TECHNICAL QUALIFYING REQUIREMENT FOR 765 KV GIS

Bidder should be manufacturer of the offered GIS. Bidder needs to meets the following technical requirements as stipulated here under:

Route-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 two (2) bays of 715 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 as on the originally scheduled date of technical bid opening of this tender
OR
Route-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 "Route-1" above) and Bidder/Sub vendor should have designed, manufactured, and supplied one (1) Gas Insulated Switchgear (GIS) equipment(s) installation having at least two (2) bays of 715 kV or above voltage class years as on the originally scheduled date of technical bid opening of this tender.

NOTE: -

1. Note for Route-1: Letter of Technical Support should be submitted by bidder as per format attached. The bidder will also be fully responsible for the performance of the GIS portion of the contract.
2. Note for Route-2: Bidder shall arrange a Letter of Technical Support to this effect from its Associate as per the format enclosed in the bidding document. The bidder & associate will also be fully responsible for the performance of the GIS portion of the contract.
3. For the purpose of qualifying requirement, one no. of bay shall be considered as a comprising of at least one circuit breaker (3 phase), two disconnector (3 phase) and single-phase current transformers (3 phase).

PREPARED BY REVIEWED BY APPROVED BY

NABINAGAR SUPER THERMAL POWER PROJECT STAGE-II

(3X800MW) EPC PACKAGE

(Experience Details - Applicable to all the Bidders)

ATTACHMENT 3K- DOCUMENT(SWITCHYARD*) :*

Sub: Sub-Qualifying Requirements for 765KV GIS Switchyard: (Route-I)

In order to satisfy the requirement of as indicated in Technical Specification, Clause No. 5.13.1 of Sub-Section-IA, Part-A, Section-VI, We/ Sub vendor hereby confirm that M/s..... ..... is the Bidder / Sub vendor have designed, manufactured, erected/ supervised erection, tested/ supervised testing and commissioned/ supervised commissioning of one (1) Gas Insulated Switchgear (GIS) equipment(s) installation having at least two (2) bays of 715kV or above voltage class with short circuit current of not less than 40 kA for 1 sec as per stipulated requirements mentioned under Clause no. 5.13.1 of Sub-Section-IA, Part-A, Section-VI of Bidding documents. The details of above are as under:

Sl. No.	Item Description	Details
1.	Name and Address of Bidder /sub vendor and Name of contact person with email ID, Telephone & Fax Nos.	
2.	Client Name and its Address, including Tel. No. and Fax no.	
3	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) Gas insulated Switchgear (GIS) Substation installation having at least two (2) bays of 715kV or above voltage class with short circuit current of not less than 40 kA for 1 sec .	
4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No

Signature **of authorized signatory.....**

	vi)Commissioning	Yes/No
08	Details of 715kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iv)Whether GIS insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
112	Whether one (1) GIS insulated substation of 715kV or above voltage class having at least two(2) bays has been in successful operation for a minimum period of two(2) years.	Yes / No
11.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

1. For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker (3 phase), two disconnectors(3 phase) and three single phase current transformer.
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.

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Signature **of authorized signatory.....**

Route-II:

In order to satisfy the requirement of as indicated in Technical Specification, Clause No. 5.13.2(a) of Sub-Section-IA, Part-A, Section-VI, We/ Sub vendor hereby confirm that M/s..... ..... is the Bidder / Sub vendor have designed, manufactured, erected/ supervised erection, tested/ supervised testing and commissioned/ supervised commissioning one (1) Air Insulated Substation/ Switchyard of 715 kV or above voltage class having at least two (2) bays which should have been in successful operation for a minimum period of two(2) years as per stipulated requirements mentioned under Clause no. 5.13.2(a) of Sub-Section-IA, Part-A, Section-VI of Bidding documents. The details of above are as under:

Sl. No.	**Item Description**	**Details**
1.	Name and Address of Bidder /sub vendor and Name of contact person with email ID, Telephone & Fax Nos.	
2.	Client Name and its Address, including Tel. No. and Fax no.	
3	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) Air insulated substation of 715kV or above voltage class having at least Two (2) bays.	
4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No
	vi)Commissioning	Yes/No
08	Details of 715kV or above Bays:	
	i)Voltage Level (in KV)	

Signature **of authorized signatory.....**

	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iv)Whether Air insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
112	Whether one (1) Air insulated substation of 715kV or above voltage class having at least Two(2) bays has been in successful operation for a minimum period of two(2) years.	Yes / No
11.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

i) For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker (3 phase), two disconnectors(3 phase) and three single phase current transformer.

ii) 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.

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common Seal).....

Signature **of authorized signatory.....**

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

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

Sl. No.	**Item Description**	**Details**
1.	Name and Address of associate and Name of contact person with email ID, Telephone & Fax Nos.	
2.	Client Name and its Address, including Tel. No. and Fax no.	
3	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) GIS insulated substation of 715kV or above voltage class having at least Two (2) bays. with short circuit current of not less than 40 kA for 1 sec .	
4.	Name and designation of the responsible person in Clients organization.	
5	Name & location of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Construction / Erection	Yes/No
	v)Testing	Yes/No
	vi)Commissioning	Yes/No
08	Details of 715kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	

Signature **of authorized signatory.....**

	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iii)Whether GIS insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
112	Whether one (1) GIS insulated substation of 715kV or above voltage class having at least two(2) bays have been in successful operation for a minimum period of two(2) years.	Yes / No
11.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

i)For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker (3 phase), two disconnectors(3 phase) and three single phase current transformer.

ii)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.

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common Seal).....

Signature **of authorized signatory.....**

ROUTE-III:

We have established manufacturing facilities for GIS Equipment in India based on technological support of an associate M/s …….. Who meet the requirements specified in clause no. 5.13.1 of 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 two (2) bays of 715kV 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:

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

Sl. No.	Item Description	Details
1	Name & Location of the GIS manufacturing facilities	
2.	Name of contact person with email ID, Telephone & Fax Nos of GIS manufacturing facility.	
3	Name and address of the associate providing technological support with Telephone, Fax and email etc	
4	Whether manufacturing facility for GIS available in India based on technological support of Associate.	Yes*/ No*
5	Name of the plant / project & its location for which the Bidder / Sub vendor have designed, constructed / erected, tested and commissioned one (1) GIS insulated substation of 715kV or above voltage class having at least Two (2) bays. with short circuit current of not less than 40 kA for 1 sec .	
4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	

Signature **of authorized signatory.....**

07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No
	vi)Commissioning	Yes/No
08	Details of 715kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iii)Whether GIS insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
112	Whether one (1) GIS insulated substation of 715kV or above voltage class having at least Two(2) bays which should have been in successful operation for a minimum period of two(2) years.	Yes / No
11.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

i)For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker (3 phase), two disconnectors(3 phase) and three single phase current transformer.

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

Signature **of authorized signatory.....**

*Bidder to strike-off whichever is not applicable.

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Signature **of authorized signatory.....**

SUPPORT FOR SATISFACTORY PERFORMANCE OF 765kV GIS FOR NABINAGAR-II STPP(3X800MW)

TO:

[EMPLOYER'S NAME & ADDRESS]

Sub: Letter of Support submitted From ……..(name of the Associate) undertaking the responsibility for satisfactory performance of 765kV 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 765kV 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 765 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 765 KV GIS.

   (f) Further, We shall ensure proper design, manufacture, supply, installation, testing and commissioning for the successful performance of the 765 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 the Authorised Representative:……..

For M/s ……

(Associate)

Name ……

Designation ……

Signature **of authorized signatory.....**

Date:……

Common Seal of the Company

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

Signature **of authorized signatory.....**

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	**TB-PBTU-NTPC-NABINAGAR-7GIS**	**Rev 00**	**Prepared**	**Checked**	**Approved**
TYPE OF DOC.	**TECHNICAL SPECIFICATION**	**NAME**	**JK**	**VK**	**VK**
TITLE		**SIGN**	-sd-	-sd-	-sd-
		DATE	18.07.2024	18.07.2024	18.07.2027
765 kV Gas Insulated Switchgear with its accessories		**GROUP**	**TBEM**		
		WO No.			

CUSTOMER	**GSECL**
PROJECT	Pre Bid Tie up for, 765KV Switchyard of NABINAGAR SUPER THERMAL POWER PROJECT STAGE -II (3X800 MW)

Contents

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

Rev. No.	Date	Altered	Checked	Approved	
02	06/08/2024				BOQ UPDATED
Distribution				To	
				Copies	

SECTION 1: CHECKLIST FOR TECHNICAL EVALUATION

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

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

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

NIT Reference No.:

Name of Bidder:

Name of Project:

Date: Bidder's Stamp & Signature

Standard Specification for GIS

CONTENTS

1. SCOPE

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

The complete technical specification comprises of following sections:

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

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

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

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

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

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

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

2. PROJECT SPECIFIC TECHNICAL REQUIREMENTS

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

3. GENERAL TECHNICAL REQUIREMENTS

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

1. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders.
2. The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for operation and maintenance purposes.
3. The service activities shall include consumables/ commissioning spares required during commencement of GIS installation, testing and commissioning in all respect.
4. Bidder shall offer their latest type tested model to accommodate the specified & allocated space as per attached layout drawing of GIS.
5. Bidder shall conduct insulation co-ordination studies including VFTO report in line with IEC for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS, however, additional supply of surge arrester in line with above required shall be paid as per Bill of Quantity, as applicable.
6. Bidder shall check and ensure adequacy of system protection for successful operation of GIS. After checking of system by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after/ during commissioning, same shall be replaced immediately without any extra cost.
7. In case, Controlled Switching Device is specifically required as per BOQ/ Technical specification, same shall have display facility at the front for the display of settings and measured values. In case, CSD does not have complete display facility for settings and measured values, bidder to supply one number laptop PC with pre-installed, licensed software for each site. Special cable required for integration is deemed inclusive in bidder's scope.
8. The quantity of SF6 gas for GIs shall include quantity for initial installation of complete GIS System, including wastage during installation, testing and successful commissioning. Hence, Supply of additional quantity to cater the losses during installation, testing & commissioning shall be deemed to include in bidder's scope.
9. The offered GIS with LCC & its Accessories shall be complete in all respect in compliance to technical specification and relevant IS/ IEC/ IEEE standards as applicable. Any other equipment/ material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply & services.
10. All essential and desirable accessories are deemed inclusive of offer i.e. and not limited to Gas Monitoring Devices, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators

etc. complete in all respect.

11. Length & route of GIB is purely indicative and same shall be finalized during detailed engineering stage.
12. BHEL reserve rights to amend Bay sequence during contract stage, no separate claim shall be admissible in this regard.
13. Any Item not quoted mentioned "Not Applicable" in Bill of Quantity and found applicable as per technical specification and system requirement shall be supplied without any commercial implication to BHEL/ Customer.
14. Gas Insulated Bus Bars running across the length of the switchgear/ main bay to tie bay to interconnect each of the bay modules (as per layout) along with necessary interfaces (as applicable under the technical requirement) is deemed to be inclusive in the scope of bidder, however, it shall be payable/ not payable as per Bill of Quantity.
15. Special Tools &, tackles, Testing & Maintenance Equipment/ Instruments shall be supplied and demonstrated at site as per requirement of Bill of Quantity, however same shall not be used for erection/ installation, testing and commissioning of GIS, hence bidder to bring Special Tools &, tackles, Testing & Maintenance Equipment/ Instruments at site for during erection/ installation, testing & commissioning on returnable basis.
16. Final documentation shall be submitted in hard copy (six copies) as well as soft (Three CDs/DVDs/ Pen Drives).
17. Bidder to submit all supporting documents in English. If document submitted by bidder is other than English language, self-attested English translated document should also be submitted.
18. Total contract value may vary up to ±20% at contract stage.

4. METHODOLOGY FOR MEASUREMENT OF GIB DUCT

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

5. SUPPORT STRUCTURE & HARDWARE (INCLUDING STRUCTURE STEEL)

1. Structural Steel, Support Structure & Hardwares (required for installation of complete GIS system with LCC & its Accessories etc.) are deemed to be inclusive in bidder's scope of supply, whether, same may/ may not be indicated with break-up in Bill of Quantity.
2. All steel structure members shall be hot-dip galvanized after fabrication (excluding floor embedded items for which OEM standard practice & recommendation shall be followed). All field assembly joints shall be bolted. Field welding shall generally not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work, however for complete details, please refer Section-2.
3. Lattice/ pipe structure materials for support of GIS, Bus Ducts, SF6 to oil bushing/ SF6 to cable connection, SF6 to air bushing/ connection including anchor fastener, bolts, foundation bolts, base plate / channel / metallic / structural member for placement of GIS

system, all floor and wall embedded Items, wall crossing arrangements, rails and/ or other items structural items as required. Bidder shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, Anchor Fasteners, foundation bolts, nuts and washers, equipment fixing hardware shall be provided to fasten the switchgear base frames to the foundation channels as applicable.

4. **Chemical / Mechanical Anchors** Bolts are to be provided by bidder for GIS, GIB & SAB.
5. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc. for each bay and it shall be of modular construction and extendable design.
6. Structural steel for complete GIS system with LCC & its Accessories is deemed to be inclusive in bidder's scope of supply.

6. INTERNAL CABLING

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

7. EARTHING MATERIALS FOR GIS

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

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

8. DRAWINGS / DOCUMENTS FOR MANUFACTURING CLEARANCE

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

Sl. No.	Overall Drawings approval required in Cat I /Cat II
	Lot1
1	GIS- Gas Schematics with Single Line Diagram (Including CT VT Parameters)
2	GIS- Guaranteed Technical Particulars (Including all GIS equipment)
3	GIS- Layout, Plan & Section Drawing
4	GIS- Interfacing Drawings for Cable Connection Module / SF6 to Air Bushing / SF6 to Oil Module (as applicable) with its Guaranteed Technical Particulars
5	GIS- Type Test Reports (Including all GIS equipment)
6	GIS- Quality Assurance Plan & Inspection Test Schedule
	Lot 2
7	GIS- Secondary Engineering Base Design & Control Schematics for GIS and Local Control Cabinet
8	GIS- Maintenance Equipment Catalogue with Guaranteed Technical Particulars, test reports
9	GIS- Civil Design Specification with Foundation Loading Diagram (Including interfacing details)
10	GIS – Support Structure, Platform, Wall & Floor Inserts & Hardware drawing & BOM
11	GIS- Earthing Layout with Design
12	GIS- Quantification for main Items, Spares, Consumables
13	Design Calculations for GIS including insulation co-ordination studies with VFTO report, earthing design calculations etc.
	Miscellaneous Drawing
15	GIS- 3D OGA Drawing compatible with Autocad & Primtech for GIS System (3D-Model with complete editable data base)
16	Manuals on unloading, safe storage, transportation, installation, testing, commissioning, routine check, preventive maintenance

9. TYPE TESTING

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

10. QUALITY PLAN

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

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

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

11. SITE SERVICES

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

Further, bidder shall carry out following supervision activities at site,

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

12. TESTING & COMMISSIONING

1. The GIS System shall be subjected to the site tests as per technical specifications, IEC-62271-203. Bidder to submit site acceptance testing (SAT) procedures and get the same approved from BHEL / Customer before commencement of testing at site.
2. Carrying out successful HV/ Power Frequency Testing of GIS as per IEC shall be in scope of bidder, which includes HV test kit with operator, accessories & tools required for completion of HV testing. In case, HV testing could not be completed in one go, same shall be payable/ not payable as per details mentioned in Bill of Quantity.
3. BHEL shall provide extend support and assistance at site for smooth conduction of HV Testing including unloading, assembling of HV test kit, dismantling, packing & loading back for transportation.

4. Complete Field testing and commissioning of GIS system with LCC & its Accessories are under the scope of Bidder.
5. Start-up & Commissioning spares are included in bidder's scope of supply and shall be included in the base price. Adequate stock of start-up & commissioning spares shall be made available at the site such that commissioning of the equipment/ systems, performance testing and handing over the equipment/ systems to customer can be carried out without any hindrance or delays.
6. Bidder shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply. Bidder shall give a notice of at least one year to the Customer & BHEL (both) before phasing out the products/spares to enable the owner for placement of order for spares and services.

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

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

14. PACKING AND DISPATCH

1. The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Packing of the equipment shall be suitable for long storage (minimum 1 year).
2. The GIS transport units shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner.
3. Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., and other details as per purchase order & technical specification.
4. The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature.
5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Dry nitrogen/air or dry SF6 gas (in full

compliance to technical requirement) shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.

6. All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. Any seals, gaskets, `0' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Vendor to provide quantity of components accordingly considering permanent installation and commissioning.

