be of non-magnetic material except nuts and bolts, which shall be of hot dip galvanised mild steel.

3.18.2 Spacers shall generally meet the requirements of clamps and connectors as specified above. Its design shall take care of fixing and removing during installation and maintenance.

3.18.3 In addition to the type tests as per IS: 10162, clamp slip test should have been conducted. In this test the sample shall be installed on test span of twin/quad bundle string at a tension of 44.2kN (4500 kg). One of the clamps when subjected to a longitudinal pull of 2.5kN (250 kg) parallel to the axis of conductor shall not slip, i.e. permanent displacement between conductor and clamp after test shall not exceed 1.0 mm. This test should have been performed on all other clamps of the sample.

3.19 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS, AND DISC INSULATORS

3.19.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 60137 while hollow column insulators shall be manufactured and tested in accordance with IEC62155/IS 5284. The support insulators shall be manufactured and tested as per IS: 2544/IEC 60168/IEC 60273. The insulators shall also conform to IEC 60815 as applicable having alternate long and short sheds.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.19.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

3.19.3 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.19.4 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.19.5 Post type insulators shall consist of a porcelain/polymer part permanently secured in metal base to be mounted on supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand all shocks to which they may be subjected to during operation of the associated equipment.

3.19.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.19.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued, porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.19.8 In accordance with the requirement stipulated elsewhere, bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests and acceptance test/sample test in accordance with relevant standards.

3.20 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

3.20.1 All types of control cabinets, junction boxes, marshalling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:60439 as applicable.

3.20.2 They shall be of Stainless steel or Aluminium. The thickness of Stainless steel shall be minimum 1 mm. The thickness of aluminium shall be minimum 3 mm and shall provide rigidity. Top of the boxes shall be sloped towards the rear of the box.

3.20.3 BAY MARSHALLING BOX

Bay Marshalling Box located at a convenient location to receive and distribute cables shall be provided as required. It shall meet all the requirements as specified for cabinets/boxes.

It shall have three separate distinct compartments for following purposes:

- To receive two incoming 415V, three phase, AC supplies controlled by 100A four pole MCBs with auto changeover provision, and to distribute five (5) three phase ac supplies controlled by 32A four pole MCBs. It shall also be provided with 63A, 3 phase 4 pin industrial grade receptacle with rotary switch.

- To receive three phase incoming from first compartment and to distribute ten (10) single phase ac supplies controlled by 16A two pole MCBs.

- 150 nos. terminal blocks in vertical formation for interlocking facility.

3.20.4 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.
b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination
c) Heat run test on contacts
d) IR/HV test, etc.

3.21 CABLE GLANDS AND LUGS/FERRULES

3.21.1 Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine

finished and nickel chrome plated. Thickness of plating shall not be less than 10 microns. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

3.21.2 Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards.

3.22 CONDUITS, PIPES AND ACCESSORIES

3.22.1 The bidder shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes, etc. including all necessary sundry materials, such as tees, elbows, check nuts, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.

3.22.2 The size of the conduit/pipe shall be selected to limit the fill to a maximum of 40%. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed in an approved manner to prevent damage to threaded portions and en- trance of moisture and foreign materials.

3.22.3 PVC conduits shall be of high impact, heavy gauge (at least class 2) conduit conforming to BS-4607.

3.22.4 The outer surface of the steel conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel pipes shall be hot-dip galvanized. All rigid conduits/pipes shall be of a reputed make.

3.22.5 The hume pipes and accessories shall be of reinforced concrete conforming to class NP2 of IS-458. All tests on hume pipes shall be conducted as per IS-458.

3.22.6 Flexible conduits shall be of heat-resistant lead coated steel, water-leak, fire and rust proof.

3.23 MOTORS

The voltage level for motors shall be as follows:

a) Upto 0.2 KW	: Single phase 240V AC / 3 phase 415V AC
b) Above 0.2 KW and upto 200 KW	: 3 phase, 415V AC
c) Above 200 KW and upto 1500 KW	: 3 phase, 3.3 kV AC
d) Above 1500 KW	: 11 kV

The bidder may adopt 415V/3.3 KV for the drives rated in the range of 160-210 KW.

The voltage rating of the drives indicated above is for basic guideline.

3.23.1 All motors shall conform to IEC-60034-5 / IS Standard and with principal dimensions in accordance with IEC 60072-1 (1991), IEC 60072-2 (1990) and IEC 60072-3 (1994).

3.23.2 All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification

3.23.3 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

3.23.4 Degree of Protection

Degree of protection for various enclosures as per IEC60034-05 shall be as follows:

Indoor motors - IP 55
Outdoor motors - IP 55 (additional canopy to be provided)
Cable box-indoor area - IP 55
Cable box-Outdoor area - IP 55

3.23.5 Type:

AC Motors:

a) Squirrel cage induction motor suitable for direct-on-line starting.
b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30.
c) Crane duty motors shall be squirrel cage Induction motor as per the requirement.
d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

DC Motors Shunt wound

3.24 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.
b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination
c) Heat run test on contacts
d) IR/HV test, etc.

3.25 LAMPS AND SOCKETS

3.25.1 Lamps:
All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

3.25.2 Sockets
All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.25.3 Hand Lamp:
A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

3.26 SWITCHES & FUSES

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch-fuse units. Selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

All fuses shall be of HRC cartridge type conforming to IS 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal Protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

All control switches shall be of rotary type. Toggle/piano switches shall not be accepted.

3.27 TYPE, ROUTINE & ACCEPTANCE TESTS:

3.10.1 TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN GIS

a) All equipments to be supplied shall be of type tested design. During detail engineering, the bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out not earlier than ten years prior to the date of techno-commercial bid opening (06-June -2022). 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 not earlier than ten years prior to the date of techno-commercial bid opening (06-June -2022)., or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder 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.

3.28 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

a) The corona and RIV tests shall confirm to the requirements as per Annexure A.
b) The seismic withstand test for shall conform to requirements as per Annexure B.

3.29 Enclosures:

1. ANNEXURE- A - CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST
2. ANNEXURE- B - SEISMIC WITHSTAND TEST
3. ANNEXURE- I – MQP (NTPC format)
4. ANNEXURE- II – QUALITY ASSURANCE FOR SWITCHYARD

ANNEXURE – A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

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 Levels

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3.0 Test Methods for RIV (400kV):

3.1 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.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107 – 1964 except otherwise noted herein.

3.3 In measurement of RIV temporary additional external corona shielding may be provided. 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.

3.4 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 420kV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendations or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to the voltage read by the noise meter.

4.0 Test Methods for visible Corona (400kV AIS only)

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 (400kV AIS only)

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

b.) The supplier shall arrange to transport the structure from his purchaser's premises / owner's sites for purpose of seismic withstand test only.

c.) 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.