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

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

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

Rev. No.	Date	Initiated by	Reviewed by	Approved by	Updates
04B	03.05.2024	By	DKS	VK	Revised for non POWERGRID projects
04C	06.07.2024	By	JAI	VK	Revised for MEJA

Project Specific Specification for GIS

Contents

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

Name of the Customer	NTPC
Name of Main Contractor	Bharat Heavy Electricals Limited
Name of the Project/ Tender	Pre Bid Tie up for, 765KV Switchyard of NABINAGAR SUPER THERMAL POWER PROJECT STAGE-II (3x800 MW)
Location	NABINAGAR

765KV Gas Insulated Switchgear:

Bay details:

The SF6 gas insulated switchgear (50 Hz) shall be of the indoor metal-enclosed type. 765KV SF6 gas insulated switchgear shall have one and a half breaker bus bar arrangement. The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting power and control wiring, grounding connections, gas monitoring equipment & piping and support structures along with necessary base plate, Anchor Fastener for foundation bolts. In addition, all necessary stairs, platforms, supports, fixed ladders, portable scissor lift and walkways etc. as required for operation & maintenance work shall also be provided.

SF6 gas insulated metal enclosed bus bars, Circuit Breakers, Isolators, safety ground switches, High speed fault making ground switches, Current transformers, Surge arresters, GIS ducts, Local Bay control cabinets, On

line Partial Discharge Monitoring system for GIS switchgear, GIS Busducts, SF6 gas monitoring equipments, Bus VTs, etc.

Bay details are as shown in the Single Line diagram & project SLD.

a) 765KV GIS modules as per Bill of Quantity (BOQ) and description given in SLD, Protection SLD & section-2.
b) Controlled Switching devices as per Bill of Quantity (BOQ).
c) Testing and Maintenance equipment as per Bill of Quantity (BOQ).
d) Any other equipment/material required to complete the specified GIS scope of work.

1. BILL OF QUANTITIES:

Please refer the followings

Section.1 Annexure_BOQ_GIS_NTPC_NABINAGAR

a) During tender stage No of bays of GIS may vary. No of bays of GIS shall be finalized after receipt of Notification of award (NOA) from Customer/ BHEL.
b) Overall contract value may vary ±20%.
c) Type Test are optional and may be deleted in full or part thereoff

2. SPECIFIC TECHNICAL PARAMETERS

Please refer the following documents for project specific technical requirement,

- General Specification for 765KV GIS

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

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

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

3. OTHER TECHNICAL REQUIREMENTS

- SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL

OPERATION - Complete in all respect in compliance to technical specification and requirements. Bidder to consider supply of SF6 losses during installation and commissioning.

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

4. SPECIFIC TECHNICAL REQUIREMENTS FOR CSD

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

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

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

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

5. TECHNICAL QUALIFYING REQUIREMENTS:

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

6. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

Please refer Section-2 and Section-3 of technical specification for the detailed list of type test requirement.

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

In case the bidder 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-May 2020 & with latest amendments as on date of bid opening that is 12 July 2024.

The reports for all type tests as per technical specification & relevant IEC / IS shall be furnished by the Bidder along with equipment / material drawings. Type test reports of similar equipment / material shall be applicable for similar requirement with compliance to IEC. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by representative of Utility /representative of accredited test lab/ representative of The National Accreditation Board for Certification Bodies (NABCB) certified agency shall also be acceptable.

In case the test reports are of the test conducted earlier than 15 years from scheduled date of bid opening that is dated 12 July 2024, the Bidder shall repeat these test(s) at no extra cost to the BHEL / NTPC:-

Note:-

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

The Contractor shall intimate the Employer the detailed program about the type tests at least THIRTY (30) DAYS in advance in case of domestic supplies & NINETY (90) DAYS in advance in case of foreign supplies.

Note – The type test report shall be reviewed for approval in detailed engineering stage only. For evaluation purpose, abstract sheets of type test reports with tabulated list of the same are to be submitted along with the technical bid as per Technical Qualification requirements.

ANNEXURE: BOQ_765KV GIS_SUPPLY_NTPC_NABINAGAR **R.1.1** **06-08-2024**

Sl. No.	Item Description	Unit	Qty.	Remarks
1.0	**SUPPLY- GIS: 765KV, 50 kA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS (Two bus with One & Half Breaker Scheme)**			
1.01	**GIS BAY SUPPLY: 765KV, 3150A, 50 kA, SF6 GIS GT FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS**	**SET**	**3**	765KV GIS GT FEEDER BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker complete with operating mechanism (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 4 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 6 NO- 1 phase multi ratio Current Transformer CT-A (e) 3 NO- 1 phase multi ratio Current Transformer for metering purpose CT-M In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System (OPMS), Local Control Cubicle (LCC) and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.021	**GIS BAY SUPPLY: 765KV, 3150A, 50 kA, SF6 GIS TRANSFORMER FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS**	**SET**	**2**	765KV GIS TRANSFORMER BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker, compatible for Controlled Switching Facility, complete with operating mechanism (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 4 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 6 NO- 1 phase multi ratio Current Transformer CT-A (e) 3 NO- 1 phase multi ratio Current Transformer for metering purpose CT-M (f) 3 NO- 1 phase multi ratio (5 core) Current Transformer for CT-B In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System (OPMS), Local Control Cubicle (LCC) and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.022	**GIS SUPPLY: ADDITIONAL EQUIPMENTS FOR INTERFACING OF TRANSFORMER FEEDER TO AUXILIARY BUSBAR MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS**	**SET**	**2**	765KV GIS MODULES FOR INTERFACING OF TRANSFORMER FEEDER TO AUXILIARY BUSBAR MODULE shall include following but not limited to, Additional modules for Transformer Bay for complete interfacing with switching of spare Transformer through 765kV auxiliary bus module for Spare Transformer. The isolator must meet the operational requirement in terms of Phase-Phase insulation withstand capability. Complete as per system requirement. shall include following but not limited to, **(g) 3 SET - 3 NO x1 Phase, individual pole operated isolator switches complete with operating mechanism.** **(h) 1 SET - 3 NO x1 Phase, earth switch, complete with manual and motor driven operating mechanisms** In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System (OPMS), Local Control Cubicle (LCC) and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.03	**GIS BAY SUPPLY: 765KV, 3150A, 50 kA, SF6 GIS BUS REACTOR FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS**	**SET**	**1**	765KV GIS BUS REACTOR FEEDER BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker, compatible for Controlled Switching Facility, complete with operating mechanism (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 4 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 6 NO- 1 phase multi ratio Current Transformer CT-A (e) 3 NO- 1 phase multi ratio Current Transformer for metering purpose CT-M In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System (OPMS), Local Control Cubicle (LCC) and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc.

Sl. No.	Item Description	Unit	Qty.	Remarks
1.04	**GIS BAY SUPPLY: 765KV, 3150A, 50 kA, SF6 GIS <u>LINE FEEDER BAY</u> MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS**	**SET**	**2**	765KV GIS LINE FEEDER BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker , compatible for Controlled Switching Facility, complete with operating mechanism (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 3 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 1 SET- 1 NO x3 phase High Speed make proof Earthing Switch, complete with operating mechanism. (e) 6 NO- 1 phase multi ratio Current Transformer CT-A (f) 3 NO- 1 phase multi ratio Current Transformer for metering purpose CT-M (g) 3 NO- 1 phase multi ratio Current Transformer for CT-L In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc.
1.05	**GIS BAY SUPPLY: 765KV, 3150A, 50 kA, SF6 GIS <u>TIE BAY</u> MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS**	**SET**	**4**	765KV GIS TIE FEEDER BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker, compatible for Controlled Switching Facility, complete with operating mechanism (b) 2 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 2 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism.. (d) 6 NO- 1 phase multi ratio Current Transformer CT-A In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.06	GIS SUPPLY: 765KV, 4000A, 50 kA, SF6 GIS **<u>BUS BAR MODULE</u>** (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	765KV GIS BUS BAR MODULE shall include following but not limited to, (a) 1 SET - 3 NO. X 1 Phase bus bars enclosures running across the length of the switchgear to interconnect each of the bay modules (b) 1 SET - 3 NO. X 1 Phase End Piece (Interface) modules with isolating test link for Future extension on one side of Bus bar module The end piece module shall be designed in such a way so that future GIS module may be tested without extending voltage to existing bus by removing the test link. End piece (interface) module for both the buses shall be in one alignment. In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.07	GIS SUPPLY: 765KV, 4000A, 50 kA, SF6 GIS **<u>AUXILIARY BUSBAR MODULE</u>** FOR SPARE TRANSFORMER (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	1	765KV SF6 GIS auxiliary busbar module for Spare Transformer including: Set of isolated phase, 765kV SF6 gas-insulated metal enclosed Auxiliary busbar module for connection with spare Transformer comprising of following: a. One (1) number 1-Phase, Auxiliary bus bar enclosure running across the length of the switch gear to inter-connect the spare unit of Transformer with all Transformer bay modules under present scope through GIS ducts. b. One (1) number 1-phase, single pole disconnector, complete with operating mechanism. c. One (1) number 1-phase, single pole operated safety grounding switch, complete with manual and motor driven operating mechanisms. d. End Piece (Interface) module with the test link for future extension. The end piece module shall be designed in such a way so that future GIS module may be tested without extending voltage to existing bus by removing the test link.
1.08	GIS SUPPLY: 765KV, 50 kA, SF6 BUS VT BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	765KV PT BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. **(b) 1 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism** **(c) 1 SET- 1 NO x3 phase High Speed make proof Earthing Switch, complete with operating mechanism.** (d) 3 NO- 1 phase multi winding Voltage Transformer (e) LOCAL CONTROL CUBICLE if applicable In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable shall be included, however, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.09	GIS SUPPLY: 765KV, ONLINE PD MONITORING SYSTEM (OPMS) FOR 765KV GIS SYSTEM	Lot	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.1	GIS SUPPLY: 765KV, CONTROLLED SWITCHING DEVICE (CSD) FOR 765KV, 3- PH CIRCUIT BREAKER	SET	6	It is considered for Reactor, Transformer BAYS WITH ASSOCIATED TIE BAYS. 1 SET= 1 NO. OF EACH TYPE & RATING Please refer section-2 (TS for 765KV GIS)- Technical Specification.

Sl. No.	Item Description	Unit	Qty.	Remarks
1.11	SUPPLY- GIS : 765KV, 3150A, 1 PHASE GAS INSULATED BUS DUCT (INCLUDING SF6 GAS, STRUCTURE WITH HARDWARES AND EARTHING MATERIALS)	MTRS	**5000**	Please refer section-2 (TS for 765KV GIS) shall include the following but not limited to Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable shall be included, however, Online PD Monitoring System and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 765KV GIS)- Technical Specification.
1.12	GIS SUPPLY: 765KV, 3150A, 1 PHASE SF6 TO AIR BUSHING (POLYMER) (INCLUDING SF6 GAS, STRUCTURE WITH HARDWARES AND EARTHING MATERIALS)	NO	24	Please refer section-2 (TS for 765KV GIS)- Technical Specification. It is considered for GT, ST & LINE BAYS only.
1.13	GIS SUPPLY: LOCAL CONTROL CUBICLES	SET	12	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Mode of measurement shall be number of Circuit Breaker BAYS only.
2.0	**SUPPLY- GIS: SPECIAL TOOLS AND TESTING & MAINTENANCE INSTRUMENTS AS PER TS**			
2.01	GIS SUPPLY: SF6 GAS FILLING AND EVACUATING PLANT	SET	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-D Clause 1.0 SF6 Gas Handling Plants:- a) SF6 gas filling and evacuating equipment (Portable)
2.02	GIS SUPPLY: SF6 GAS PROCESSING UNIT	SET	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-D Clause 1.0 SF6 Gas Handling Plants: b) SF6 gas filtering, drying, storage and recycling plant.
2.03	GIS SUPPLY: SF6 GAS ANALYZER	NO.	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-D Clause 2.0
2.04	GIS SUPPLY: SF6 GAS LEAKAGE DETECTOR	NO.	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-D Clause 3.0
2.05	GIS SUPPLY: Operational analyser with DCRM kit	NO.	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-D Clause 4.0 Operational analyser with DCRM kit
2.06	GIS SUPPLY: Dew Point Meter	NO.	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-E 1.0 Dew Point Meter
2.07	GIS SUPPLY: PARTIAL DISCHARGE MEASUREMENT SET	SET	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification.Annexure-E 2.0 PORTABLE PD MONITORING SYSTEM FOR GAS INSULATED SWITCHGEAR
2.08	GIS SUPPLY: Portable Leakage current analyzer (for Gapless Surge Arrester),	SET	1	Please refer section-2 (TS for 765KV GIS)- Technical Specification. Annexure-E 4.0) Portable Leakage current analyzer (for Gapless Surge Arrester), Qty: 1no

3.00	SPARES- GIS: 765KV, 50 kA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS		Rev.1 06/08/2024
Sr. No.	Description	Unit	Nos
3.00.00	Switchyard 765kV GIS Switchgear		
3.01.01	SF6 Gas Pressure Relief Devices of each type along with O-Rings	Nos	3
3.01.02	SF6 gas gauge cum switch or Density monitors and pressure switch as applicable of each type 5% of total population (Max 5nos and min,1no)	Set	1
3.01.03	Coupling device of each type for pressure gauge cum switch for connecting Gas handling plant	Set	2
3.01.04	Rubber Gaskets, "o" rings and Seals for Sf6 gas of each type of Circuit Breaker, Disconnector and other GIS equipment's .	Set	3
3.01.05	Molecular filter for Sf6 gas with filter bags (5% of total weight)	Set	1
3.01.06	All type of control valves for Sf6gas of each type	Nos	3
3.01.07	SF6 gas cylinders of 50kgs / cylinder (20% of total gas quantity)	Set	1
3.01.08	Locking device to keep the Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (If	Nos	3
3.01.09	Spares for Local control cabinet: MCB, fuses, timers, Aux Relay of each type & rating, terminals of each type (Set)	Set	2
3.01.10	UHF PD sensors of each type - 5% of total population(max 5nos and min 1no)	Set	1
3.01.11	Bus Support insulator / gas Barrier of each type along with associated contacts and shields	Nos	5
3.01.12	SF6 to air bushing of each type & rating along with conductor and enclosure for 1 phase enclosure	Nos	1
3.01.13	All types of Corona shield (3 Nos. of each type)	Set	1
3.01.14	Locking device to keep the Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (If	Nos	0
3.02.00	GIS Circuit Breaker (765KV)		

3.00	SPARES- GIS: 765KV, 50 kA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS		Rev.1 06/08/2024
3.02.01	One complete pole (1phase unit) of circuit breaker including CSD/Closing resistor, grading capacitor(as applicable), of each type & rating complete with , interrupter, main circuit , enclosure and marshalling Box with operating Mechanism to enable replacement of any type / rating of CB by spare - (1no of each type & rating	Set	1
3.02.02	Tripping coils assembly with resistors as applicable r (3nos of each type)	Set	2
3.02.03	closing coil assembly with resistor as applicable (3nos of each type)	Set	2
3.02.04	Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating(If applicable)	Set	1
3.02.05	Aux. switch assembly, 3 Nos. of each type	Set	1
3.02.06	Operation counter, 3 nos. of each type	Set	1
3.02.07	Window scope/ Observing window, 3 Nos. of each type (if applicable)	Set	1
3.02.08	Spare of Hydraulic operated mechanism if Applicable: Spare of hydraulic operated mechanism - 1 Set for each type of Circuit Breaker [a] Hydraulic operating mechanism with drive Motor of each type – 1 no. [b] Ferrules and joints & couplings of each type – 1 Set [c] Hydraulic Filter of each type – 1 Set [d] High Pressure Hose of each type – 1 Set [e] N2 accumulator of each type – 2 No. [f] Pressure Transducers – 1 No. [g] Valves of each type – 1 Set [h] O-rings, gaskets and seals – 1 Set [i] Pressure gauges with coupling device of each type – 1 Set [j] Hydraulic oil – 20% of total used quantity in substation [k] Limit switch – 1 no. of each type [l] Pipe length (Copper & steel) of each size & type - 1 Set [m] Pressure switch of each type - 2 nos [n] Pressure Relief device of each type - 1 Set"	Set	1
3.02.09	Complete Spring operating Mechanism including charging mechanism etc of each type & rating	Set	1
3.02.10	Spring charging motor of each type & rating	Set	2
3.03.00	GIS Disconnector(765KV		

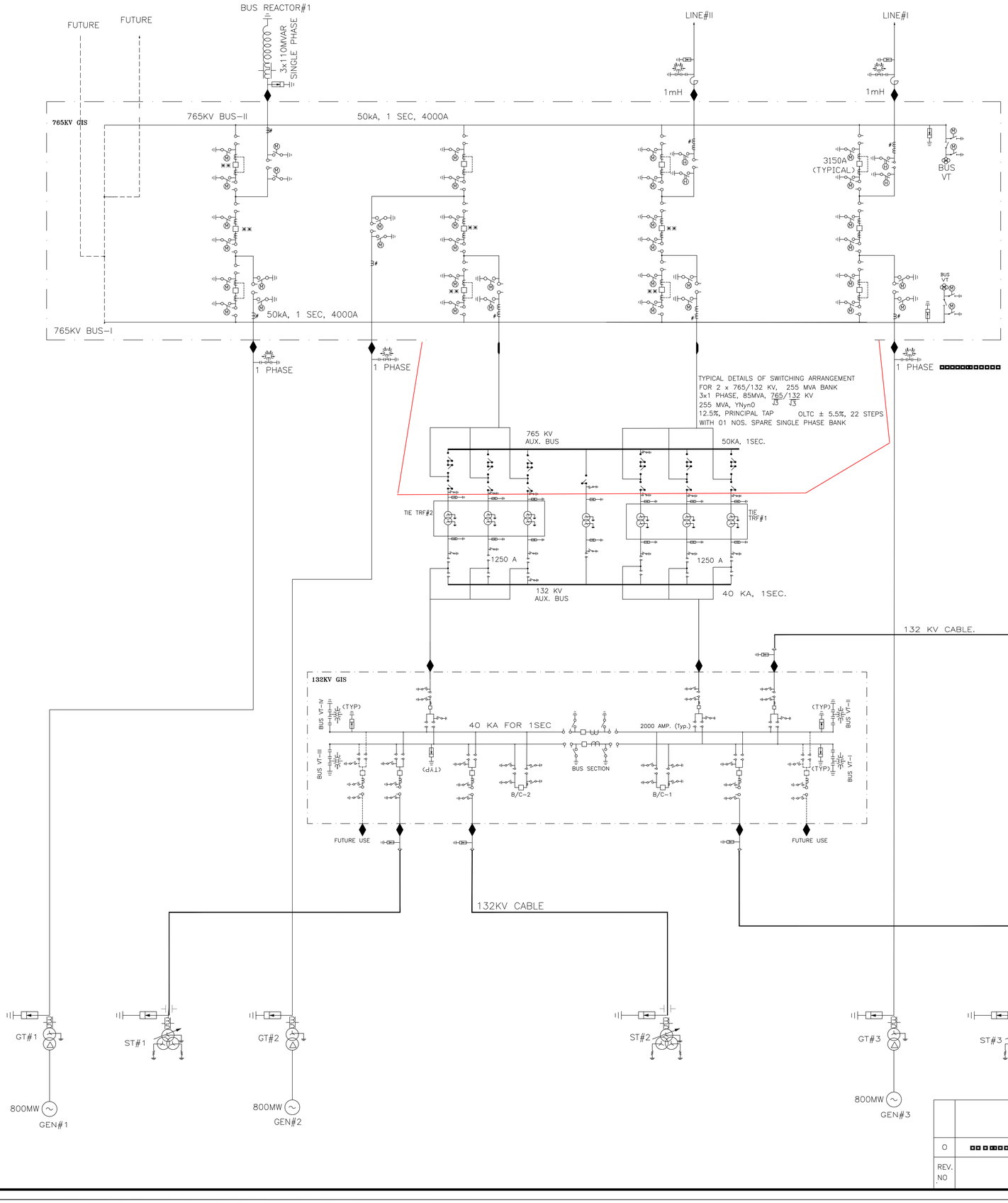
3.00	SPARES- GIS: 765KV, 50 kA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS		Rev.1 06/08/2024
3.03.01	Complete set of 3 nos. of single phase / one 3-ph isolator of each type , dimension , current &voltage rating including main circuit , enclosure ,driving mechanism and support insulator etc to enable replacement of any type / rating of isolator	Set	1
3.03.02	Complete set of 3 nos. of single phase / one 3-ph Maintenance earthing switch of each type ,dimension , current & voltage rating includingmain circuit , enclosure , driving mechanism and support insulator etc to enable replacement of any type / rating of isolator by	Set	1
3.03.03	Complete set of 3 nos. of single phase / one 3-ph Fast earthing switch of each type ,dimension , current & voltage rating includingmain circuit , enclosure , driving mechanism and support insulator etc to enable replacement of any type / rating of isolator by spare	Set	1
3.03.04	Copper Contact fingers for isolator male &female contact along with corona shield -for one complete (3phase) isolator of each type andrating	Set	1
3.03.05	Copper Contact fingers for Maintenance earthing switch male & female contact along with corona shield -for one complete (3phase) isolator of each type and rating	Set	1
3.03.06	Copper Contact fingers for Fast earthing switch male & female contact along with corona shield - for one complete (3phase) isolator of each type and rating	Set	1
3.03.07	Open/ close contactor assembly, timers, key interlock , interlocking coils, relays , push buttons indicating lamps , power contactors, resistors, fuses MCBs & drive control cards etcfor one complete MOM box (3-lh gang operated or 1-ph unit) disconnector and (3ph) earthingswitch of each type and rating for one complete(3phase) disconnector and earthing switch of each type & rating (if applicable		
3.03.07.1	For isolator	Set	1
3.03.07.2	For Maintenance Earth switch	Set	1
3.03.07.3	For Fast Earthing switch	Set	1
3.03.08	Limit switches and Aux. switches for complete 3-phase equipment		
3.03.08.01	For isolator	Set	1
3.03.08.02	For Maintenance Earth switch	Set	1
3.03.08.03	For Fast Earthing switch	Set	1

3.00	SPARES- GIS: 765KV, 50 kA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS		Rev.1 06/08/2024
3.03.08.04	Drive Mechanism of each type		
3.03.09.00	For isolator	Set	0
3.03.09.01	For Maintenance Earth switch	Set	0
3.03.09.02	For Fast Earthing switch	Set	0
3.03.10.00	Motor Drive Mechanism of each type		
3.03.10.01	For isolator	Set	1
3.03.10.02	For Maintenance Earth switch	Set	1
3.03.10.03	For Fast Earthing switch	Set	1
3.04.00	GIS Current Transformers (765KV)		
3.04.01	Complete CT, of each type and with enclosure to enable replacement of any type / rating of CT as spare (1no of each type/ rating)	Set	1
3.05.00	GIS Voltage Transformers (765KV)		
3.05.01	Complete VT of each type and with enclosure to enable replacement of any type / rating of VT as spare (1no of each type / rating)	Set	1
3.06.00	GIS Surge Arrestor (765KV)		
3.06.01	Complete Surge Arrestors of each type and with enclosure with surge monitor counter to enable replacement of any type / rating of VT as spare (1no of each type / rating)	Set	1
3.06.02	Surge Monitor and counter of each type / rating (1no of each type / rating)	Set	1
3.07.00	765KV Air to SF6 bushing for Transformers & reactor as applicable for each (1no of each type / rating)	Set	1
3.09.00	Control switching device along with Transducers, sensors, contactors, switches etc - 1set of each make	Set	1

Sl. No.	Item Description	Unit	Qty.	Remarks
4.0	**SPARES- GIS: REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SUPPLY ITEMS** (Unit Prices of Individual Equipment included here or in manadatory spares are required for any Addition/Deletion of Equipment and replacement of damaged items. Bidder to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation)			
4.01	SUPPLY- GIS: SPARES: 765KV, OPERATING MECHANISM FOR CIRCUIT BREAKER COMPLETE IN ALL RESPECT	Set	1	
4.02	SUPPLY- GIS: SPARES: 765KV, OPERATING MECHANISM FOR DISCONNECTOR	Set	1	
4.03	SUPPLY- GIS: SPARES: 765KV, OPERATING MECHANISM FOR MAINTENANCE EARTHING SWITCH COMPLETE IN ALL RESPECT	Set	1	
4.04	SUPPLY- GIS: SPARES: 765KV, OPERATING MECHANISM FOR FAST ACTING/ HIGH SPEED GROUNDING SWITCH COMPLETE IN ALL RESPECT	Set	1	
4.05	SUPPLY- GIS: SPARES: 765KV, 1 PHASE MAINTENANCE EARTHING SWITCH COMPLETE IN ALL RESPECT (EXCLUDING OPERATING MECHANISM)	Set	1	
4.06	SUPPLY- GIS: SPARES: 765KV, 3 PHASE FAST ACTING/ HIGH SPEED GROUNDING SWITCH COMPLETE IN ALL RESPECT (EXCLUDING OPERATING MECHANISM)	Set	1	
4.07	SUPPLY- GIS: SPARES: 765KV, SINGLE PHASE BUS BAR	Mtrs	1	Complete in all respect.
4.08	SUPPLY- GIS: SPARES: 765KV, GIS METALLIC ENCLOSURE	Kgs	1	
4.09	SUPPLY- GIS: SPARES: 765KV, EXPANSION JOINTS	Set	1	1set= 1 nos. of each type and each rating.
4.1	SUPPLY- GIS: SPARES: 765KV, FLEXIBLE CONNECTIONS	Set	1	1set= 1 nos. of each type and each rating.
4.11	SUPPLY- GIS: SPARES: 765KV, BARRIER INSULATOR	Set	1	1set= 1 nos. of each type and each rating.
4.12	SUPPLY- GIS: SPARES: 765KV, NON-BARRIER INSULATOR	Set	1	1set= 1 nos. of each type and each rating.
4.13	SUPPLY- GIS: SPARES: 765KV, GAS SEALS	Set	1	1set= 1 nos. of each type and each rating.
4.14	SUPPLY- GIS: SPARES: 765KV, GAS DENSITY MONITOR SWITCH	Set	1	1set= 1 nos. of each type and each rating.
4.15	SUPPLY- GIS: SPARES: 765KV, GAS PRESSURE SWITCH	Set	1	1set= 1 nos. of each type and each rating.
4.16	SUPPLY- GIS: SPARES: 765KV, TEE BEND	Set	1	1set= 1 nos. of each type and each rating.
4.17	SUPPLY- GIS: SPARES: 765KV, ANGLE BEND	Set	1	1set= 1 nos. of each type and each rating.
4.18	SUPPLY- GIS: SPARES: 765KV, L-BEND	Set	1	1set= 1 nos. of each type and each rating.

Sl. No.	Description	Unit	Quantity	Remarks
5.0	**SERVICES- GIS : 765KV, 50kA FOR IS, GAS INSULATED SWITCHGEAR (GIS) AS PER TS**			
5.01	SERVICES- 765KV GIS: SUPERVISION OF ERECTION OF GIS	Bays	12	Supervision of erection of GIS with main bus, complete as per TS in all respect including LCC and its accessories. It also includes verification of materials for proper storage at site for final storage. Earthing, SF6 Gas Filing works, Internal Cabling from GIS to LCC, including Structure Works are covered under this item. GIS Bus Duct, SF6 to Air Bushing (SAB)/ SF6 to Oil Bushing (SOB), Surge Arrester, VT are not covered in this BOQ item.
5.02	SERVICES- 765KV GIS: SUPERVISION OF ERECTION OF 1-PHASE GAS INSULATED BUS DUCT	MTR	5000	Supervision of erection of GIB complete as per TS in all respect. GIB shall be considered from first equipment of GIS. Earthing, SF6 Gas Filing works, Internal Cabling with tray work including Structure Works are covered under this item.
5.03	SERVICES- 765KV GIS: SUPERVISION OF ERECTION OF 1 PHASE SF6 TO AIR BUSHING	SET	24	Supervision of erection of SF6 to Air Bushing complete as per TS in all respect. Earthing, SF6 Gas Filing works, Internal Cabling with tray work, including Structure Works are covered under this item.
5.04	SERVICES- 765KV GIS: TESTING & COMMISSIONING OF GIS	Bays	12	Testing and commissioning of complete GIS system including main bus, LCC and associated system (LA, VT, CSD etc.) is to be executed by bidder. All the special testing instruments, kits, T&P etc. are to be arranged by bidder on returnable basis. Please refer relevant section of technical specification for details.
5.05	SERVICES- 765KV GIS : TESTING & COMMISSIONING OF GAS INSULATED BUS DUCT	MTR	5000	Testing and commissioning of GIB complete as per TS in all respect. GIB shall be considered from first equipment of GIS. All the special testing instruments, kits, T&P etc. are to be arranged by bidder on returnable basis. Please refer relevant section of technical specification for details.
5.06	SERVICES- 765KV GIS : FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	Bays	12	Carrying out successful HV/ Power Frequency Testing of GIS as per IEC including Arrangement of HV Test kit with operator (on returnable basis) shall be in scope of bidder, which includes charges of HV test kit with operator, accessories & tools required for completion of HV testing. The quoted price shall include GIS bays including Main Bus, GIB, SAB/SOB and other common items as per TS complete in all respect. In this BOQ item, mobilization and demobilization for HV test kit is considered for once. In case of more, for reasons not attributable to bidder, same shall be paid extra as per BOQ Item.
5.07	SERVICES- 765KV GIS : INSULATION CO-ORDINATION STUDIES FOR GIS SYSTEM	LOT	1	1 Lot means Complete study report as per technical specification, Including VFTO report.
5.08	SERVICES- 765KV GIS : TRAINING FOR GIS AT SITE	DAY	5	
5.09	SERVICES- 765KV GIS : TRAINING FOR GIS AT MANUFACTURER WORKS	DAY	5	

Sl. No.	Description	Unit	Quantity	Remarks
6.0	**SERVICES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SERVICES:** (UNIT PRICES OF INDIVIDUAL SERVICES INCLUDED HERE ARE REQUIRED FOR ANY ADDITION/DELETION OF EQUIPMENT AND REPLACEMENT OF DAMAGED ITEMS. VENDOR TO ENSURE THAT THE UNIT PRICES HAVE A LOGICAL RELATIONSHIP WITH PRICES OF ASSEMBLIES IN MAIN ITEMS. QUOTING FOR UNIT PRICES IS MANDATORY AND SHALL BE CONSIDERED FOR			
6.01	SERVICES- 765KV GIS: REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the bidder) This item will be executed only if repetition of services is required by BHEL.
6.02	SERVICES- 765KV GIS: REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the bidder) This item will be executed only if repetition of services is required by BHEL.
	DEMOBILIZATION AND REMOBILIZATION CHARGES			
6.03	SERVICES- 765KV GIS: DEMOBILIZATION AND REMOBILIZATION CHARGES FOR GIS ERECTION SUPERVISION TEAM	Set	2	THIS BOQ ITEM SHALL BE PAYABLE IF REQUIRED FOR REASONS NOT ATTRIBUTABLE TO BIDDER.
6.04	SERVICES- 765KV GIS: DEMOBILIZATION AND REMOBILIZATION CHARGES FOR GIS TESTING & COMMISSIONING TEAM	Set	2	BOQ ITEM SHALL BE PAYABLE IF REQUIRED FOR REASONS NOT ATTRIBUTE TO BIDDER. HV TESTING IS NOT PART OF THIS ITEM.
6.05	SERVICES- 765KV GIS: DEMOBILIZATION & REMOBILIZATION CHARGES OF HV TEST KIT ALONG WITH OPERATOR	Lot	1	In this BOQ item, mobilization and demobilization chages for HV test kit is considered for second time or more , for reasons not attributable to bidder. HV testing charges shall be paid per bay basis as per main HV testing charge.