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : SUB-SYSTEM:	QP NO.: REV.NO.: DATE: PAGE: …. OF….	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER C**:** MAIN SUPPLIER, **N**: NTPC **P:** PERFORM **W**: WITNESS AND **V:** VERIFICATION. AS APPROPRIATE, **CHP:** NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"		DOC. NO.: REV…… CAT…..		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1 1/1 ENGG. DIV./QA&I

ANNEXURE-II

ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP / SQP/*RFQP/SFQP*)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		To be filled in by NTPC
PROJECT NAME		*REVIEW & ENDORSEMENT BY NTPC* PROJECT SPECIFIC QP NUMBER ALLOTTED
CONTRACT NO.:		QP NO.:
MAIN SUPPLIER		
MANUFACTURER WORKS & ADDRESS	M/S	REV. NO.: DATE:
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.		** The RQP/SQP/RFQP/SFQP once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
APPROVED QP NO.: RQP/SQP/RFQP/SFQP	0000-999-QV - - REV. NO.: DATED**:	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		*(TICK APPLICABLE)*
I. That the item/ component is identical to that considered for QP approval. OR.		The QP is endorsed for this project without any change
II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP. OR		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		The QP is endorsed for this project with changes as indicated.
		DISTRIBUTION OF ENDORSEMENT OF A) RQP/SQP: *1. MAIN SUPPLIER (WITH A COPY OF QP)* *2. MANUFACTURER* *3. RIO* *4. CQA-SPL* *5. CQA-O/C* B) RFQP/SFQP: *1. MAIN SUPPLIER (with a copy of QP)* *2. MANUFACTURER* *3. NTPC FQA (with a copy of QP)* *4. NTPC Erection (with a copy of QP)* *5. CQA-SPL* *6. CQA-O/C*
SIGN.: (Main Supplier) *DATE*	*SIGN.: (Manufacturer)* *DATE:*	NTPC (Reviewed /Approved by/ Date & Seal)

SUB-SECTION-DB13

GAS INSULATED SWITCHGEAR

PAGES 39 TO 71 ARE
DELETED AS THEY ARE
NOT RELEVANT.

CLAUSE NO	GAS INSULATED SWITCHGEAR .

Bidder's Name: .....

I. GIS MODULE

The bidder shall submit with his bid the following technical particulars for the Each ' gas-insulated switchgear and accessories, complete with any additional data which, in bidder's opinion, will describe the merits of the equipment offered.

1.	Name of manufacturer & address	.....
2.	Place of manufacture, inspection & testing	.....
3.	Manufacturer's type / designation	.....
4.	Standard applicable	.....
5.	Rated voltage	.....
6.	System frequency	.....
7.	Maximum (continuous) service rated voltage	.....
8.	Single phase or three phase design	.....
9.	Normal current rating	
	i) Generator Transformer feeder circuit	.....Amp.
	ii) Line feeder circuit	.....Amp.
	iii) Bus coupler circuit	.....Amp.
	iv) Bus bars	.....Amp.
10.	Rated peak withstand current	.....KA
11.	Short time current rating	
	- 1 second rms.	.....kA
	- 3 second rms.	.....kA
12.	Rated Lightning impulse withstand voltage	.....kV (peak)
13.	Rated Switching impulse withstand voltage	.....kV (peak)

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Bidder's Name: .....

14.		Rated one minute power frequency withstand voltage	.....kV (peak)
15.		Maximum temperature rise over 50 deg. ambient	deg. C.
16.		Thermal rating of current carrying parts at 420 kV for the rated symmetrical short circuit current	Sec
17.	a.	Features adopted for preventing burn through in the various enclosures of SF6 GIS	.....
	b.	Time in m sec to withstand an internal flashover without burn through	.....
18.		Design pressure of the enclosures for	
	a)	Circuit breakers	.....
	b)	Disconnectors	.....
	c)	Surge arresters etc.	.....
	d)	GIS duct	.....
	e)	VT	.....
	f)	CT	.....
19.		No of gas compartments	
	a)	Each line bay	.....
	b)	Each Generator bay	.....
	c)	Bus coupler bay	.....
20.	a)	Average leakage rate of SF6 gas	.....%/year
	b)	Quantity of SF6 gas required to completely charge the 3-pole equipment	.....(Kg)

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c) Quantity of SF6 gas required for largest gas compartment .... (Kg).....Compartment

d) Operating pressure(bar)

- Circuit breaker .....
- GIS Duct .....
- CT .....
- VT .....
- Disconnector .....
- SA .....

21. Creepage distance adopted for GIS/AIS termination (mm) .....

22. Heat generated in K.W. when the complete switchgear is operating at its rated capacity .....

23. a) Seismic level for which GIS is designed . .....

b) Noise level in (dB) at distance of (m)

i) 0 .....
ii) 50 .....
iii) 100 . .....
iv) 150 .....

24. Type and Material of

a) Breaker main contact. .....

b) Disconnecting switch contact .....

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c) Grounding switch contact .....

d) Busbars .....

e) Internal bus contact. .....

f) Enclosure. .....

g) Terminal pads. .....

25. Dimensions

a) Bus enclosure outside diameter .....(mm)

b) Bus enclosure wall thickness ..... (mm)

c) Internal bus, outside diameter ..... (mm)

d) Internal bus thickness ..... (mm)

26. Whether GIS are despatched filled with SF6 or required to be filled at site .....

27. Capacity of EOT crane in GIS building .....

28. Type and make of SF6 pipe coupling used .....

29. Type and make of mandatory maintenance equipment to be supplied

i) SF6 gas filling and evacuation plant (portable) .....

ii) SF6 gas filtering, drying, storage and recycling plant .....

iii) Operation analyzer with DCRM KIT .....

iv) SF6 gas leak detector .....

v) Gas analyzing equipments .....

30. Whether the following are enclosed

a) Type test reports Yes/No

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	b)	Operation manual for equipments	Yes/No
	c)	Leaflets & literature bringing out salient feature s of equipment offered	Yes/No
	d)	The details of control room building	Yes/No
	e)	The details of GIS building	Yes/No
31.	Details of equipments and procedure for conducting site test (including power frequency. test) of the bay module as per IEC	.....	
32.	Weight of the heaviest piece of equipment to be handled during installation on site.	..... Kg	
33.	**SF6 GAS**		
	a.	Name of manufacturer & address	.....
	b.	standard applicable	.....
34.	Whether the common point of bus disconnectors alongwith Earth Switch has been brought out in a separate compartment		Yes/No
35	Whether provision exists for extension of busbars on both ends		Yes/No
36.	Details of arrangement provided to account for thermal expansion for busbars enclosed		Yes/No
37.	Details of earthing arrangement adopted for the GIS enclosed		Yes/No
38.	Whether layout plan sections of each bay/equipment of GIS/AIS indicating the complete arrangement enclosed		Yes/No

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Bidder's Name: .....