LEGEND:

FOR TENDER PURPOSE ONLY

REV. NO	DESCRIPTION	DRAWN	DESIGN	CHKD	APPD	DATE
0	[redacted]			KRK		28.03.24

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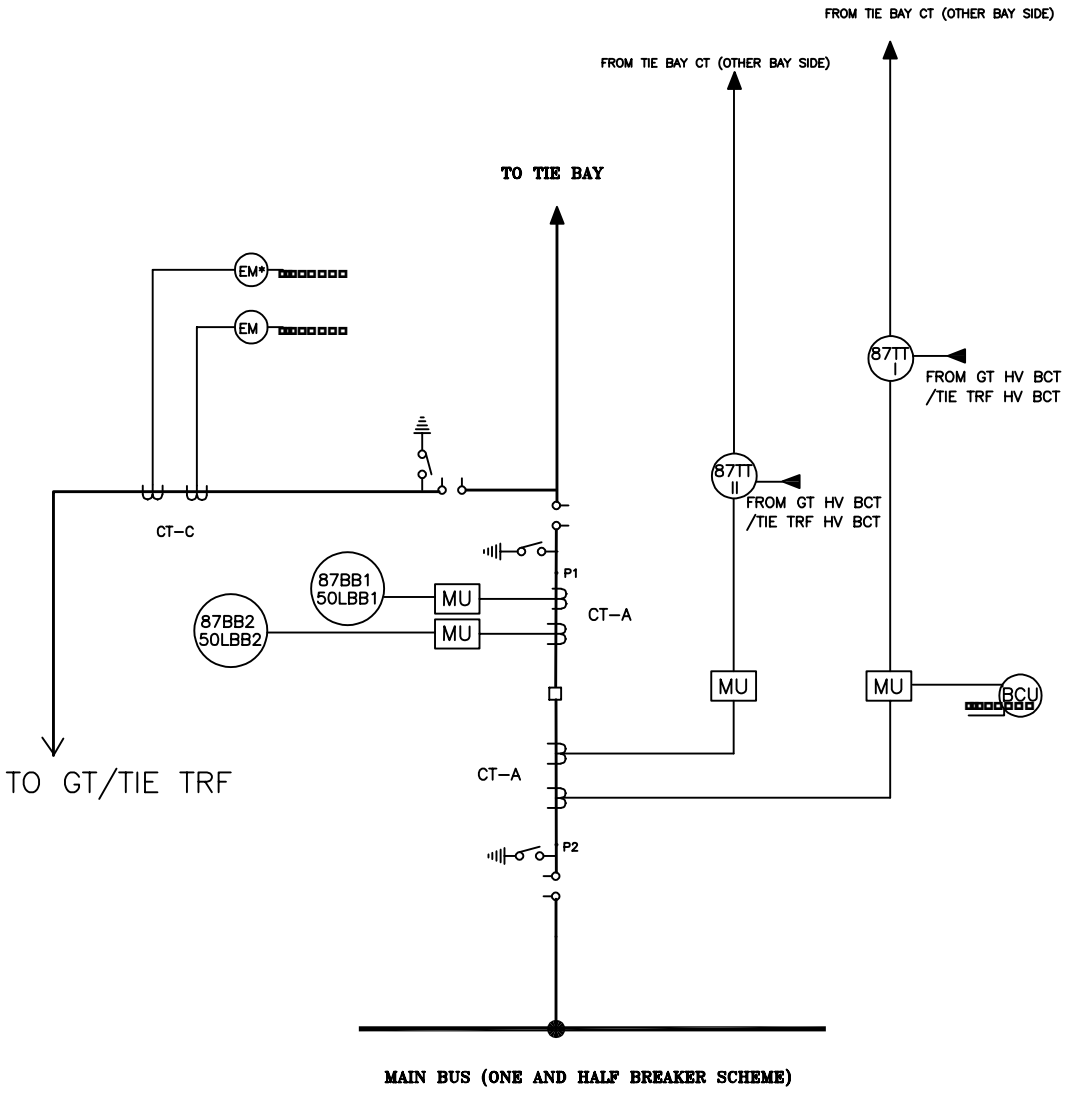
NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT [redacted]

TITLE
765/132 KV GIS SWYD SINGLE LINE DIAGRAM

SIZE A1 | DRAWING NO. [redacted] | REV. NO.



LEGEND:–

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

NOTE:

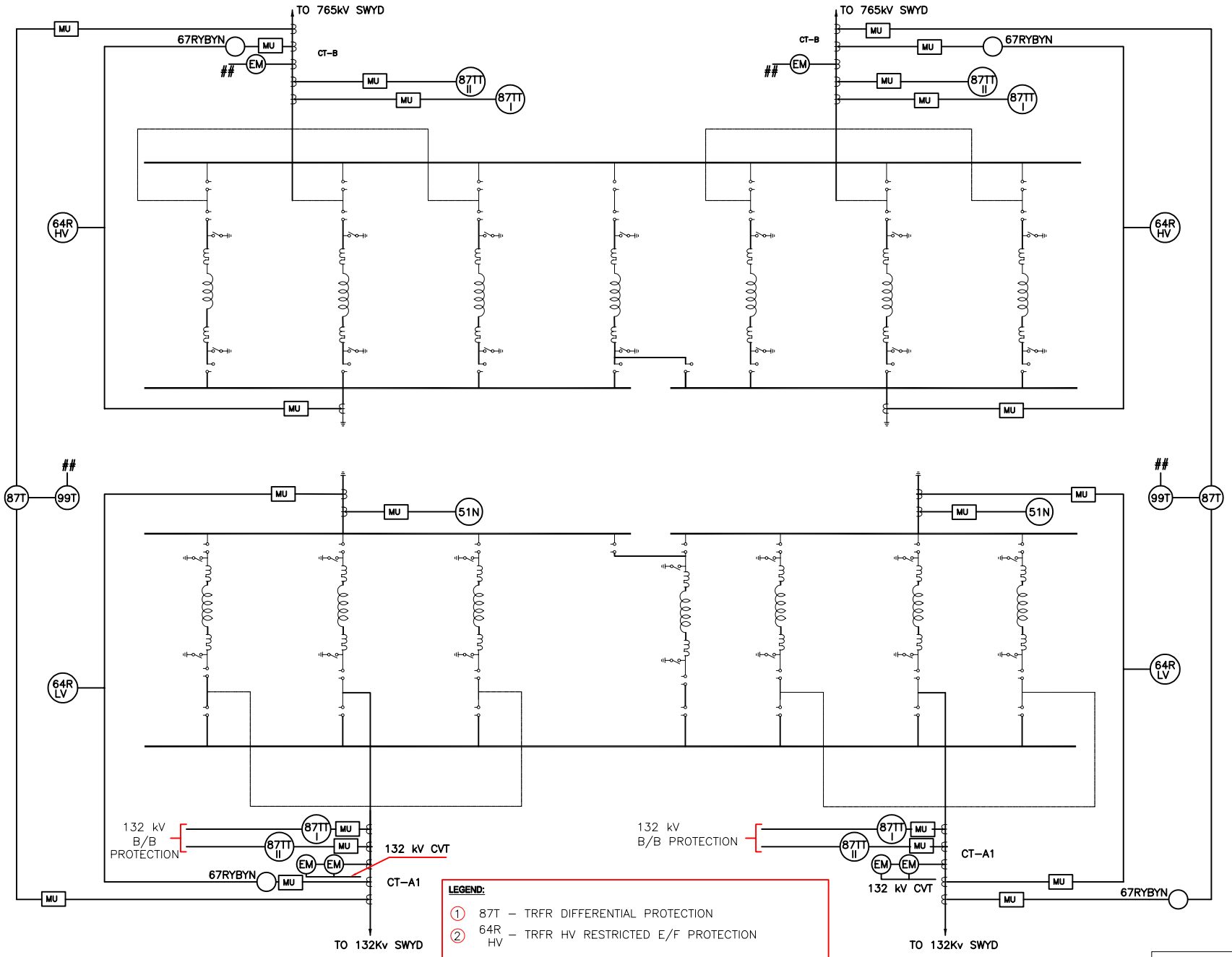
– Voltage from selected CVT
* – To be provided by owner
** – Breaker with CSD

FOR TENDER PURPOSE ONLY

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

TITLE: PROTECTION S.L.D. FOR GT/TIE TRF BAY

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

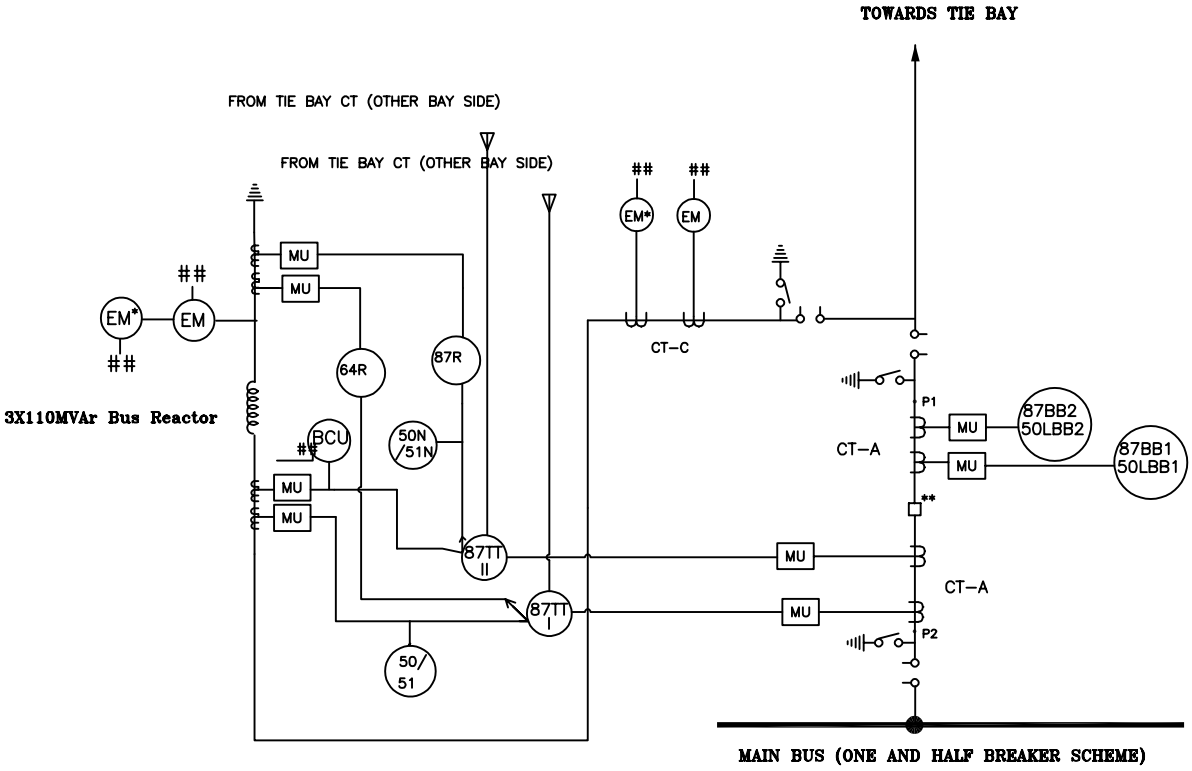


FOR TENDER PURPOSE ONLY

NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TITLE: TIE TRANSFORMER PROTECTION SLD
765/132kV SWITCHYARD

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	APPD	DATE	SIZE	SCALE	DRAWING NO.	REV. NO.
						14.07.23			XXXX–999–POE–J–015	0



LEGEND:–

64R – REACTOR REF PROTECTION

87R – REACTOR DFFERENTIAL PROTECTION

50/51 – BACKUP OVERCURRENT PROTECTION

50N/51N – BACKUP EARTH FAULT PROTECTION

50LBB – BREAKER FAILURE PROTECTION

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

BCU – BAY CONTROL UNIT

EM – ABT COMPLIANT ENERGY METER

NOTE:

– Voltage from selected CVT

* – To be provided by owner

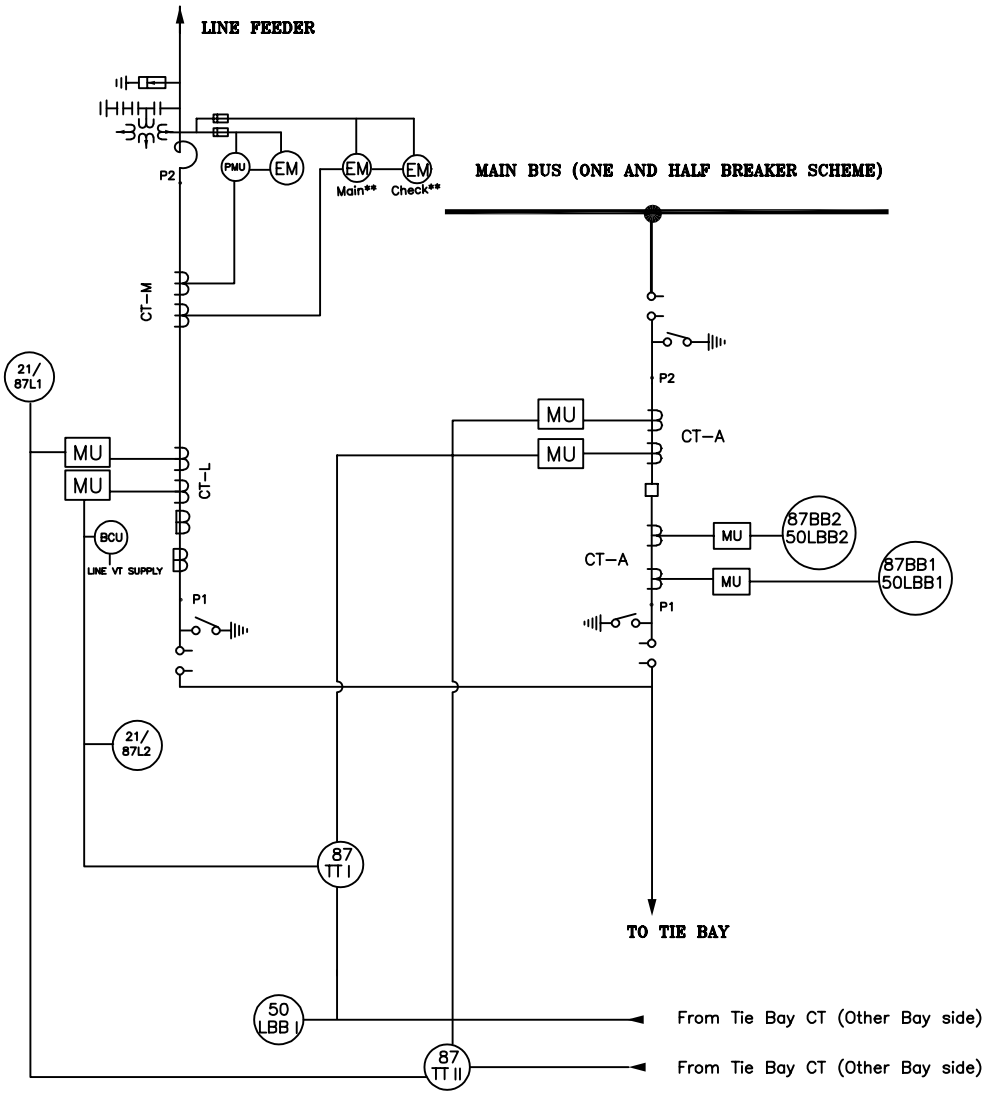
** – Breaker with CSD

FOR TENDER PURPOSE ONLY

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

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

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



LEGEND:–

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

NOTE:

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

– SELECTED BUS CVT

FOR TENDER PURPOSE ONLY

OWNER

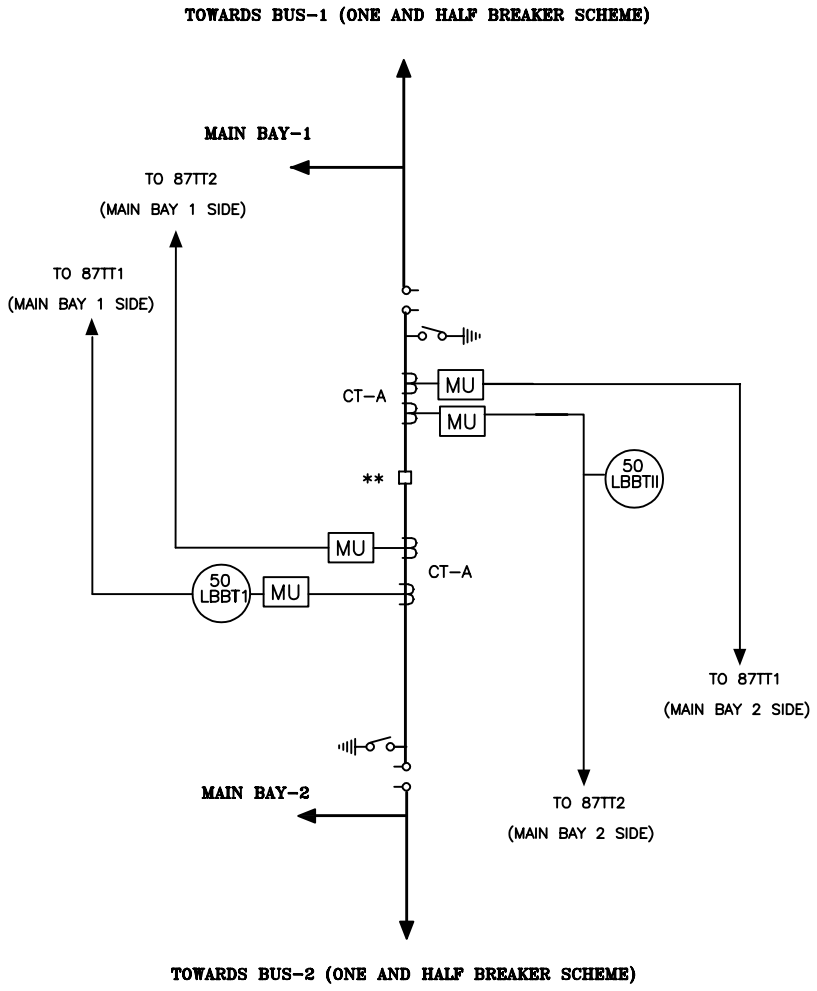
NTPC Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TITLE

PROTECTION S.L.D. FOR LINE BAY

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

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



LEGEND:-

50/51 – BACKUP OVERCURRENT PROTECTION
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EM – ABT COMPLIANT ENERGY METER
87ST – ST DFFERENTIAL PROTECTION
64RHV – ST HV REF PROTECTION
64RLV – ST LV REF PROTECTION

NOTE:

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

FOR TENDER PURPOSE ONLY

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

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

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

SECTION-2

SWITCHYARD ELECTRICAL

CHAPTER: SWITCHYARD ELECTRICAL

1.00.00 SCOPE AND GENERAL INFORMATION

1.01.00 The Voltage level for the Switchyard shall be as per Single Line Diagram. In addition to the detailed scope and other requirements specified in Part-A, the intent of the specifications for various electrical equipments shall also cover the following scope:

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

1.01.04	Exposed live parts shall be placed high enough above ground to meet the requirements of Indian Electricity Rules and other statutory codes. All responsibilities regarding co-ordination with Electrical Inspection Agencies and obtaining clearance certificate from them rests with the Contractor. The necessary fees for such clearances shall be borne by the Owner.
1.01.05	All equipment shall be supplied with suitable terminal connectors. The terminal connector shall be well coordinated with the rating/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 quad/ Bull / Twin conductor. The spacing for quadruple and twin conductor shall be 450 mm for 765kV and spacing for twin conductor shall be 250 mm for 132kV. . For Jack Bus Line side Quad ACSR Moose / AAAC Bull and rest Twin ACSR Moose shall be used. The type of terminal clamps would be finalised by the Contractor in consultation with Employer based on layout requirement. The terminal pads shall preferably be capable of taking the required conductor span under normal, short circuit and meteorological conditions, without effecting the performance of the equipment.
1.01.06	The rigid busbars for equipment inter connections shall have rigid connections at one end and expansion /flexible at other end. The tubular Al. connections shall have not more than one joint per span. Corona Bell shall be provided at the end of the rigid busbars.
1.01.07	The line take off arrangement from GIS building up to line take off gantry / 765KV ,132 KV Aux Bus shall be through GIS ducts as indicated in Single line diagram. The line side insulators and hardwares 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 shall be provided wherever required. HES shown in the SLD are the minimum requirements.
1.01.08	The minimum sizing criteria of the control room and GIS building shall be as given below: i)The GIS buildings(765kV,132KV) shall be adequately designed so as have a passage of minimum 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 switchyards shall have a Separate suitable Control Room Building with provision of Switchgear room, Battery room, charger room, office, cable vault, SAS room, Lab room, CRP Panel room, conference room, 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. GIS buildings(765KV,132KV) shall have adequate provision (at least 4.0mt) 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..
1.01.09	The EOT crane to be provided inside the GIS buildings and shall be suitable to move heaviest part for maintenance. The minimum capacity of EOT crane shall be 12.5T for 765kV, 5T for 220kV & 132kV GIS buildings.
1.01.10	The Contractor shall cooperate in all respects and exchange the necessary technical data/ drawings with other agencies and Employer's other Contractors under intimation to Employer to ensure proper coordination and completion of work in time.
1.01.11	All equipment's shall be suitable for hot lie washing .The sag tension, conductor spacing, short circuit forces, spacer location, conductor swing and clearances shall be carried out in accordance with IEC 60865 to achieve the specified clearances. Short circuit force calculation shall be submitted by the bidder as per relevant IEC for Flexible bus and rigid bus. This short circuit force shall be considered for designing of Tower, Girder and equipment structure and their foundation.
1.01.12	All overhead stringing shall be carried out by minimum double tension string insulator assembly. The earth wire for shielding purpose shall be double anchored at the towers/ other locations and shall run through with out cutting wherever feasible so as to avoid snapping. The earth wires crossing each other shall also be bolted together for additional safety
1.01.13	Post insulators shall be provided at line entry and near transformers and other jumpers so as to avoid mechanical forces on the LA's and Bushings etc.

1.01.14 Necessary fire wall shall be provided between single phases of reactors and transformers. The fire wall height shall be 600mm above reactor/ transformer bushing.

1.01. 15 The pit size of reactors and transformers shall be designed for minimum 1000mm beyond the physical dimension of the reactor.

1.01. 16 iThe towers and gantries shall be suitable for a normal conductor tension of minimum 2T/conductor in case of twin/ single conductors and 1.5T/conductor in case of quad conductor. The foundations and structures etc shall be designed accordingly.

ii)The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550 mm. All gantries and towers (including intermediate/required for turning etc.) as required for GT & ST O/H stringing & its anchoring on A-Row column of TG building and line take off, are to be provided by the contractor.

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

Voltage level	Eqpt./1st level	Line take off gantry height
765 kV	14000mm	39000mm
132kV	4600mm	12200mm

The peak of towers for 765kV shall be 8500mm and for 132kV shall be 5200mm.

The intermediate gantry height for O/H connection for GT shall be min. 29m+8.50m peak for 765kV . The gantry width for 765kV, 132kV AIS shall be min. 30m, 12m respectively or as required to meet the specified clearances.

1.01.17 The switchyard shall be provided with peripheral roads and roads for maintenance/approach for GIS equipment's, GIS duct , Bus reactors,Tie & service Transformers, major AIS equipment's etc for maintenance purpose. The specification for Roads (RCC / B.T) some where else specified in the Civil specification.

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

1.01.19 Voltage drop for sizing of power cables shall not be more than 6%.

1.01.20	The illumination level for AIS shall be 20 lux in general and minimum 50lux on equipment boxes. No lighting fixture shall be mounted on gantries, they shall be mounted on Structured Lightning Cum Lighting Masts or Structured Lighting Masts / towers only . For Approach / work roads , Lighting pole to be used . Specification of lighting is provided elsewhere in the specification. Detailed specification covered in Section -VI, Part-B, B-11(Lighting).
1.01.21	Contractor shall provide panel mounted automatic start / stop type centrifugal self priming pump for sump pit to drain the water in approximately one (1) hour. The contractor shall also provide suitable pedestal/ foundation for this pump. The pump shall be complete with all necessary fittings such as NRV, inlet & outlet pipes of suitable length and dia. The out door cable trenches shall be connected to common sump pit with necessary slope shall be maintained. In side GIS building , Switchyard MCC room , control room etc for cable trenches , panel mounted automatic start / stop type centrifugal self-priming pump shall be provided to drain the water in approximately one (1) hour.
1.01.22	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.
1.01.23	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.
1.01.24	Adequate AC & Ventilation of Control room building and Ventilation of GIS Building is to be provided by the contractor. Specification of AC & Ventilation is specified elsewhere. Specification of AC & Ventilation is specified elsewhere in the specification (Part-B Mechanical) .

1.01.25 The cable trenches from control room to switchyard shall be designed to cater as required for bays indicated in SLD. The contractor shall construct the common sections suitably of appropriate sizes upto common points so that the same can be extended in future.

1.01.26 one no(1no) suitable industrial socket and suitable power cable for oil filtration equipment for Bus reactor and Tie Transformers shall be provided.

1.01.27 The scope also include cable trenches , cable trays & supports, accessories , Roads , drains & its interconnection to storm water drain , fencing with gate required for present scope of bays.

1.01.28 Contractor shall make earth resistivity measurements at site (based on four electrode method) and design the earthing grid as per IEEE: 80 (Latest edition) and Gravel filling of switchyard . Earthing of all switchyard equipment's and its connection to earthing grid. Also connection of switchyard earthing grid with main plant earthing grid. Earth pit as per IS-3043 as required.

1.01.29 Supply & laying of power, control cables , Screen cable, Fibre optic cable and cabling between Contractor supplied equipment and Owner supplied equipment required. etc , from owner feeders , panels and from present scope of panels to existing panels to complete the system is in the scope of Bidder.

1.01.30 Lighting, earthing , lightning protection , cabling including all civil works etc of complete switchyard of 765kV,132kV.

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

1.02.00 **CLEARANCES :**

The minimum clearances for 765kV, 132kV AIS shall be as given below:

Sl.no	Description	765KV	132KV
1	Phase to earth clearance	i)4900m (conductor to structure) ii)6400mm(rod to structure)	1300mm
2	Phase to phase	i)7600mm(conductor to	1300mm

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	clearance	conductor) ii)9400mm(rod to structure)	
3	Section clearance	10300mm	4000mm
4	Ground Clearance	14000mm	4800mm
5	Height of Insulator bottom from Ground	Min.2550mm	Min.2550mm

The Contractor shall supply the structures suitable to meet the above clearances. For 765kV,132kV Switchyard, the average limit of 10kV per meter and 500 micro tesla for electric and magnetic field respectively are to be met at a height of 1.8 meter from ground level. The Contractor shall furnish calculations.

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

1.04.00 Not used

1.05.00 EQUIPMENT CONNECTOR RATING :The connectors and clamps shall be rated same as the connected equipment's

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

1.07.00 CONTROL PHILOSOPHY :The switchyard control philosophy and protection system is described in chapter B-13 Substation Automation System of section-VI Part-B.

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

The 800 kV systems is being designed to limit the power frequency over voltage of 1.4 p.u.(base=462kV) and the switching surge over voltage to 1.9 p.u.(base=653). In 765 kV system the initial value of temporary over voltage could be 1.6 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.

1.09.00 **SITE SUPERVISION OF EQUIPMENTS:**

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

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

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

1.11.00 **SYSTEM PARAMETERS:**

1.11.01 **FOR GIS & AIS (765KV,132kV):**

Sl.no	Description	Unit	765KV	132KV
1	i)Highest System voltage)	kV rms	800	145
	ii)Rated / Nominal system voltage	kVrms	765	132
2	Phase	No	3	3
3	Rated Frequency	Hz	50	50
4	Ambient Temperature	Deg,C	50	50
5	Specific Creepage Distance (Very Heavy)	mm/kV	31	31
6	Rated Fault current and duration	kA	50kA,1sec	31.5kA,1sec
7	Min.Corona Extinction Voltage	kV rms	508	105
8	Min.Radio Interference Voltage(RIV) for frequency between 0.5 &2.0 Mhzμ	μ-volt	2500(at 508kV rms)	500(at 92kV rms)
9	Seismic accelaration	g	0.3	0.3
10	System neutral earthing		Effectively earthed	Effectively earthed
11	Auxiliary AC .supply(3 ph , 4wire, 50Hz)	V	415+-10%	415+-10%
12	Auxiliary DC .supply(2wire, grounded)	V	220+-10%	220+-10%
13)	Lightning Full wave impulse withstand voltage 1.2/50micro sec(ph to earth & between	kVp	±2100	±650

	phases)			
14)	Switching impulse voltage (250/2500µsec- Dry & wet (ph to earth)	kVp	±1550kVp	NA
15	Power frequency withstand (for I min. rms.) to earth & between phases-Dry & wet	kV rms	dry-830 wet-870	wet-275
16	Rated dynamic with stand current	kAp	125	78.5
17	PD Level for GIS		<5pico coulomb	<5pico coulomb
18	Min.Eelctromechnaicl strength of Insulators	KN	210	120
19	Min.Creepage distance	mm	430	430
20	Main Busbar rating	A	4000A	2000A
21	GIS & AIS Equipment ratings	A	3150A	2000A

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

1.12.00 **TYPE TEST REQUIREMENTS:**

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

a) All equipments to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out not earlier than ten years prior to the date of techno-commercial bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client.

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

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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.

1.12.02 **TYPE TEST REQUIREMENTS FOR GIS :**

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 only for the test(s) actually conducted successfully under the contract and upon certification by the Employer's engineer.~~

b) ~~The type tests shall be carried out in the presence of the Employer's representative, for which minimum.90(ninty) days notice shall be given by the Contractor in case the type test is planned to be conducted in abroad and min.30days(Thirty) in case the type test is planned to be conducted with in india. The Contractor shall obtain the Employer'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 Contractor has conducted such specified type test(s) according to the relevant standard and / or specification as per CEA Guidelines for the validity period of Type test(s) conducted on Major Electrical equipment in power Transmission May2020 & with latest amendments as on date of bid opening, submit the type test reports to the Employer for waiver of conductance of such type test(s). These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client. The Employer reserves the right to waive conducting of any or all the specified type tests(s) under this contract. In case the type tests are waived, the type test charges shall not be payable to the Contractor.~~

1.12.03 Common requirements (For GIS):

a) The Employer will have the right of getting any test of reasonable nature carried out on any component or completely assembled equipment at Contractor's premises or at site or in any other place in addition to the

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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 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.

The offered GIS equipments shall confirm to the type tests as per IEC 62271-203. The list of the type tests shall be as follows:

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.

Sl.No	List of Type tests as per IEC.
i)	Lightning impulse voltage dry tests.
ii)	Switching impulse voltage dry tests
iii)	Power frequency voltage dry tests.
iv)	Partial discharge tests
v)	Radio Interference Voltage test (as applicable)
vi)	Test to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit.
vii)	Test to prove the ability of the main circuit and earthing circuit to carry the rated peak and the rated short time withstand current.
viii)	Test to verify the making and breaking capacity of the included switching devices.
ix)	Test for satisfactory operation of the included switching devices

x)	Test to prove the strength of enclosures
xi)	Gas tightness test
xii)	Electromagnetic capability test (if applicable)
xiii)	Test on partitions
xiv)	Internal arc tests.
xv)	Mechanical operation tests.
xvi)	Test to prove the satisfactory operation at limit temperature
xvii)	Verification of degree of protection of auxiliary and control circuits
xviii)	Test to prove performance under thermal cycling and gas tightness test on gas barrier insulators
xix)	Capacitive Current switching test
xx)	Shunt reactor current switching test

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):

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

1.12.04 **Type tests to be conducted on AIS Circuit Breaker(132KV)**

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 as applicable
i) IP: 55test on each type of box	

1.13.00 **CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:**

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 :

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 (765kV & 132kV):**

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 765kV, & 132kV 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 (765kV 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 (for 765 kV AIS only):

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

b.) The bidder shall arrange to transport the structure from his contractor'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.

2.00.00 REQUIREMENTS FOR GAS INSULATED SWITCHYARD:

2.01.00 GENERAL:

2.01.01 The GIS shall comply to IEC – 62271-203. The general requirements and special requirements for Gas Insulated Switchgear (GIS) are given in this chapter. GIS shall also meet other requirements specified under switchyard for various equipments as applicable. Materials and components not specifically stated in this specification but are necessary for the satisfactory operation of the equipment shall be deemed to be included unless specifically excluded and shall be supplied at no extra cost.

2.01.02 The GIS shall be modular in structure and shall be housed indoor. The modules shall be single phase encapsulated for 765kV & 132kV 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.

2.01.03 The GIS equipment's for 765kV & 132kV shall be housed in separate 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.

2.01.04 The bus bars shall be rated for the duty specified and current rating shall be derived considering maximum possibilities.

2.02.00 TECHNICAL REQUIREMENTS:

2.02.01 The requirements for all switchyard equipments are given in subsequent sections.

2.02.02 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.

2.02.03 The Surge arrestors for main buses shall be of GIS type only.

2.02.04	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.
2.02.05	Each section & phase of the GIS enclosure shall be monitored for leakage of SF6 gas and suitable indication shall be provided in the control room.
2.02.06	All components of the same rating and construction shall be interchangeable.
2.02.07	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.
2.02.08	All the SF6 gas insulated circuit breakers, disconnectors, grounding switches and bus bars shall be of single phase isolated type for 765 kV & 132kV ..
2.02.09	Protective Finish -Preferable All the exterior surfaces shall be cleaned and painted before leaving the factory with one coat of approved primer and two coats of water resistant approved paint on the equipment. The under-side of all painted surfaces bearing upon the concrete foundation shall be given two coats of approved primer. Extra paint for retouching at site shall be made available by the Contractor.
2.02.10	Fire Retardancy
a)	All components shall be fire retardant and shall be tested in accordance with IEC 695.
2.03.00	**DESIGN AND SAFETY REQUIREMENT:**
2.03.01	The GIS assembly shall be as per switching arrangement indicated under single line diagram and consist of separate modular compartments e.g. Circuit Breaker compartment, Bus bar compartment filled SF6 gas and separated gas tight partitions so as to minimize risk to human life, allow ease of maintenance and limit the effects of gas leaks failures & internal arcs etc.

SECTION-2

	These 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. Rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions. The compartments of GIS assemblies shall be supplied filled with nitrogen/ air or dry SF6 gas at a positive pressure and hermetically sealed to protect the dielectric system during transportation.
2.03.02	The workmanship shall be of the highest quality and shall conform to the latest modern practices for the manufacture of high technology machinery and electrical switchgear.
2.03.03	The switchgear, which shall be of modular design. The conductors and the live parts shall be mounted on insulators. These insulators shall be designed to have high structural strength and electrical dielectric properties and shall be shaped so as to provide uniform field distribution and to minimize the effects of particle deposition either from migration of foreign particles within the enclosures or from the by-products of SF6 breakdown under arcing conditions.
2.03.04	Gas barrier insulators and support insulators shall have the same basis of design. The support insulators shall have holes on both sides for proper flow of gas.
2.03.05	Gas barrier insulators shall be provided so as to divide the GIS into separate compartments. They shall be suitably located in order 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. They shall be designed to withstand any internal fault thereby keeping an internal arc inside the faulty compartment. Due to safety requirement for working on the pressurized equipment, whenever the pressure of the adjacent gas compartment is reduced, it should be ensured by the contractor that adjacent compartment would remain in service with reduced pressure. The gas tight barriers shall be clearly marked on the outside of the enclosures.
2.03.06	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 at rated short time withstand current. The material shall be such that it has no effect of environment as well as from the by-products of SF6 breakdown under arcing condition.