II. EQUIPMENTS INCLUDED IN GIS

A. Circuit Breaker

1. Name plate data

a. Manufacturer's name ……

b. Type / designation ……

c. Standard applicable ……

d. Rated frequency ……Hz

e. Rated voltage ……kV

f. Rated current

i) Under normal condition ----------kA

ii) Under site condition ---------- KA

g. Number of poles per unit ……

h. Class (indoors) ……

i. Number of interrupting chambers per pole (No of breaks per pole) ……

j. Whether 3 pole or single pole design ……

k. Maximum Operating Voltage for guaranteed Breaking Capacity ……kV

l. Duty cycle as per IEC M1/M2&C1/C2 ……

III. GUARANTEED RATINGS

A) Making & Breaking

1. Breaking Capacity

- Rated short circuit breaking Current KA(rms) …… KA

- Symmetrical component at …… KA

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Bidder's Name: .....

highest system voltage

- DC Component (%) .....
- Asymmetrical breaking current at highest system voltage ..... KA
- Rated breaking MVA (Symmetrical) .....kA(rms)
- Breaking time .....secs.

b) Making Capacity

- Rated making current .....kA
- Rated making MVA symmetrical .....
- Making time .....secs

2. Operating voltages of closing/opening coil

- Maximum operating voltage V
- Minimum operating voltage V

3. Current ratings

- Rated continuous current at 27^0C ambient temp. .....A
- Rated interrupting current for 1s, ...kA
- Rated symmetrical interrupting current .....kA
- Rated asymmetrical interrupting current .....kA
- Rated short circuit making current .....kA (peak)

4. Rated Insulation level

a) One minute dry power

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Bidder's Name: .....

frequency withstand voltage

i) Between live terminal and ground (kV rms) .....

ii) Between terminals with breaker contacts open (kV rms) .....

b) 1.2/50 micro second impulse withstand test voltage .....

i) Between live terminal and ground (kV peak) .....

ii) Between terminals with breaker contacts open (kV peak) .....

c) 250/2500 micro second impulse switching surge withstand test voltage .....

i) Between live terminal and ground (kV peak) .....

ii) Between terminals with breaker contacts open (kV peak) .....

d) Line to ground power frequency withstand voltage at gas pressure equivalent to atmospheric pressure ……kV

e) Minimum allowable moisture content in interrupting medium ……ppm/vol.

f) Maximum total break time for any current upto rated breaking current (ms)

i) For Test duties 2,3 & 4 at rated values .....

ii) For other duties at limiting conditions of voltage and pressure .....

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Bidder's Name: .....

g) Closing time ……

h) Minimum opening time under any condition with limiting voltage and pressure (ms) .....

i) Maximum opening time under any condition with limiting voltage and pressure (ms) .....

j) First pole to clear factor .....

5. Maximum temperature rise above ambient at rated load and voltage for

- Contacts ……..deg C
- Hottest part ……..deg C

6. Operating data

- Rated operating duty cycle
  - a) Line Breakers ……
  - b) Generator Transformers, & Bus Coupler Breakers ……
- Reclosing duty cycle (Line Breakers) ……
- Permissible tripping delay ……ms
- Maximum arc duration at
  - a) 10% rated breaking current ……ms
  - b) 30% — do— ……ms
  - c) 60% — do— ……ms
  - d) 100% — do— ……ms
- Closing time, ……..ms
- Total breaking time at ……..ms

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Bidder's Name: .....

a) 10% rated breaking current .....ms

b) 30% — do— .....ms

c) 60% — do— .....ms

d) 100% — do— .....ms

e) Arc duration from separation of arc at contact to instant of arc extinction for full rated interrupting capacity. .....ms

- Longest time to interrupt current less than 25% of rated symmetrical short circuit current from energizing trip circuit .....ms

- Minimum time from arc extinction to contact remake for auto reclosing. .....ms

- Minimum dead time for

  a) 3 phase reclosing .....ms

  b) 1 phase reclosing .....ms

- Maximum difference of time at opening of series contacts within one pole .....ms

- Maximum difference of time at opening between phases .....ms

- Maximum difference of time at closing between phases .....ms

- Details of the curve enclosed for maximum opening time vs. 3 phase fault current .....

- Number of interruptions before scheduled maintenance is required .....

- Number of mechanical operations before scheduled maintenance is required .....

CLAUSE NO	GAS INSULATED SWITCHGEAR .

Bidder's Name: .....

- Number of interruptions at rated S.C. current with associated TRV without changing any parts. .....
- Description and frequency of scheduled maintenance required .....
- Recovery voltage rate of rise at
  - a) Rated symmetrical interrupting current .....kV/ms
  - b) 60 percent of rated symmetrical interrupting current .....kV/ms
  - c) 30 percent of rated symmetrical interrupting current .....kV/ms
  - d) 10 percent of rated symmetrical interrupting current data for Restrike voltage .....kV/ms
- Amplitude factor .....
- Phase factor .....
- Natural frequency .....(Hz)
- Rate of rise of restriking voltage .....
- Devices used for controlling RRRV .....
- Devices used for uniform voltage distribution .....
- Distribution of voltage across breaks .....
- Pre-insertion resistor (if applicable) .....
  - i) Value / pole (Ohms)/with tolerance .....
  - ii) Minimum and maximum duration of insertion per pole (ms) .....
  - iii) Thermal rating for the C-1m-0-CO-2m-C-1m-O-CO for terminal fault considering

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Bidder's Name: .....

maximum resistance and time setting .....

- Recovery voltage distribution between breaks in percent of rated voltage .....

  a) Single line to ground fault .....

  b) Interruption of short lines .....

  c) Switching off an unloaded transformer .....

7. Operating Mechanism .....

   a) Type of operating mechanism for . .....

      i) Closing .....

      ii) Opening .....

   b) Normal power consumption (w) at rated voltage of .....

      i) Trip coil .....

      ii) Closing coil .....

7.1. Pneumatic operating mechanism .....

   a) Rated operating pressure (kg/sq.cm) .....

   b) Rated of pressure for (kg/sq.cm) .....

      i) Closing .....

      ii) Opening .....

   c) Air Consumption at rated pressure for .....

      i) Closing (m^3) .....

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ii) Opening (m^3) .....

iii) Close -Open (m^3) .....

d) Pressure drop/metre length of piping .....

e) Number and Capacity (m^3) of breaker local air storage receivers .....

f) No. of close operations for which sufficient air as available in local receiver .....

g) Capacity of compressor (m^3/hr) and working pressure (kg/cm^2) .....

h) Maximum time for which compressor can operate continuously (Minutes) .....

i) Time to fill .....

i) Air receiver after one C-O operation (Minutes) .....

ii) For making up of losses occuring in 4 hours (Minutes) .....

j) Pressure at which compressor .....

i) Starts (kg/cm^2) .....

ii) Stops (Kg/cm^2) .....

k) Material of compressed air piping .....

l) Inner & outer dia of piping (mm) .....

m) Whether time totaliser for the compressor provided .....

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n) Safety valve blow off at (Kg/Cm^2) .....

o) Alarm switch closes (Kg/Cm^2) .....

i) Closing .....

ii) Opening .....

iii) Auto reclose .....

7.2 Hydraulic operating mechanism .....

a) Rated pressure of oil in operating cylinder (Kg/cm^2) .....

b) Limits of pressure (Kg/cm^2) .....

c) Quantity of oil (litre) .....

d) Details of monitoring arrangement for hydraulic pressure .....

e) No. of close-open operation possible after loss of AC supply to drive motor .....

f) Pressure drop starting from lowest pressure at which motor starts for .....

i) C-operation .....

ii) O-operation .....

iii) CO-operation .....

iv) O-CO-operation .....

v) 2CO-operation .....

g) Time required to make up pressure upto loss of nitrogen pressure after .....

i) C-operation .....