2.03.07	Sufficient inspection windows/access openings shall be provided at the switchgear to ensure that each switchgear component can be inspected / monitored during installation and future maintenance. Each section shall have plug-in or easily removable connection pieces to allow for easy replacement of any component with the minimum of disturbance to the remainder of the equipment.
2.03.08	The material used for manufacturing the switchgear equipment shall be of the type, composition and have physical properties best suited to their particular purposes and in accordance with the latest engineering practices. All the conductors shall be fabricated of aluminum/ copper tubes of cross sectional area suitable to meet the normal and short circuit current rating requirements. The finish of the conductors shall be smooth so as to prevent any electrical discharge. The conductor ends shall be silver plated and fitted into finger contacts or tulip contacts. The contacts shall be of sliding type to allow the conductors to expand or contract axially due to temperature variation without imposing any mechanical stress on supporting insulators.
2.03.09	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 .
2.03.10	The maximum SF6 gas leakage shall not exceed half percent (0.5%) per year for the whole equipments and for any individual gas compartment separately.
2.03.11	Each gas-filled compartment shall be equipped with static filters, density switches, filling valve and safety diaphragm. The filters shall be capable of absorbing any water vapour which may penetrate into the enclosures as well as the by-products of SF6 during interruption. Each gas compartment shall be fitted with separate non-return valve connectors for evacuating & filling the gas and checking the gas pressure etc.
2.03.12	The switchgear line-up when installed and operating under the ambient conditions shall perform satisfactorily and safely under all normal and fault conditions. Even repeated operations up to the permissible servicing intervals under 100% rated & fault conditions shall not diminish the performance or significantly shorten the useful life of the switchgear. Any fault caused by external reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear.
2.03.13	Void.

2.03.14	The thermal rating of all current carrying parts shall be minimum for one sec. for the rated symmetrical short-circuits current.
2.03.15	The Switchgear shall be of the free standing, self-supporting with easy accessibility to all the parts during installation & maintenance with all high-voltage equipment installed inside gas-insulated metallic and earthed enclosures, suitably sub-divided into individual arc and gas-proof compartments at least for:
a)	Bus bars
b)	Intermediate compartment
c)	Circuit breakers
d)	Bus / Line disconnections
e)	Gas insulated bus duct sections
f)	Voltage Transformers
g)	Surge Arrestors
	The bus enclosure should be sectionalized in a manner that maintenance work can be carried out by isolating and evacuating the small effected section and not the entire bus.
	The design of the one and half breaker scheme GIS shall be such that in case one circuit breaker module is removed for maintenance, there is no disruption in the power flow in any of the two circuits in a diameter.
	The design of double bus scheme shall be such that the common point of the two bus bars along with the earth switch shall be designed and housed in a separate compartments so as to avoid complete shutdown of the system in case of maintenance required in any bus disconnector. Further maintenance on one bus disconnector should be possible when the feeder is live through other disconnector.
2.03.16	The arrangement of the individual switchgear bays shall be such so as to achieve optimum space-saving, neat and logical arrangement and adequate accessibility to all external components.
2.03.17	It is required that the three phases of each switchgear bay be arranged side by side. The arrangement of the equipment offered must provide adequate access for operation, testing and maintenance.
2.03.18	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.
2.03.19	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. It should be impossible to unwillingly touch live parts of the switchgear or to perform operations that lead to arcing faults without the use of tools or brute force.
2.03.20	All interlocks that prevent potentially dangerous mal operations shall be constructed such that they can not be operated easily, i.e. the operator must use tools or brute force to over-ride them.
2.03.21	The actual position of circuit breakers, disconnectors and grounding switches must be positively displayed by mechanical indicators visible from the operating position.
2.03.22	In general the contours of energized metal parts of the GIS and any other accessory shall be such, so as to eliminate areas or points of high electrostatic flux concentrations. The surfaces shall be smooth with no projection or irregularities which may cause visible discharges. There shall be no radio interference from the energized switchgear at rated voltage.
2.03.24	The fabricated metal enclosures shall be of Aluminum alloy and have high resistance to corrosion, low electrical losses and negligible magnetic losses. All jointed surfaces shall be machined and all castings shall be spot faced for all bolt heads or nuts and washers. All screws, bolts, studs and nuts shall conform to metric system.
2.03.25	The breaker enclosure shall have provision for easy withdrawal of the interrupter assemblies/complete CB pole.
2.03.26	The enclosures of the same phase shall be electrically interconnected and at proper points they shall be connected to the other phases thus entailing a return current almost equal to the current circulating in the conductors.
2.03.27	The enclosure shall be designed to practically eliminate the external

	electromagnetic field and thereby electrodynamics stresses even under short circuit conditions.
2.03.28	The elbows, bends, cross and T-sections of interconnections shall include the insulators bearing the conductor when the direction changes take place in order to ensure that live parts remain perfectly centered and the electrical field is not increased at such points.
2.03.29	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.
2.03.30	The ladders and walkways shall be provided wherever necessary for access to the equipment. 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
2.03.31	Wherever required, the heaters shall be provided for the equipment in order to ensure the proper functioning of the switchgear at specified ambient temperatures. The heaters shall be rated for 240V AC supply and shall be complete with thermostat, control switches and fuses, connected as balanced 3-phase, 4-wire load. The distribution of AC / DC power supply to LCC, Switchgear equipment's such that isolation of AC / DC supply to One particular Bay equipment's will not effect the other bay equipments.
2.03.32	Arrangement shall be provided to visually observe the contact position of disconnecting switches and earth switches. Viewing window shall be provided to visually observe the contact position for all phases of disconnecting switches and earth switches. Also clearly identifiable local, positively driven mechanical position indicator, Open / Close Indication for all phases of disconnecting and earth switches shall be provided
2.03.33	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 for maintenance.
2.03.34	The sealing provided between flanges of two modules / enclosures shall be such that long term tightness is achieved.

2.03.35	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)	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-disordance
	In addition, all the above alarms shall also be hooked up to the Substation Automation system.
2.03.36	Each gas compartment barrier shall be easily identifiable from the outside of the switchgear.
2.03.37	Maximum weight of gas in gas tight section of GIS duct shall not exceed 400 kg (for 765kV) and 250 kg (for 220kV & 132kV)
2.03.38	The equipment shall be suitable for operation under the ambient conditions prevailing at project site. The prevailing conditions shall be taken into account by the Contractor in the design of the equipment.
2.03.39	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.

2.03.40 Online Partial Discharge Monitoring system for GAS insulated switchgear and Busduct shall be provided to monitor the entire 765kV GIS installation as per the Specification mentioned at **Annexure-C:**

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

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

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

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

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

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

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

Design of on-line PDM System:

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

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

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

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

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

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

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

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

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

	The applicable standards to meet IEC & IEEE requirements for electromagnetic compatibility shall be specified. The offered system should have been tested for the same for working in a 400kV & above substation environment. The necessary documentation must be submitted in this regard. 10)Calibration: i) The UHF Couplers must be first calibrated as per CIGRE procedure TF 15/330305 as part of factory acceptance tests to guarantee detection sensitivity of 5pC or better. The GIS of same design shall be used as test specimen during the coupler calibration. The pulse injection level determined through above factory calibration tests shall only be used as reference for site sensitivity checks during commissioning of PDM system. The data sheet/frequency response characteristics shall be submitted for reference. 11) The system shall generate alarms if suspected partial discharge activity is noticed or the system itself is in failure, thereby eliminating the necessity of periodic system access by the user and one such alarm shall be connected to Substation automation system (SAS). The alarms shall be configured coupler wise. 12) Filtering Facility: The filtering facility must be provided to distinguish real PD from internal/external noise such as switching operations, self-test signal, radio, communication signal etc. 13) Diagnostic Software: To interpret various types of PD defects, intelligent diagnostics software (expert system) shall be built- in as part of the PDM software capability. This is mainly to reduce the dependence on PD specialist. The bidder shall also make available typical point-on-wave patterns as library pictures to train the user. 14)Special tools and critical spare parts for trouble free operation of the system are also to be supplied along with the PDM system. Pulse generator for UHF sensor sensitivity test shall also be supplied as a standard accessory.
2.03.41	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:

i) To enable sections of the switchgear to be removed and reinserted without interfering with adjacent parts.

ii) To accommodate changes in length of bus bars due to temperature variations.

iii) To accommodate large linear expansions and angle tolerances.

iv) For taking up manufacturing, site assembly & foundation tolerances.

v) for absorbing vibrations caused by the transformers when connected to SF6 switchgear by oil / SF6 bushings.

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.

If the pressure relief devices vent directly into the atmosphere, suitable guards and deflectors shall be provided. Contractor shall submit to the owner the detailed criteria design regarding location of pressure relief devices/rupture diaphragms.

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 Aluminium casting has to 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 has to 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 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. Adequate provisions shall be made for absorption of the thermal expansions between the conductors and the enclosures. The metal bellow type compensators for adjusting tension shall be provided where ever required. The enclosures shall be designed to eliminate as much as possible all external effects of the flux created by normal and fault currents. The power losses in the system shall be kept to a minimum. The induced voltages on the enclosures shall not be allowed to exceed reasonable limits of safety for operating personnel.

2.10.02 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.
2.10.03	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.
2.10.04	All necessary indoor and outdoor galvanised steel supporting structures for the proper erection, leveling and alignment of the bus bars shall be provided by the Contractor.
2.10.05	The SF6 GIS bus-bars shall have continuous current rating as shown in the single line diagram or as required for the system.
2.10.06	The system employed shall be of the electrically continuous enclosure type, allowing free circulation of induced currents in the enclosures. The enclosures shall be cylindrical in shape and designed for maximum shielding to minimize electromagnetic forces caused by short circuit currents.
2.10.07	Wherever necessary, to absorb expansion / contraction, relative movement between the various items of equipment and the earthquake forces, bellows or other means shall be provided. The contractor must submit details of the means deployed along with the offer.
2.10.08	Each gas compartment barrier shall be easily identifiable from the outside of the switchgear. The means of identification used shall be a black band, approx. 10mm wide, permanently affixed to the barrier insulator on the outer surface of the enclosure at the location of the barrier insulator. In case of leakage of the gas from any compartment, indication of respective compartments should be provided on the annunciator
2.11.00	**BAY MODULE CONTROL CABINETS:**
2.11.01	Each switchgear bay module shall be suitable for local control and remote control. The contractor shall supply the main control cabinet of the floor standing type along with GIS equipments. The cabinet shall have double, full height, hinged, gasketed, lockable doors. One door shall have a safety glass window through which the various switchgear controls can be viewed without opening the doors.
2.11.02	The cabinet will be utilized for the switchgear bay local control module and as the terminating center for all power supply, control annunciation and

supervisory wiring interfacing with Employer's systems.

2.11.03 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.

2.11.04 The following equipments shall be mounted internally in the cabinet:

- All bay switchgear interlocking wiring and auxiliary relays.
- AC and DC power supply circuit breakers.
- All necessary incoming and outgoing terminal blocks.
- Space heaters
- All instruments and devices required for supervision & control of GIS

2.11.05 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.

2.11.06 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.

2.11.07 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	The floor of the switchgear building will be designed to support all the loads imposed by the equipment supporting framework. The Contractor shall make provision in his designs to minimize transfer of forces resulting from thermal expansion or switchgear operation to the walls & floors of the switchgear building. To facilitate the design of floor of switchgear, the Contractor shall supply the details of static and dynamic loads to be supported by the slab along with the offer.
2.12.03	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.
2.12.04	All steel structure members shall be hot dip galvanised.
2.12.05	All supporting structures shall be designed in such a way so as to allow dismantling for the addition of further switchgear components or maintenance of existing equipment without requiring temporary supports.
2.12.06	The supporting arrangements for the GIS duct outside the building shall have adequate provision for thermal expansion/seismic forces etc.
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. The relative merits, however for such switches in place of adjustable density switches shall be indicated in the offer. 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.

2.13.03 Each gas section shall be fitted with a suitable valve for routine gas sampling.

2.13.04 The Contractor shall satisfy the Employer regarding accuracy limits of gas monitoring devices.

2.13.05 The equipment shall have provision to monitor the following parameters periodically to check anomalies and/or wear & tear of equipment.

i) Operation of mechanical components:

The parameters to be monitored are:

- Fluid pressure(oil) or hydraulic mechanism power reserve
- The displacement speed of the moving parts
- The travel of moving parts
- Friction of moving parts

ii) Wear of circuit breakers interrupting chamber:

The parameters to be monitored are:

- Determination of contact closing position
- Accumulated effect of interrupted currents
- Decomposition products content in SF6 Gas

iii) Insulation failure:

The parameters to be monitored are:

- SF6 gas density monitoring of all the compartments
- High frequency current detection for partial discharge detection
- Sonic detection

iv) Safety bursting disc for each SF6 gas compartment.

2.14.00 HIGH VOLTAGE TRANSIENTS:

High voltage transients from switching operations and internal faults are coupled to the external enclosure of the GIS. Since the effects of these transients on people are not known, the operating personnel are required to avoid contact with the enclosure during switching operations. The contractor is therefore required to establish that the reduced transient levels are within acceptable level.

2.15.00 BURN THROUGH PREVENTION:

The Contractor shall furnish the details regarding the design features of their equipment which are intended to prevent burn through when an internal arc occurs.

2.16.00 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.

All the thermostats and the temperature indicating devices shall be calibrated in metric units.

2.17.00(A) 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 (B) SEISMIC DESIGN CRITERIA:

a)	The equipment shall be designed for operation in seismic zone for earthquake resistance. The seismic loads are due to the horizontal and vertical acceleration which may be assumed to act on concurrently. Seismic Qualification requirements shall be as per IEC 62271-207 for the design of equipment. The equipment along with its parts shall be strong enough and sufficiently well connected to resist total operating stresses resulting from the forces in normal operation, but in case of abnormal condition shall also resist with forces superimposed due to earthquakes. The copies of type test reports for similar rated equipment, if tested earlier, should be furnished. If the equipment has not been type tested earlier, Test Report/Analysis Report should be furnished.
b)	To prevent the movement of GIS sub-assemblies i.e. various bay modules during the earthquake, suitable devices shall be provided for fixing the sub-assemblies to the foundation. The contractor shall supply necessary bolts for embedding in the concrete foundation. The fixing of GIS sub-assemblies to the foundation shall be designed to withstand the seismic events. It will also be ensured that the special devices as well as bolts shall not be over stressed. The details of the devices used and the calculations for establishing the adequacy shall be furnished by the supplier and shall be subject to the employer's approval.
2.18.00	**INSPECTION AND TESTING:**
2.18.01	All the equipment, apparatus, materials and supplies provided by the contractor under the contract shall be subjected to tests in the shop and at the field in the presence of employer 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 Employer well in advance i.e. no less than 30 days before these tests are conducted. Unless otherwise specified, the contractor shall perform all shop and field tests.
2.18.02	The Contractor shall submit a detailed quality assurance plan with 30 days after the commencement date intimating the testing program to the Employer for testing may proceed with minimum delay. The performances tests shall start, proceed, stop and be resumed in accordance with the approved schedule.
2.18.03	The Contractor shall, at its own expense, promptly make good all defects evident by testing or made apparent in any other ways. After defects in the equipment have been rectified, the equipment is proved to be in satisfactory operation.

2.18.04	Within 30 days of completion of each and every specified test, including commissioning tests, the Contractor shall submit six signed copies of the test reports to the Employer.
2.18.05	The test reports shall indicate the tests performed, the result obtained, instruments used, names of personnel carrying out the tests and provisions for signature of witnesses. They shall also show the number and date. The format of these reports shall be submitted along with testing procedure for the employer's approval well in advance.
2.18.06	The test report shall include, but not necessarily be limited to the following: - A description of the test equipment with diagram showing arrangement of the test instruments and devices. - Sample computations, wherever necessary or desirable to show the test values employed in the equations. - Curves showing relation of tested quantities - Data in tabulated form The comparison of the test results with the guaranteed requirements of the specification and explanation of deviations, if any.
2.19.00	**Shop test:**
2.19.01	All major part of equipment, is essentially those necessitating subdivision of parts are transport and subsequent and reassembly at site, shall be matched, assembled in the factory and carefully marked before dismantling. The dowel holes shall be provided with dowels to assist reassembly. The accuracy of fitting has to be assured at site at all stages of assembly.
2.19.02	Each transport section of switchgear shall be shop tested.
2.19.03	Switchgear components forming part of GIS namely circuit breakers, disconnectors, grounding switches, current transformers, Voltage transformers, surge arrestors & SF6 interface bushing, the routine tests of which have been covered under other relevant IEC standards and which do not form the part of tests specified below shall have these tests performed before being assembled into the switchgear. However, for electronic modules, equipment and individual components burn-in tests, temperature & voltage stress tests shall also be performed. Routine tests shall be

conducted by automatic processes, wherever practicable particularly during testing of wiring. An example of the other tests referred to above would be as follows:

a) Verification of terminal markings and accuracy & composite error tests for current and potential transformers.

b) Routine and standard acceptance tests for surge arrestors specified in IEC60099-4 relevant to metal oxide type arrestors without gaps.

c) Routine tests (on transport section):

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

The applicable standards for the above tests shall be IEC 62271-203, IEC 62271-100 and IEC 62271-1.

In addition, corrosion protection tests at random on all equipment shall be performed.

2.20.00 Type Tests:

For Type Test requirement, Please refer clause No.1.12.00.

2.21.00 Performance Tests:

Performance tests will be required to prove that equipment meets the requirements of the specifications and the guarantees. All the tests shall be conducted by the contractor subject to Employer's approval. The contractor shall supply all labour, consumables, materials, equipment, meters, gauges etc. necessary for the performance of all the tests and recording the results of the tests. The contractor shall assume full responsibility for the operation and safety of the equipment during all tests. The reports of all the tests shall be prepared by the contractor and incorporated in the final test report. 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.

2.22.00 **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. These tests shall include, but not be limited to the following:

(a) Continuous testing of the properties of SF6 gas through the entire filling period.

(b) Test to check the continuity of wiring and correct operation of electrical systems.

(c) Testing of all current carrying & ground connections to all conductors and terminal pads, to determine that the surfaces & all the bolted connections are tightly secured with lock washers; testing of all the flexible connections to ensure that sufficient slack is available for expansion.

(d) Individual inspection of pressure relief devices, pressure gauges, moisture detectors and all other auxiliary devices to examine their condition.

(e) Checking of cabling between apparatus by the contractor, prior to acceptance tests. Written evidence shall be produced on these tests. Random checks shall be made in the presence of the Engineer.

(f) Measurement of the insulation resistance of the various measuring and control circuits, including cables, instruments and apparatus wherever practical and feasible.

(g) Operation checks of operating mechanism, all control, signaling, measuring, metering, recording and interlocking equipment to confirm complete conformity with designed data.

Prior to commencement of these tests, the contractor shall submit a detailed programme to Employer's for approval. Detailed records, including all the details of tests performed and the results obtained shall be prepared by the contractor and furnished to the Employer.

2.23.00 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.

Except as otherwise provided hereunder, responsibility for apparatus & test equipment and the control thereof shall be exercised by contractor subject to the over riding control of the Employer.

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.

2.24.00 Final Acceptance Tests:

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

2.25.00 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.

2.26.00 TRAINING: GIS manufacturer 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**				

Sl No.	Description of Training	Training Duration (Days)	Place of Training	Number of Trainees from Employer	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	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 Plants:-

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 largest comportment. The required vacuum for complete evacuation shall be attained with the help of this plant.

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

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

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

iii)For heavy items within the plant, the lifting hooks shall be provided for lifting

and moving with the overhead cranes.

iv)The capacity of the plant shall be such as to handle and store the maximum quantity of gas that could be removed from alleast one phase of complete one bay.

v))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.

Note:

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

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

2.0 SF6 gas analyzer : Qty:1no

The SF6 gas analyser should be portable type and instrument should have following features:

a. Sensitivity of the equipment shall not be affected by any atmospheric conditions like dust, humidity, heat, wind etc.
b. Equipment should be equipped with pumped back facilities so that no SF6 gas is wasted.
c. Equipment shall be supplied with suitable regulator which can be used to connect SF6 cylinder if required.
d. Following acidic/impurities products should be detected as per IEC 60480 and IEC 60376

i) SF6 purity – Range: 0-100 %
ii) Dew point - Range: -60 to +20 deg C
iii) SO2 - Range: 0-150 ppm
iv) CF4 – Range: 0-60% vol
v) HF - Range: 0-25 µl/l

e. Instrument should work on AC source as well as on rechargeable battery
f. Input pressure: upto 10 bar
g. It should be housed in a robust IP67 case with wheels

3.0 **SF6 Gas leak detector – Qty:1no**

The SF6 gas leak detector shall meet the following requirements:

a) The detector shall be free from induced voltage effects.

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

c) The accuracy of the equipment shall be at least 10 ppm.

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

The operational analyser shall meet the following requirements:

a) Operational analyser shall be one complete system, which once installed should record all the parameters, as laid down in subsequent clauses.

b) 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.

c) The analyser shall have provisions for recording atleast 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 enough for recordings at site on a completely assembled and erected breaker.

d) The analyser shall be suitable for operation outdoor and shall be suitably shielded against induced charges.

e) The output of the analyser shall be on a plain paper or any paper having infinite shelf life and the output thus obtained shall have a long life and shall not require any special storage facility.

Photographic paper is not acceptable.

f) All the necessary catalogues, write up for operation and maintenance of the analyser shall be furnished alongwith each analyser and peripheral system.

g) Demonstration at manufacturer's premises for functional/operational check and compatibility with breaker.

h) The necessary equipments for monitoring various parameters of circuit breaker termed as signature analysing shall be supplied along with all softwares, laptop computer, devices etc. with the breaker. The same shall be demonstrated at site on a fully assembled breaker.

5.0) Self-powered hydraulic aerial working platform with articulated and fly boom for General purpose maintenance in switchyard and Transformer yard. (Suitable for 30mt 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 due 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 due 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 and use of the instrument must be simple, direct without the use of any other material/chemical like dry ice/acetone etc. It should be battery operated with rechargeable batteries.

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

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

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

iv) The equipments should have the following parameters:

a) Measurement shall be possible in noisy environment.

b) Stable reading shall be possible in presence of vibrations within complex GIS assemblies, which can produce signals similar to PD.

c) Environment should have necessary synchronizing circuits to obtain PD correlation with power cycle and power frequency.

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

e) 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.

f) 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.

g) The function of software shall cover the following :

- Data recording, storage and retrival 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

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

i) Supplier shall have “Adequate after sales service” facility in India.

j) Necessary training may be accorded to personnel to make use of the kit for locating PD sources inside the GIS.

k) Instrument shall be robust and conform to relevant standard.

l) Adequate number of UHF sensors shall be provided in the offered GIS for detection of Partial discharge as per IEC 60270 through Partial Discharge (PD) monitoring system and the number and location of these sensors shall be subject to approval of the employer. Pulse generator for UHF sensor sensitivity test shall also be supplied as a standard accessory.

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

All above maintenance equipment’s shall be demonstrated at site during

handover.

3.00.00 CIRCUIT BREAKER:

3.01.00 **GENERAL :**

Circuit Breakers shall be metal enclosed SF6 gas insulated, single phase encapsulated for GIS and outdoor type Sf6 gas insulated for AIS, both comprising three identical single pole units, complete in all respects with all fittings and wiring. The circuit breakers and accessories shall conform to relevant standard IEC-62271-100.

The controlled switching device for circuit breakers (as indicated in single line diagram) shall meet the requirements as specified in Annexure-F.

3.02.00 **DUTY REQUIREMENTS:**

3.02.01 Circuit breaker shall be restrike free under all duty conditions and shall be capable of performing their duties without opening resistor. The circuit breaker shall meet the duty requirement of any type of fault or fault location and shall be suitable for line charging and dropping when used on 765/ 132kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily. 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 765kV & 132kV.

3.02.02 The Bidder may note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage, pneumatic/hydraulic pressure and arc extinguishing medium pressure, etc. While furnishing the proof of the total break time of complete circuit breaker, the Bidder may specifically bring out the effect of non-simultaneity between same pole and poles and show how it is covered in the guaranteed total break time.

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.

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:**
3.04.01	Circuit breakers shall be single pressure type.
3.04.02	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.
3.04.03	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. As long as 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 The insulators and terminal connectors shall conform to requirements stipulated elsewhere. All routine tests shall be conducted on the insulators as per relevant IEC.

3.06.02 **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 is capable of performing following operations satisfactorily :

i) Total running time of compressor not exceeding 45 minutes per day, considering 2% leakage and 2 CO-operations.

ii) Air charging time not exceeding 20 minutes after one CO operation of the breaker.

c) Air Receivers**:**

i) The capacity of receivers shall be sufficient for two (2) CO operations of the breaker.

ii) Air receiver shall be designed in accordance with the latest edition of the ASME Code for Pressure Vessel - Section VIII of BS:5179. A corrosion allowance of 3.0 mm shall be provided for shell and dished ends. Receivers shall be hot dip galvanized.

d) Controls and Control Equipment**:**

i) The compressor control shall be of automatic start stop type initiated by pressure switches on the receiver. Supplementary manual control shall also be provided.

ii) All control equipment shall be housed in a totally enclosed cabinet. Pressure gauges and other indicating devices, control switches shall be mounted on the control cabinet.

iii) Facility to annunciate failure of power supply to the compressor control shall also be provided.

e) Compressed Air Piping, Valves and Fittings:

i) The flow capacity of all valves shall be at least 20% greater than the compressor capacity.

ii) The high pressure system shall be such that after one 0 - 0.3 Sec - CO operation, the breaker shall be capable of performing one CO operation within 3 minutes.

iii) All compressed air piping shall be bright annealed, seamless phosphorous Deoxidized Non-Arsenical Copper alloy or stainless steel pipe (C-106 of BS: 2871).

3.07.00 **TESTS:**

3.07.01 **Type test:**
a) GIS circuit breaker shall be type tested in accordance with the requirement stipulated under clause no :1.12.00.

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:**

3.08.01 **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.
h)	Type of operating mechanism	Pneumatic/spring/hydraulic/or a combination of these

3.08.02 **765kV Class Circuit Breakers (GIS)**

a) Rated voltage :800 kV rms

b) Rated continuous current : 3150A , as per SLD

c) Rated short circuit breaking :50kA, 1sec

d) Symmetrical interrupting Capability :50 kA rms,1sec

e) Short time current carrying Capability :50 kA rms for One (1) second

f) Short circuit making current Capability :125 kAp

g) Rated out-of-phase breaking :12.5 kA rms

h) Rated line charging breaking Current (voltage factor of 1.4) :900A at 90□ C leading power factor with maximum permissible switching overvoltage of 2.0 pu.

i) First pole to clear factor :1.3

j) Rated break time : As per IEC

k) Lightning, Switching, Power frequency Voltages : As per IEC 62271-100

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	m)	Pre Insertion Resistor Rating : 450 ohms minimum with pre- insertion time of 9 (+1,- 0) millisec. (if required)
3.08.03	**132 kV Class Circuit Breakers (GIS):**	
	a)	Rated voltage :145 kV, rms.
	b)	Rated continuous current at an ambient temperature of 50^0 C :2000A,as per SLD
	c)	Symmetrical interrupting Capability 31.5 kA, rms.
	d)	Rated short circuit making current 80 kAp
	e)	Short time current carrying Capability for one second :31.5 kA, rms.
	f)	Out of phase breaking current Capacity : 7.8 kA, rms.
	g)	i) Rated line charging breaking current capacity(rms) : 50A ii) Rated cable charging breaking current capacity(rms) : 160A
	h)	Rated small inductive current Switching capability with over-voltage less than 2.3 p.u. 0.5 to 10 A
	i)	Interrupting capability of Transformer steady and transient magnetising current up to 500 MVA
	j)	First pole to clear factor 1.3
	k)	Rated breaktime As per IEC
	l)	Total breaktime As per IEC
03.08.04	**132 kV Class Circuit Breakers (AIS):**	
	a)	Rated voltage :145 kV, rms.
	b)	Rated continuous current at :2000A,as per SLD

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	an ambient temperature of 50^0 C	
c)	Symmetrical interrupting Capability	31.5 kA, rms.
d)	Rated short circuit making current	78.75 kAp
e)	Short time current carrying Capability for one second	:31.5 kA, rms.
f)	Out of phase breaking current Capacity	: 7.8 kA, rms.
g)	i) Rated line charging breaking current capacity(rms) ii) Rated cable charging breaking current capacity(rms)	: 50A : 160A
h)	Rated small inductive current Switching capability with over-voltage less than 2.3 p.u.	0.5 to 10 A
i)	Interrupting capability of Transformer steady and transient magnetising current	up to 500 MVA
j)	First pole to clear factor	1.3
k)	Rated breaktime	As per IEC
l)	Total breaktime	As per IEC

ANNEXURE-F

Requirement of Controlled Switching Device for 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. The device shall be such that only switching commands (for operating purpose) are processed in the device. Open command triggered by protection on fault shall be forwarded directly to the breaker. In these cases switching instance is not controlled.
3. Circuit breaker should be able to be switched while switching controlled device is not in operation e.g. during maintenance work or power supply is not connected, a bypass shall be provided to the device. In these cases the switching commands will then be forwarded directly to the circuit breaker via this Bypass. The switching time will not be controlled with these switching operations.
4. The device shall have functions for switching ON & OFF the circuit breakers.
5. 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.
6. The device shall also have an adaptive control feature to consider the next operating time of the breaker in calculation of optimum time of issuing the switching command and optimize the switching behavior as necessary. In calculation of next operating time of the breaker the controller must consider all factors that may affect the operating time of the breaker.

7.	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.
8.	The device shall have self monitoring facility.
9.	The device shall be suitable for operation considering transient and dynamic state values of the current and voltage from the secondary of the CTs and CVTs
10.	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 work station (EWS) located in the switchyard control room. It shall be possible to extract the switching oscillographic records and also to do CSD parameterization from this EWS. All necessary software & hardware shall be in bidder's scope. .
11.	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.
12.	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.
13.	The device shall have time setting resolution of 0.1 ms or better.
14.	The device shall have sufficient number of output/input potential free contacts for connecting the monitoring equipment and annunciation system available in the control room. Necessary details shall be worked out during engineering the scheme.
15.	Supply of all the necessary accessories required for the successful operation of controlled switching device shall be in the scope of supplier of the device.
16.	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 as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-6)
j. Power frequency immunity test on binary input as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-16)

4.00.00 DISCONNECTOR:

4.01.00 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.

4.01.02 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.

4.01.04	Complete disconnector with all the necessary items for successful operation shall be supplied.
4.02.00	**DUTY REQUIREMENTS:**
4.02.01	Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the Isolators and earth switches shall be capable of withstanding the dynamic system in their closed position. They shall be constructed such that they do not open under influence of short circuit current, wind pressure and other mechanical loads together. The earth switches wherever provided shall be constructional interlocked so that the earth switches can be operated only when the isolator is open and vice-versa.
4.02.02	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 fail safe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated in relevant section. The interlock coil shall be provided with adequate contacts for facilitating permissive logic for 'DC' control scheme of the isolator as well as for AC/DC circuit of the motor to prevent opening or closing of isolators when the interlocking coil is not energised.
4.02.03	The earthing switches shall be capable of discharging trapped charges of the associated lines. Isolator and earth switches shall be able to bear on the terminals the total forces including wind loading and electrodynamic forces on the attached conductor without impairing reliability or current carrying capacity.
4.02.04	The earth switches wherever provided shall be constructional interlocked so that the earth switches can be operated only when the isolator is open and vice-versa. Mechanical Endurance : M2 type of duty as per IEC for 400kV earthing switches shall be of class M0 / M1 duty
4.02.05	The isolator shall be capable for making / breaking normal currents when no significant change in voltage occurs across the terminals of each pole of the isolator on account of making / breaking operation.
4.03.00	**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 & power house 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	Back ground	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:

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 Power House 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)	Interlocks shall be provided so that manual operation of the switches or insertion of the manual operating device will disable the electrical control circuits.
g)	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.
h)	Provision shall be made for padlocking the ground switches in either the open or closed position.
i)	All portions of the grounding switch and operating mechanism required for grounding shall be connected together utilizing flexible copper conductors having a minimum cross-sectional area of 50 mm2.
j)	The main grounding connections on each grounding switch shall be rated to carry the full short circuit rating of the switch for 1 s and shall be equipped with a silver-plated terminal connector suitable for steel strap of adequate rating for connection to the grounding grid.
k)	The safety grounding switches shall conform to the requirements of IEC 62271-102
l)	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.
4.05.00	**HIGH SPEED GROUNDING SWITCHES:**
a)	Grounding switches located at the beginning of the Feeder bay modules shall be of the high-speed and will be used to discharge the respective charging currents, in addition to their safety grounding function. These grounding switches shall also be capable of interrupting the inductive currents and to withstand the associated TRV.
b)	Single phase switches shall be provided with individual/group operated mechanism operating mechanism for each phase suitable for operation from a 220V DC ungrounded supply.
c)	The switches shall be fitted with a stored energy closing system to provide fault making capability.
d)	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.

e) Each high speed make proof 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 Power House Control Room.

f) The details of the inscription & coloring for the indicator shall be as under:

Sign	Background	Colour
Open position	Open	Green
Closed position	Closed	Red

g) High-speed ground switch operation should be possible locally from the bay module control cabinet, or remotely from the relay room & power house control room in conjunction with opening of the associated disconnector.

h) These high-speed grounding switches shall be electrically interlocked with their associated circuit breakers and disconnectors so that the grounding switches can not be closed if the circuit breakers and disconnectors are closed.

i) Interlocks shall be provided so that the insertion of the manual operating devices will disable the electrical control circuits.

j) Each high speed ground switch shall be fitted with auxiliary switches having six normally open(NO) and six normally closed (NC) auxiliary contacts for use by others, over and above those required for local interlocking and position indication. All contacts shall be wired to terminal blocks in the local bay control cabinet. Provision shall be made for padlocking the grounding switches in either the open or closed position.

k) All portion of the grounding switches and operating mechanism required for connection to ground shall be connected together utilizing flexible copper conductor having minimum cross-sectional area of 50 sq mm.

l) The main grounding connection on each grounding switch shall be rated to carry the peak withstand current rating of the switch for 1 sec and shall be equipped with a silver-plated terminal connector suitable for steel strap of adequate design for connection to the grounding grid.

m) The high speed grounding switches shall conform to the requirements of IEC-62271-102.