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		i) O-operation	.....
		iii) CO-operation	.....
		iv) O-CO-operation	.....
		v) 2CO-operation	.....
	h)	Life expectancy & guaranteed leakage rate of nitrogen accumulators	.....
7.3		Spring charged mechanism	.....
	a)	Number of close open operations possible after failure of AC supply to motor	.....
	b)	Time required for motor to charge the closing spring (minutes)	.....
	c)	Whether indication of spring charged condition provided in central control cabinet	.....
8.		Motor Data	
	a)	Type	.....
	b)	Rating at site conditions (kW)	.....
	c)	Rated voltage (V)	.....
	d)	Full load current (A)	.....
9.		SF6 gas system	
	-	Normal operating pressure	…….bar
	-	Normal operating density	……..g/cc
	-	Weight of gas per breaker	…….Kg
	-	Lockout pressure	…….bar
	-	Alarm pressure	……bar

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- Whether breakers work at single pressure or dual pressure ……
- Type of SF6 gas flow(axial or radial) ……
- Type of nozzles (single flow or double flow) ……
- Compression ratio for puffer action ……
- Quantity of compressed gas for puffer action ……
- Total volume of SF6 gas required per circuit breaker at operating pressure. ……

10 Control power requirement

- Tripping(3poles)current at rated supply voltage (220 V.D.C.) A
- Closing(3 poles) current at rated supply voltage (220 VDC) A
- Tripping voltage range (percent) ……
- Closing voltage range (percent) ……

11. Heaters

- Continuously current rating ……A
- Thermostat power rating ……A

12. Noise level in (dB) at distance of (m)

i) 0 .....

ii) 50 .....

iii) 100 .....

iv) 150 .....

13. Interrupters

- Type of main contacts, arcing .....

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contacts & Aux. contacts.

- Material of main contacts/arcing contacts, silver coated or not .....
- Contact pressure (Kg/sq mm) .....
- Number of interrupters per pole .....
- Length of contact travel .....mm
- Rate of contact travel at tripping .....m/sec
- Rate of contact travel at closing .....m/sec

14. Whether fixed trip or trip free .....

15. Details of anti pumping device .....

16. Maximum line charging breaking current with temporaty over voltage up to 1.4 p.u. (kA) .....

17. Rated capacitive breaking current .....

18. Rated small inductive breaking current .....

- Generator transformer, Line & Bus coupler breakers .....

19. Rated characteristics for short line fault .....

20. a) Rated transient recovery voltage for terminal faults .....

b) Parameters as per IEC .....

21. Rated value of phase making current kA(rms)

22. Max. interrupting capacity under phase opposition conditions .....

23. Maximum breaking Capacity under Kilimeteric faults and rated TRV characteristic (kA peak) .....

24. Maximum period between closing

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		of first contact & last contact in a pole (ms)	.....
25.		Maximum pole discrepancy (ms)	.....
26.		Capacity for interrupting in-rush current of transformer	.....
27.		Max. over voltage factor of the circuit breaker when switching off	.....
	a)	Unloaded transformer	.....
	b)	Loaded transformer	.....
	c)	Open circuited lines	.....
	d)	Synchronous system	.....
28.		Details of operation counter	.....
29.	a)	Number of auxiliary contacts per pole provided	.....
		i) NO	.....
		ii) NC	.....
		iii) Adjustable	.....
	b)	Rated voltage of auxiliary contacts (V)	.....
	c)	Current capacity of Aux. contacts	
	i)	Continuous (Amps)	.....
	ii)	DC breaking with 20 ms time constant (A)	.....
30.		Partial discharge level at 1.1 Un/√3	.....Pico-coulombs
31.		Radio interference level at 266 kV (rms)	..... microvolt
32.		Maximum impact loading on foundation during breaker operations under	..... Kg

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		fault conditions.	
		i) Closed conditions	.....
		ii) Open conditions	.....
33.		Seismic withstand value	.....
		i) Vertical	.....
		ii) Horizontal	.....
34.		Tests to be conducted by the supplier at works (whether enclosed)	.....
		a) Type tests	yes/no
		b) Routine tests	yes/no
		c) Tests to be conducted at site	yes/no
35.		Overall dimensions (LxBxH),	m
36.		Weight of breaker complete with operating mechanism, bushing, frame work,	Kg
		a) with SF6 gas	.....
		b) without SF6 gas	.....
37.		Descriptive bulletins and drawings of the circuit breakers giving general details of construction.	.....
38.		Out of phase switching capability of the circuit breaker	.....
39.		Comments regarding the suitability of the circuit breaker for restrike free operation of power transformer carrying full load current.	.....
40.		Guaranteed time difference between the first pole and last pole operation timing.	..... ms

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41. Data on operating Coils

(a) No. of trip coils/pole (No.) .....

(b) No. of close coils/pole (No.) .....

42. Details of the standard accessories to be supplied alongwith the breaker .....

43 No. of the enclosed drg. showing the control scheme of circuit breaker .....

44 Details of the provision to be made on GIS to reduce H.V. transients to acceptable values. .....

45. Guaranteed degraded values of B.I.L. switching surges and 50 Hz rated values during the life of equipment (Test data to support this guarantee to be enclosed by the bidder). .....

46. Whether the following are enclosed

a) Type test reports Yes/No

b) Operation manual for breaker Yes/No

c) OGA drawing of breaker Yes/No

B) Disconnectors/Grounding Switches

B-I Disconnecting Switches

1. Manufacturer's name & address .....

2. Type & designation .....

3. Standard applicable and duty M1/M2 .....

4. Rated Frequency .....

5. Whether all the 3 poles are gang operated .....

6. Rated voltage .....

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i) Rated kV

ii) Max. permissible ……..

7. Dielectric with-stand capacity of Completely assembled DS and earth switch .....

a) One minute power frequency withstand test voltage (kV) rms

i) against ground (kV peak) .....

- dry (kV rms) .....

b) 1.2/50 micro second impulse withstand test voltage .....

i) against ground (kV peak) .....

ii) across open contacts (kV peak) .....

c) 250/2500 micro second switching surge withstand test voltage (dry)

i) against ground (kV peak) .....

ii) across open contacts (kV peak) .....

d) Radio interference level at 1.1 x Um/√3 (in micro volts) for frequency between 0.5 MHz to 2.0 MHz ----------

8. Rated normal current

- Generator Transformer module ……A

- Line module ……A

- Bus coupler module ……A

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Bidder's Name: .....

9.	Rated peak short circuit current			.....kA
10.	Interruption of loop current			.....A/V
11.	a)	Rated short time current of DS		.....
		i)	for 1 sec. (kA rms)	.....
		ii)	for 3 sec. (kA rms)	.....
		iii)	Dynamic current	.....
	b)	Opening time of		.....
		i)	DS (sec)	.....
		ii)	Earth switch (sec)	.....
	c)	Closing time of		.....
		i)	DS (sec)	.....
		ii)	Earth switch (sec)	.....
	d)	Temperature rise over 50^{o}C ambient temperature corresponding to maximum continuous current (^{o}C)		.....
12.	Rated peak withstand current			.....kA (peak)
13.	Rated inductive breaking current			.....A
14.	TRV caused by breaking/making inductive current			.....kV
15.	Rated capacitive breaking current			.....A
16.	TRV caused by breaking/making capacitive current			.....kV
17.	Maximum temperature rise above ambient at rated current			

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Bidder's Name: .....

	-	Contacts,	……..Deg. C
	-	Hottest part	……..Deg. C
18.	Operating Mechanism		.....
	a)	Rated torque of the mechanism	.....
	b)	Type and rating (KW) of motor	.....
	c)	Rated voltage of motor	.....
	d)	Full load current (A)	.....
19.	Interlockings		.....
	a)	Whether mechanical/ constructional interlock between DS and Earth switch provided	Yes/No .....
	b)	Details of electrical interlock enclosed for	.....
		i) DS .	.....
		ii) Earth Switch	.....
	c)	Arrangement provided to prevent electrical or manual operation unless interlock conditions are satisfied	.....
	d)	Whether interlock coil is continuously rated	.....
	e)	Rated D.C. control voltage and variation allowed	.....
	f)	Power consumption (watts)	.....
20.	Controls		.....
	a)	Rated D. C. control	

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		Bidder's Name: .....
	voltage (Volts)	.....
	b) Limits of voltage	.....
	c) Power consumption of control coils (W)	.....
	21 Constructional Features	
	a) Whether position of earth switch can be interchanged at site to either side of pole	Yes/No
	b) Main contacts	.....
	i) Type of contacts	.....
	ii) Contact area (cm^2)	.....
	iii) Material of contacts	.....
	iv) Contact pressure (Kg/cm^2)	.....
	v) Maximum current density under normal current carrying capacity (Amp/cm^2)	.....
	vi) Thickness of silver plating	.....
	c) Auxiliary contacts on Disconnecting switch	.....
	i) Total number	.....
	i) NO	.....
	iii) NC	.....
	iv) Adjustable	.....
	v) Make before break	.....
	vi) Rated voltage (volts)	.....

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Bidder's Name: .....

vii) Rated continuous current (Amps) .....

viii) Rated DC breaking current with 20 ms time constant (A) .....

d) Auxiliary contacts on earth switch .....

i) Total number .....

ii) NO .....

iii) NC .....

iv) Adjustable .....

v) Rated voltage (volts) .....

vi) Rated continuous current (Amps) .....

vii) Rated DC breaking current with 20 ms time constant (A) .....

e) Whether counter balance spring provided for isolator and earth swtich .....

22. Design data

- Type of contacts .....
- Contact area .....
- Contact pressure .....
- Surface treatment and thickness of surface coating/ silver electrolytic plating. .....
- Overtravel distance after making of contacts mm

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		- Distance between the contacts in the fully open position	……..mm
		- Current density at the minimum cross section of switch blade	……..A/mm^2
		- Speed of operation	……..m/s
	23.	Partial discharge level at 1.1 Un / √3	….pico-coulombs
	24.	a) Total operating time of disconnector along with its operating mechanism	……..secs.
		b) Total operating time of disconnector after the command is given	……secs.
	25.	No. of operations the switch can withstand without any need for inspection	.....
	26.	Type of mounting	.....
	27.	No. of poles per phase	.....
	28.	Safety factor taken into account while designing the disconnector.	.....
	29.	Type and material used for arcing contacts, if provided	.....
	30.	Weight of 3 pole isolating switch	
		- with earthing blades	……Kg
		- without earthing blades	……Kg
	31.	Type of interlock between main isolator and earthing switch	.....
	32.	Details of the type test reports enclosed and the standards as per which these tests have been carried out	.....
	33.	Rated maximum time duration of short circuit	……ms
	34.	Rated mechanical terminal load.	……..Kg

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35.	Rated supply voltage of operating devices and auxiliary circuits.		…….V
36.	Rated pressure of SF6 gas		…….bar
37.	Minimum pole discrepancy between poles with regard to insulation and forces caused by short circuit currents.		…….ms
38.	Tests to be conducted at site Whether the following are enclosed:		.....
	a)	Type test reports	Yes/No
	b)	OGA drawing for disconnecting switches with & without earth switches	Yes/No
	c)	Operation manual	Yes/No
	d)	Details of motor operating mechanism	Yes/No
	e)	Leaflets & literature bringing out salient features of equipment offered	Yes/No
	f)	Whether details of constructional interlock enclosed	Yes/No

B- II Safety Grounding Switches

1.	Manufacturer's name & address	.....
2.	Type / designation	.....
3.	Standard applicable	.....
4.	Maximum permissible operating voltage	kV
5.	Maximum make and carry current for one sec.	kA (peak)
6.	Rated inductive breaking current	A
7.	TRV caused by breaking/making inductive current	kV

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8.	Rated capacitive breaking current		…….A
9.	TRV caused by breaking/making capacitive current		…….kV
10.	Operating Mechanism		.....
	a)	Rated torque of the mechanism	.....
	b)	Type and rating (KW) of motor	.....
	c)	Rated voltage of motor	.....
	d)	Full load current (A)	.....
11.	Operating voltage range & rated voltage		……V
12.	Ground connection insulation		…….kV
13.	Type of contacts		.....
14.	Over travel distance		……mm
15.	Distance of fully open contacts		…….mm
16.	Size of the removable link		……..
17.	Speed of make		……m/s
18.	Partial discharge level at 1.1 Un / √3		.....pico-coulomb
19.	Radio interference level at 266 kV (rms)		……..microvolt
20.	Details of type test reports enclosed and the standards as per which these tests have been carried out		……..
21.	Auxiliary contacts on earth switch		.....
	i)	Total number	.....
	i)	NO	.....

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iii) NC .....

iv) Adjustable .....

v) Rated voltage (volts) .....

vi) Rated continuous current (Amps) .....

22. Whether the following are enclosed:

a) Type test reports Yes/No

b) OGA drawing for disconnecting switches with & without earth switches Yes/No

B-III High Speed Fault Making Grounding Switch

1. Manufacturer's name &c address .....
2. Type/ designation .....
3. Standard applicable
4. Maximum permissible operating voltage ……..kV
5. Maximum make and carry current for 1 sec. ……..kA (peak)
6. Rated inductive breaking current ……A
7. TRV caused by breaking/making inductive current ……kV
8. Rated capacitive breaking current ……A
9. TRV caused by breaking/making capacitive current ……kV
10. Operating Mechanism .....

a) Rated torque of the mechanism .....

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Bidder's Name: .....

	b)	Type and rating (KW) of motor	.....
	c)	Rated voltage of motor	.....
	d)	Full load current (A)	.....
11.		Making current	…….kA
12.		Induced current switching capablity	.....
13.		Closing current	…….A
14.		Closing time	……..S
15.		Opening current	…….A
16.		Opening time	……..S
17.		Operating voltage range & rated voltage	…….V
18.		Ground connection insulation	……kV
19.		Type of contacts	.....
20.		Over travel distance	……mm
21.		Distance of fully open contacts	……mm
22.		Size of the removable link	.....
23.		Speed of make	……m/s
24.		Partial discharge level at 1.1 $U_n/\sqrt{3}$	…….pico-coulomb
25.		Radio interference level at 266 kV	…….microvolt
26.		Has equipment been type tested and to which standards ?	.....
27.		Auxiliary contacts on earth switch	
	i)	Total number	.....
	ii)	NO .	.....
	iii)	NC	.....

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iv) Adjustable .....

v) Rated voltage (volts) .....

vi) Rated continuous current (Amps) .....

28. Total operating time of switch alongwith its operating mechanism .....s

29. Total operating time of switch after the command is given. .....s

30. Operating Mechanism

a) Rated torque of the mechanism .....

b) Type and rating (KW) of motor .....

c) Rated voltage of motor .....

d) Full load current (A) .....

C) CURRENT TRANSFORMERS
(Bidder to fill up date separately for each type of CT)

1. Name of manufacturer .....

2. Type .....

3. Manufacturer's type / designation .....

4. Standard applicable .....

5. Mounted inside/outside SF6 Gas enclosure .....

6. Rated frequency .....

Rated continuous normal current (A) .....

7. Short time current withstand for 1 sec. (kA) .....

8. Dynamic current withstand

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(kA peak) .....

9. Transformation Ratio .....

10. Rated primary current .....

11. Rated secondary current .....

12. Numbers of cores. .....

13. Number of secondary turns .....

14. Particulars of for each type of C.T. .....

1.	2	3	4	5	6	7
CORE	Rated output (VA)	Class of accuracy	Accuracy limit	Current error at rated primary current (%)	Phase displa-cement at rated primary current (minutes)	Composite errors at cement rated accuracy limited it primary current.
I						
II						
III						
IV						
V						

	8	9	10	11	12
CORE	Knee point voltage (V) (Volts)	Secondary limiting voltage	Secondary winding resistance (ohm)	Magnetising current (mA) at knee point voltage	Instrument security factor
I					
II					
III					
IV					

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	Bidder's Name:	
V		
	15. One second over current factor & corresponding value of current.	.....kA
	16. Rated dynamic current (peak value) in amps.	.....kA
	17. Rated continuous thermal current temperature rise over ambient.	.....Deg C
	18. Partial discharge level at 1.1 Un/√3	.....Pico-coulomb
	19. Radio Interference voltage at 266 kV (rms)	.....micro-volt
	20. Total weight	.....Kg
	21. Magnetisation curves of CT cores	.....
	22. Mounting details	.....
	23. Overall dimensions	.....
	24. Temperature rise over an ambient temp. of 50 ^{o}C (^{o}C)	.....
	25. Whether CT characteristic curves enclosed	Yes/No
	26. Type Test Reports enclosed	Yes/No .....
	27. OGA drawing enclosed	Yes/no .....
	28. Tests proposed to be conducted at site.	.....
	D) VOLTAGE TRANSFORMERS	
	1 Name of manufacturer	.....
	2. Type designation	.....
	3. Standard applicable	.....

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		Wdg - I	Wdg - II	Wdg - III
4.	Rated primary voltage	……..kV		
5.	Rated secondary voltage	…… V		
6.	Rated output per phase	……..VA		
7.	Rated burden	……..VA		
8	Rated frequency	…… Hz		
9.	Standard values of rated voltage factor	.....		
10.	Limits of temperature rise	.....		
11.	One-minute power frequency withstand voltage	……..kV(rms)		
12.	1.2/50 microsecond lightning impulse withstand voltage	……kV(peak)		
13.	250/2500 micro second impulse switching surge withstand test voltage of capacitor (dry wet) (kV peak)	.....		
14.	Total weight and dimensions	……Kg		
15.	Limits of voltage error and phase displacement in %	……		
16.	Phase angle error	.....		
17.	Voltage error	.....		
18.	Accuracy class at rated burden	.....		
19.	Voltage factor and rated time	.....		
20.	Total weight	.....		
21.	Details of the tests to be conducted by the manufacturer at works			
	i) Type tests	.....		

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ii) Routine tests .....

22. Tests to be conducted at site .....

E) SURGE ARRESTORS

1. Manufacturer .....
2. Type designation .....
3. Arrestor Class & Type .....
4. Rated Voltage of Arrestor .....kV
5. Normal continuous operating voltage (MCOV) .....kV
6. i) Minimum discharge capability (kj/kV) reffered to rated voltage at minimum of discharge characteristics .....

   ii) Line Discharge class, as per IEC .....
7. Maximum discharge current (8/20 microsecond wave) kA
8. Maximum 0.5 microsecond discharge voltage kV
9. Maximum residual voltage for 8/20 micro sec current wave .....

   i) at 50% nominal discharge current (kVp) .....

   ii) at 100% nominal discharge current (kVp) .....

   iii) at 200% nominal discharge current (kVp) .....
10. Maximum switching surge protective voltage kV(peak)
11. a) One minute power frequency (dry) withstand voltage of arrester (kVrms) .....

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		b)	Impulse withstand test voltage of arrester housing with 1.2/50 micro sec wave, (kVp)	.....
		c)	Impulse current withstand	.....
			i) High current short duration (4/10 micro sec. wave) kAp	.....
			ii) Low current short duration (A peak)	.....
	12.		Partial discharge level at 1.1 Un/√3	pico-coulomb
	13.		Radio interference level at 266 KV (rms)	Microvolts
	14.		High current short duration test value	.....
	15.		Short circuit capability & class of pressure relief device	.....
	16.		I)Maximum internal ionisation at 50 Hz voltage equal to	.....
		i)	1.05 COV	.....
		ii)	1.0 COV	.....
	17.	a)	Reference voltage and corresponding reference current of arrester	.....
		b)	Maximum internal leakage current at (mA)	.....
			i) COV	.....
			ii) 1.1 COV	.....
			iii) COV at 150 deg. C	.....
			iv) Reference voltage	.....
		c)	Pressure relief class	.....

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	18.	Protective level provided by surge arrestor	.....
	19.	Energy level	kJ/kV
	20.	Details of the type test reports enclosed and the standards as per these tests have been carried out.	.....
	21.	Whether SF6 Gas insulated	Yes/No

G)	**SUPPORT & BARRIER INSULATORS** (Details for each type of insulator used to be indicated separately)		Support	Barrier
	1.	Manufacturer & address	.....	
	2.	Type of insulators used	.....	
	3.	One-minute power frequency dry withstand test voltage	…….kV	
	4.	Dry flashover value	……kV(rms)	
	5.	Wet flashover value	……kV(rms)	
	6.	1.2/50 microsecond lightning impulse withstand test voltage	……kV(peak)	
	7.	Creepage distance	…….mm	
	8.	Puncture value of insulator in SF6 gas	…….kV	
	9.	Weight of insulators in the SF6 GIS enclosure.	……Kg	
H)	**GROUNDING CONNECTION**			
	a.	Type of conductor	.....	
	b.	Arrangement for connecting conductor to ground	.....	
	c.	Type of painting, if any required to be carried out at end points of ground riser	.....	
I)	**DESIGN CLEARANCE**			

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Minimum insulating clearances at nominal rated SF6 gas pressure and rated voltage/BIL voltage for the following :

a) Main bus to ground .....

b) Circuit breaker .....

- Contact to ground .....
- Across the contacts .....

c) Isolator switches .....

- Contact to ground .....
- Across the contacts .....

d) Safety grounding switches .....

- Contact to ground .....
- Across the contacts .....

J) TOLERANCES

1. Tolerance (vertical & horizontal) and at interface of SF6 to Transformer oil bushing .....

2. Tolerance (vertical & horizontal) and at interface of SF6 to GIS bus Reactor bushing .....

SIGNATURE AND SEAL OF BIDDER

CLAUSE NO.	BIDDER'S NAME AS APPLICABLE	
	EHV INSULATORS	
A.	**BUSHING / HOLLOW INSULATORS**	
	(Bidder shall furnish these data for each equipment separately i.e. for circuit Breakers, Instrument Transformer, Surge Arrestors, etc.)	
	1. Manufacturer's Name	.....
	2. Country of Manufacturer	.....
	3. Type	.....
	4. Applicable Standards	.....
	5. i) Height	.....
	ii) Diameter (Top)	.....
	iii) Diameter (Bottom)	.....
	6. Creepage distance	.....
	a) Total (mm)	.....
	7. Rated Voltage	.....
	8. Power frequency withstand voltage for 1 min. (kv rms)	.....
	i) Dry	.....
	ii) Wet	.....
	9. 1.2/50 micro sec. impulse withstand voltage (kVp)	.....
	10. 250/2500 Micro sec. switching impulse withstand voltage (kVp)	.....
	i) Dry	.....
	ii) Wet	.....

CLAUSE NO.	BIDDER'S NAME	
	11. Weight (Kg)	.....
	12. Cantilever Strength (Kg)	.....
	13. OGA drawing enclosed	Yes/No
B.	**BUS POST INSULATOR**	
	(Bidder shall furnish these data for solid core Insulators for Disconnecting switches, bus support, etc. separately)	
	1. Manufacturer's Name	.....
	2. Country of Manufacturer	.....
	3. Type of Insulator (Product No.)	.....
	4. Applicable Standards	.....
	5. No. of units per Stack	.....
	6. Diameter & No. of Bolts	.....
	ii) Top	.....
	ii) Bottom	.....
	7. Bolt circle diameter (mm)	.....
	ii) Top	.....
	iii) Bottom	.....
	8. Height of complete stack (mm)	.....
	9. Total Creepage distance (mm)	.....
	10. Power frequency withstand voltage of insulator with corona ring	.....
	i) Dry (kV rms)	.....
	ii) Wet (kV rms)	.....

CLAUSE NO.	BIDDER'S NAME	
	11. 1.2/50 micro sec. impulse withstand voltage (kVp) of insulator with corona ring	.....
	i) Dry (kV rms)	.....
	ii) Wet (kV rms)	.....
	12. Min. Corona Extinction Voltage (kV)	.....
	13. Radio Interference Voltage at 1.1 Um/$\sqrt{3}$ (micro volts) for frequency between 0.5 to 2.0 MHz	.....
	14. Weight of complete stack (kg)	.....
	15. Cantilever strength	.....
	i) Upright (kg)	.....
	ii) Under (kg)	.....
	16. Tensile Strength (kg)	.....
	17. Torsional strength (kg/m)	.....
	18. Compression strength (kg)	.....
	19. OGA drawing enclosed	Yes/No
	20. Type test report enclosed	Yes/No
C.	**STRING INSULATOR**	
	(Bidder shall furnish this data separately for each voltage rating)	
	1. Manufacturer	.....
	a) Insulator	.....
	b) Hardware	.....
	2. Applicable Standards	.....
	3. Type of Insulator	.....

CLAUSE NO.	BIDDER'S NAME	
	a) Ball & Socket/other	.....
	b) Normal/antifog	.....
	4. Insulating Material	.....
	5. No. of units per String	.....
	6. Size of each unit	.....
	a) Diameter of disc (mm)	.....
	b) Spacing between adjacent Units (mm)	.....
	7. Weight	.....
	a) Each Disc (Kg)	.....
	b) Complete String (Kg)	.....
	8. Creepage distance	.....
	a) Each Disc (Kg)	.....
	b) Complete String (Kg)	.....
	9. Power frequency withstand voltage	.....
	a) Each Disc	.....
	i) Dry (kV)	.....
	ii) Wet (kV)	.....
	b) Complete String (Kg)	.....
	i) Dry (kV)	.....
	ii) Wet (kV)	.....

CLAUSE NO.	BIDDER'S NAME	
	10. Impulse withstand voltage	.....
	a) Each Disc	.....
	i) Positive (kVp)	.....
	ii) Negative (kVp)	.....
	b) Complete String (Kg)	.....
	i) Positive (kVp)	.....
	ii) Negative (kVp)	.....
	11. Switching Surge Withstand	.....
	a) Each Disc (kVp)	.....
	b) Complete String (kVp)	.....
	12. Power Frequency Puncture withstand voltage of each disc (kV rms)	.....
	13. Elector Mechanical Strength	Yes/No
	a) Each Disc (Kg)	.....
	b) Complete String (Kg)	.....
	i) Single tension	.....
	ii) Double tension	.....
	14. OGA drawing enclosed	Yes/No
	15. Type test report enclosed	Yes/No

CLAUSE NO.	BIDDER'S NAME AS APPLICABLE	
	MOTORS	
	(Bidder shall fill up thedata for Circuit breakers and Disconnector/Isolator and earth switches/High speed earth switches seperately)	
1.	a) Manufacturer	.....
	b) Equipment	.....
	c) Motor type	.....
	d) Frame size & type designation	.....
	e) Applicable standard to which motor conforms	.....
	f) Rated output at 50 deg. C outside air ambient temperature(KW)	.....
	g) Max. power input to the driven equipment at design duty point (KW)	.....
	h) Max. power input to the driven equipment (KW) over entire operating range.	
	i) At rated speed	.....
	ii) AT 103% speed	.....
	i) Class and type of insulation	
	j) Type of enclosure, and method of cooling	.....
	k) Degree of protection	.....
	l) Rated voltage and frequency (HZ)	
	m) Rated speed	.....
	n) Efficiency at design duty point (without -ve tolerance)	.....

CLAUSE NO.	BIDDER'S NAME	
	o) Power factor at design duty point	.....
	p) Type of mounting	.....
	q) Type of terminal box for stator leads	.....
	r) Bearing type	.....

SECTION-5
SCHEDULE OF TECHNICAL DEVIATIONS

Certified that the following are only deviations from the Technical specification (for the equipment and systems being offered)

S.No.	Page No.	Clause No.	Deviation	Reason / Justification

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

Note: 1. Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.
2. Deviation mentioned in this schedule shall only be considered.

Date :

Signature :

Name:

Designation :

Company:

SECTION-6

CHECK LIST FOR 400KV GIS

A)

Sl.	Particulars	Reply by bidder	
1	**TECHNICAL QUALIFYING REQUIREMENT**		
1.1	The bidder should comply with Technical Qualifying requirement & furnish the relevant documents.	Confirmed	Yes/No
1.2	The bid shall be submitted by the Manufacturer of GIS/ Bidder who meets the PQR criteria. The bidder's scope includes supply and services like • supervision of erection, • testing and commissioning. Bids submitted by agents (who does not meet the PQR criteria) will not be considered.	Confirmed	Yes/No
1.3	All the documents shall be submitted in English. Translated pages should be attested by the bidder.	Confirmed	Yes/No
2	**Un-priced Offer** –.		
2.1.	Confirm that all items have been quoted. (If any item has not been quoted, the same shall be specifically brought out)	Confirmed	Yes/No
2.2.	Any other item /service required for the execution for the complete job is deemed to be included in the offer, whether specifically mentioned in the specification or not. List of items along with their respective quantities required for completeness (Attach list, if required).	List of Additional items required attached	Yes/No
2.3.	Foundation for GIS shall be constructed *by* Civil contractor based on the input (configuration, loads etc) provided by bidder. The supply of all structural material to be embedded like foundation bolts as well as consumables like grouting material shall be in scope of bidder. The erection of structure shall be done by BHEL.	Confirmed	Yes/No
2.4.	SF6-GIS to Air bushing - Interface for connecting GT/ST/LINE/REACTOR with bus duct shall be complete with structures etc shall be provided by the bidder. Limit of supply as per technical specification and as per IEC 61639.	Confirmed	Yes/No
2.5.	Confirm that Consumables as per manufacturer requirement for successful erection, testing & commissioning shall be included in bidder's scope.	Confirmed	Yes/No
2.6.	Detailed list of Commissioning spares for testing & commissioning of GIS till handing over	Attached	Yes/No
2.7.	Detailed list of Tools & tackle & Testing Equipment	Attached	Yes/No
2.8.	Detailed list of Recommended Spares/operation & maintenance spare	Attached	Yes/No

Sl.	Particulars	Reply by bidder	
2.9.	The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, and interconnecting power and control Cables (between GIS to GIS/GIS to LCC/ LCC TO LCC), grounding connections (GIS to GIS and GIS to Earth Mesh on Floor), gas monitoring System and piping, support structures.	Confirmed	Yes/No
2.10.	The scope of supply shall also include all erection and mounting hardware and interconnecting cables within GIS.	Confirmed	Yes/No
2.11.	**Design philosophy of earthing submitted with the bid**	Confirmed	Yes/No
2.12.	**Tentative GIS Hall PLAN & SECTION Layout submitted with the bid**	Confirmed	Yes/No
2.13.	**Tentative Pothead yard PLAN & SECTION Layout submitted with the bid**	Confirmed	Yes/No
2.14.	**Technical Requirement of EOT Crane capacity & hook height mentioned in GIS Hall Layout**	Confirmed	Yes/No
2.15.	**Tentative / estimated AC / DC Load requirement for GIS submitted with bid**	Confirmed	Yes/No
2.16.	Earthing material as per Section 1, Clause 1.6	Confirmed	Yes/No
2.17.	Length of bus duct shall be estimated by the bidder based on drawings provided in the bid. Any change in bay pitch (distance between bays) as per civil requirement for foundation layout during detailed engineering stage shall be incorporated by bidder as per item of Expansion Joints and bellows of BOQ.	Confirmed	Yes/No
2.18.	Tentative PLAN & Section drawing of bus duct submitted with bid	Confirmed	Yes/No
3	**Technical**		
3. 1	**Location of site:** *Project site is Talcher, Orissa; design and construction of GIS should be suitable for the climate/ Meteorological Condition as mentioned in Section-1 and in section-3.* *Bidder to inform what measures shall be taken to ensure the same at bid stage.*	Writeup attached with bid.	Yes/No
3. 2	Details regarding the design features of equipment which are intended to prevent burn through when an internal arc occurs.	Enclosed with bid	Yes/No
3. 3	Material of enclosure – Non Magnetic	Confirmed	Yes/No
3. 4	Material of bus bar - Non Magnetic	Confirmed	Yes/No
3. 5	Requirement of AC and DC auxiliary loads	Enclosed with bid	Yes/No
3. 6	Catalogues of GIS	Enclosed with bid	Yes/No
3. 7	Catalogues of all Maintenance equipment. Bidder to confirm that offered equipment meets the requirements of specification.	Enclosed with bid	Yes/No
3. 8	Approved makes – Bidder to confirm that the offered Maintenance equipment are of approved make	Confirmed	Yes/No
4	**Calculations**		
4.1	All calculations including Thermal calculations based on the climatic conditions indicated in Section 3 shall be submitted during detailed engineering stage.	Confirmed	Yes/No

Sl.	Particulars	Reply by bidder	
4.2	Devices or techniques deployed for reducing transients to an acceptable level enclosed along with offer.	Enclosed with bid	Yes/No
4.3	The design of the equipment shall be such that the agreed permitted movement of foundations and mechanical or thermal effects do not impair the assigned performance of the equipment.	Confirmed	Yes/No
4.4	Insulation co-ordination study shall be conducted and based on the same the *Rating*, numbers & location of surge arresters shall be decided. The *Rating,* number and location of surge arresters shall be indicated with the bid. Any increase in quantity at the time of detailed engineering shall be on bidder's account.	Confirmed	Yes/No
4.5	Measures to limit external over voltages (e.g. surge arresters) should be considered and detailed out based on the site conditions of altitude etc.	Enclosed with bid	Yes/No
5	**Technical Deviations**		
5.1	Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned elsewhere in the bid will not be considered.	Confirmed	Yes/No
5.2	Technical Deviation sheet has been submitted.	Confirmed	Yes/No
6A	**Barchart**		
6A.1	Bidder will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning based on the drawing & document schedule attached in section1.	Confirmed	Yes/No
6B	**Conditions**		
6B.1	Store shall be provided by BHEL for GIS and accessories. Confirm that the space required for the material being supplied, both indoor and outdoor has been indicated.	Details given with the bid.	Yes/No
7	**Site Test**		
7.1	Bidder to supply Only special tools. For other tools Bidder to submit list of tools, tackle, slings, spanners, gauges, slings and other lifting devices, drills, instruments and appliances necessary for the complete assembly and erection at site of the GIS, required for installation, gas filling, maintenance, site testing of the GIS which shall be arranged by BHEL. EOT crane of shall be provided by BHEL in GIS cavern. Capacity of EOT Crane shall be as per recommendation of GIS Manufacturer. HV Test kit shall be in scope of bidder.	Confirmed	Yes/No
7.2	Bidder to furnish detailed BOQ for non-returnable Tools and Tackles along with unit prices to be handed over to ultimate customer.	Details given with the bid.	Yes/No
7.3	All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of the Employer. No separate site test will be conducted by BHEL/Customer	Confirmed	Yes/No
8	**TYPE TESTS REQUIREMENTS**		
8.1	The Bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Bidder shall	Confirmed	Yes/No

Sl.	Particulars	Reply by bidder	
	indicate the charges for the 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 only if type tests are actually conducted (for reasons not attributable to the bidder) successfully under the contract and upon certification by the Customer's engineer.		
8.2	The type tests shall be carried out in the presence of the Customer's representative, for which minimum 30 days' notice shall be given by the Bidder. The Bidder shall obtain the Customer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set up, instrument to be used, procedure, acceptance norms, recording of various parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out	Confirmed	Yes/No
8.3	In case the Bidder has conducted such specified type test(s) according to the relevant standard and / or specification not earlier than **Ten (10) years prior to 06-June-2022**, he may submit the type test reports to the Customer for waival 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 Customer. The Customer 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 Bidder. However if any type test report is found not meeting the specification requirements, bidder shall conduct all such type tests successfully according to relevant standards without any cost and delivery implication to BHEL.	Confirmed	Yes/No
8.4	Type test report for 400 kV GIS shall be submitted along with the bid. Differences, if any, in the items offered and those which have been type tested shall be clearly brought out along with explanation for suitability. Type Tests Reports Submitted along the bid shall be subject to review and approval at contract stage.	Confirmed and enclosed with bid	Yes/No

B) TYPE TESTS:

LIST OF TYPE TESTS REPORTS TO BE SUBMITTED FOR 400 kV GIS:

Type Tests for following Tests to be submitted:

As per clause 1.8 and 1.9 of Section 1. **(YES/ NO)**