4.06.00 CONSTRUCTIONAL FEATURES (For AIS):

a) The isolators shall be provided with high pressure current carrying contacts on the hinge/ jaw ends and all contact surfaces shall be silver plated. The thickness of silver plating wherever provided should not be less than 25 microns.

b) The isolator shall be provided with a galvanised steel base provided with holes and designed for mounting on a lattice/pipe support structure. The base shall be rigid and self supporting. The position of movable contact system (main blades) of each of the isolator and earthing switch shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the isolator and earthing switch. The indicator shall be of metal and shall be visible from operating level.

c) All metal parts shall be of non-rusting and non-corroding metal. Current carrying parts shall be from high conductivity electrolytic copper/aluminium. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities, if provided on current carrying parts, shall be made of copper silicon alloy or equivalent. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces.

d) The isolators shall be so constructed that the switch blade will not fall to the closed position if the operating shaft gets disconnected. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by gravity, wind pressure, vibrations shocks or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals.

e) The insulator of the isolator shall conform to the requirements stipulated elsewhere and shall have a min. cantilever strength of 800 kg for 765 & 132kV isolator.

4.07.00 **EARTHING SWITCHES (For AIS):**

Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts. The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator. Earthing switches shall be suitable for local operation only. The earthing switches shall be constructional interlocked with the isolator so that

	the earthing switches can be operated only when isolator is open and vice versa.
4.08.00	**OPERATING MECHANISM AND CONTROL (For AIS)**
4.08.01	The Contractor shall offer, motor operated switches having padlock arrangement for both 'ON' and 'OFF' positions.
4.08.02	Limit switches for control shall be fitted on the isolator/ earth switch shaft, within the cabinet to sense the open and close positions of the isolators and earth switches.
4.08.03	It shall not be possible, after final adjustment has been made for any part of the mechanism to be displaced at any point in the travel sufficient enough to allow improper functioning of the isolator when the isolator is opened or closed at any speed.
4.08.04	Control cabinet/operating mech. box shall conform to requirements stipulated under auxiliary part and IS:5039/IS 8623/IEC 60439 as applicable.
4.09.00	**OPERATION (For AIS):**
4.09.01	Isolator shall be electrically/mechanically gang operated for main blades and earth switches. The operation of the three poles shall be well synchronised and interlocked.
4.09.02	The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and interpole operating rods shall be capable of adjustments.
4.09.03	The design of linkages and gears be such so as to allow one man to operate the handle with ease for isolator and earth switch.
4.10.00	**TESTS :**
4.10.01	The GIS disconnector shall be type tested in accordance with the requirement stipulated under clause no :1.12.00
4.10.02	In continuation to the requirements stipulated under clause no.1.12.00 the isolator along with operating mechanism (AIS) shall conform to the type tests and shall be subjected to routine tests and acceptance tests in accordance with IEC 62271-102. Minimum 50 nos. mechanical operations will be carried out on 1 (one) isolator of each type assembled completely with all accessories as acceptance test. During final testing of isolator

sequential closing/ opening of earth switch shall also be checked only after isolator is fully open/close.

4.10.03 The insulator (AIS) shall conform to all the type tests as per IEC 60168. In addition to all type, routine and acceptance tests, as per IEC-60168, the following additional routine/ acceptance tests shall also be carried out:

a) Bending load test in four directions at 50% min. bending load guaranteed in all insulators.
b) Bending load test in four directions at 100% min. bending load guaranteed on sample insulators in a lot.
c) Torsional test on sample insulator of a lot.

4.11.00 **PARAMETERS:**

4.11.01 **General:(GIS)**

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

General (AIS) :

	Description	Parameter
a)	Type of isolator	Out door type , 50Hz
b)	No. of poles	Three(3poles)
c)	Rated operating time	Not > than 12sec
d)	Control voltage	220VDC
e)	Auxiliary contacts on isolator	Min.8NO & 8NC contacts per pole/isolator .

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f	Auxiliary contacts on earth/ safety/grounding/high speed switch	Min.6NO & 6NC contacts per pole/isolator .
g)	Operating mechanism of isolator and earth switch	AC/DC/universal motor
h)	Minimum creepage distance	31mm/Kv
i)	Rated ambient temperature	50 degree Celsius
j)	Support structure height	Adequate so that lowest part of support insulator of equipment is minimum 2550 mm from plinth level
k	Temperature rise	As per Table III of IEC 60694 for an ambient of 50 deg. C

4.11.02 **765kV Class Isolators (GIS) :**

a) Rated voltage :800 kV rms

b) Rated continuous current As per SLD

c) Rated short time withstand current of isolator and earthswitch 50 kA rms for One (1) second

d) Rated dynamic short circuit withstand current of isolator and earthswitch :125 kAp

4.11.03 **132 kV Class Isolators (GIS):**

a) Normal system voltage :132 kV

b) Highest system voltage :145 kV

c) Rated current at 50^0 C ambient Temperature :As per SLD

4.11.04 765kV Class Isolators (AIS) :

a)	Rated voltage	:765 kV rms
b)	Rated continuous current	As per SLD
c)	Rated short time withstand current of isolator and earthswitch	50 kA rms for One (1) second
d)	Rated dynamic short circuit withstand current of isolator and earthswitch	:125 kAp
e)	Operating time	: <20sec
f)	minimum Phae to phase spacing	: 15000mm

4.11.05 132kV Class Isolators (AIS) :

a)	Rated voltage	:132 kV rms
b)	Rated continuous current	As per SLD
c)	Rated short time withstand current of isolator and earthswitch	31.5 kA rms for One (1) second
d)	Rated dynamic short circuit withstand current of isolator and earthswitch	:78.75 kAp
e)	Operating time	: <12sec
f)	minimum Phae to phase spacing	: 3000mm

4.11.06 **33 kV Class Isolators (AIS):**

a)	Rated voltage	36kV rms
b)	Rated continuous current	AS per SLD
c)	Rated short time withstand current of isolator and earthswitch	25 kA rms for One (1) second
d)	Rated dynamic short circuit withstand current of isolator and earthswitch	62.5 kAp

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e) Rated Insulation levels

i. Rated one minute power Frequency withstand Voltage (dry & wet) — 70 kV rms

ii. Rated lightning impulse Withstand voltage — ± 170 kVp

f) Minimum total creepage distance (mm) :31mm/kV

5.00.00 INSTRUMENT TRANSFORMER:

5.01.00 **CODES AND STANDARDS:**

Current transformers	IEC 61869-1&2, BS: 3938, IS: 2705, IS:16277
Voltage transformers	IEC 61869-1&5, IEC 60358, IS: 3156
Insulating oil	IS: 335, IEC:60296

5.02.00 GENERAL REQUIREMENTS (FOR GIS):

a) The current transformers and accessories shall conform to IEC-61869-2 and other relevant standards except to the extent explicitly mentioned in the specification.

b) The instrument transformers i.e. current and voltage transformers shall be single phase transformer units.

c) Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

d) The particulars of the various cores are given here for tender purpose and may change within reasonable limits as per the requirements of protection relays. 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:

5.03.00 PARAMETERS AND CONSTRUCTION DETAILS (GIS):

5.03.01 GENERAL FOR CURRENT TRANSFORMER (GIS)

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

5.03.02(a) **765 kV Current Transformers (GIS) :**

(a) Rated dynamic current — 125 kA (peak)

(b) Rated short time thermal current — 50 kA for 1 sec.

5.03.02 (b) **132 kV Current Transformers (GIS):**

(a) Rated dynamic current — 80 kA (peak)

(b) Rated short time thermal current — 31.5 kA for 1 sec.

5.03.02 (c) **132 kV Current Transformers (AIS):**

(a) Rated dynamic current — 78.75 kA (peak)

(b) Rated short time thermal current — 31.5 kA for 1 sec.

5.03.03 **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)	Rating and Diagram Plates shall be as specified in the IEC specification incorporating the year of manufacture. 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.
f)	The current transformers shall be suitable for high speed auto reclosing.
g)	Electro magnetic shields to be provided against high frequency transients typically 1-30 MHz.
h)	The wiring between each CT and bay module control cabinet shall be included in the scope of supply.
i)	Provision shall be made for primary current injection testing of current transformers.
5.04.00	**BUS VOLTAGE TRANSFORMERS (GIS):**
5.04.01	**General :**
a)	The voltage transformers and accessories shall conform to IEC and other relevant standards except to the extent explicitly mentioned in the specification.
b)	Voltage transformers shall be of the electro magnetic 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.

c)	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.
d)	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.
e)	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.
f)	The transformer shall be able to sustain full line voltage without saturation of transformer.
g)	**Core details are given in Table-II.**
5.04.03	**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
b)	The voltage transformers shall be of induction type, nonresistant and shall be contained in their own- SF6 compartment, separated from other parts of installation. The voltage transformers shall be effectively shielded against high frequency electromagnetic transients. The voltage transformers shall have three secondary windings. The voltage transformer secondaries shall be wired by Contractor to their associated bay control cabinets
5.05.00	**GENERAL REQUIREMENTS (For AIS):**
5.05.01	The instrument transformers i.e. current and voltage transformers shall be single phase transformer units and shall be supplied with a common marshaling box for a set of three single phase units.
5.05.02	All exposed mild steel shall be hot dip galvanised or painted with Grey color of shade RAL 9002.
5.05.03	The instrument transformers shall be hermetically sealed units. The instrument transformers shall be provided with filling and drain plugs.

5.05.04	Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.
5.05.05	The Instrument transformer shall be with Polymer Insulator. For Current transformer shall have cantilever strength of not less than 500kg for 765kV. For 400kV CVT cantilever strength shall not be less than 250kgThe insulators shall have a cantilever strength of more than 500 kg.
5.05.06	No oil shall come into direct contact with Zinc galvanized surface.
5.06.00	**CURRENT TRANSFORMERS (For AIS):**
5.06.01	i) The CTs shall have single primary of either ring type or hair pin type or bar type. ii) In case of "Bar Primary" inverted type CTs, the following requirements shall be met: a)The secondaries shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution. b) The lowest part of insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses. c) The upper part of insulation assembly sealing on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome. iii)The insulator shall be one piece without any metallic flange joint. The CT shall be provided with oil sight glass
5.06.02	The CT shall be provided with oil level indicator which should be clearly visible to maintenance personnel standing on ground.
5.06.03	The core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores shall produce undistorted secondary current under transient conditions at all ratios with specified parameters. The CTs shall be suitable for high speed auto-reclosing.
5.06.04	Different ratios shall be achieved by secondary taps only, and primary reconnections shall not be accepted.

5.06.05	The guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
5.06.06	The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CT/reactor is used, then all parameters specified shall be met treating auxiliary CTs/reactors as integral part of CT. The auxiliary CT/reactor shall preferably be in-built construction of the CT. In case it is separate, it shall be mounted in secondary terminal box.
5.06.07	The physical disposition of protection secondary cores shall be in the same order as given under CT requirement table(s) given below.
5.06.08	The secondary terminals shall be terminated on stud type suitable no's of non-disconnecting and disconnecting terminal blocks inside the terminal box of degree of protection IP:55 at the bottom of CT. The CTs shall be suitable for high speed auto-reclosing
5.06.09	The CTs shall have provision for taking oil samples from bottom of CT without exposure to atmosphere to carry out dissolved gas analysis periodically. Contractor shall give his recommendations for such analysis, i.e. frequency of test, norms of acceptance, quantity of oil to be withdrawn, and treatment of CT.
5.06.10	The CT shall have provision for measurement of capacitance and tan delta as erected at site.
5.07.00	**VOLTAGE TRANSFORMERS (CVTs) (AIS):**
5.07.01	Voltage transformers shall be of capacitor voltage divider type with electromagnetic unit.
5.07.02	The CVTs shall be thermally and dielectrically safe when the secondary terminals are loaded with guaranteed thermal burdens.
5.07.03	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.
5.07.04	The secondaries shall be protected by HRC cartridge type fuses for all windings In addition fuses shall also be provided for protection and metering windings for connection to fuse monitoring scheme. The secondary terminals shall be terminated on stud type non-disconnecting terminal blocks via the

fuse inside the terminal box of degree of protection IP: 55. The access to secondary terminals shall be without the danger of access to high voltage circuit.

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

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

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

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

5.08.00 **MARSHALLING BOX:**

5.08.01 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.

5.09.00 **PARAMETERS FOR CURRENT TRANSFORMERS (For AIS):**

5.09.01 **General Parameters:**

Sl.no	Description	Parameter

a)	One minute power frequency withstand voltage between secondary terminal and earth	5kV
b)	Partial discharge level	10 pico Coulombs max.
c)	Temperature rise	As per IEC
d)	Type of insulation	Class A
e)	Number of cores	Will be finalized during detailed Engg stage As per the requirement.
f	Rated frequency	50 Hz
g)	System neutral earthing	Effectively earthed
h)	Installation	Outdoor (up right)
i)	Seismic acceleration	0.3 g horizontal
j	Number of terminals in marshalling box.	All terminals of control circuits wired up to box marshalling box plus 20 terminals spare.

765 **kV Current Transformers (oil filled type) :**

Sl.no	Description	Parameter
a)	Rated Short time thermal current	50kA for 1sec
b)	Rated Dynamic current	125kA(peak)
c)	Rated Extended Primary current	120% of rated primary current as per SLD

5.09.02 **33 kV Current Transformers (Oil filled type) (For AIS)**

a) Highest System Voltage 36 kV

b) Rated short time thermal current 25 kA for 1 sec.

c) Rated dynamic current 62.5kA (Peak)

d) Rated insulation level :

i) 1.2/50 micro seconds (impulse voltage) 170 kV (Peak)

ii) 1 minute (dry and wet) power frequency withstand voltage 70 kV (rms)

e) Rated extended primary current 120% of rated primary current as per SLD

f) Minimum total creepage distance (mm) 1260

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5.10.00 **PARAMETERS FOR VOLTAGE TRANSFORMERS (FOR AIS):**

5.10.01 **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 in Table-III below
j	CVT HF capacitance	4400 / 8800pf (as required)

5.10.02 **765 kV CVT (AIS)**

a) Highest system voltage — 800 kV (rms)

b) Rated insulation levels

i) One minute power frequency withstand voltage — 975kV rms

ii) 1.2/ 50 micro sec. impulse — 2100kV (peak)

iii) 250/2500 micro sec. switching surge withstand voltage (dry & wet) — 1550 kV (peak)

c) Radio Interference voltage at 508 kV at frequency range 0.5 to 2 MHz(rms) — 2500 micro volts (max.)

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d)	Corona extinction voltage (min.)	508 kV (rms)
e)	HF Capacitance	4400 pf / 8800pf (nominal)

5.10.04 **TESTS:**

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

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

Sl.No	Description
i)	Radio Interference and Corona test
ii)	Thermal withstand test i.e. application of rated voltage and rated current simultaneously by synthetic circuit (For CT only) Seismic withstand test along with structure (for 765kV only)
iv)	Thermal co-efficient test i.e. measurement of Tan-Delta as function of temperature (at ambient and between 80 deg. C and 90 deg. C) and voltage (at 0.3, 0.7, 1.0 and 1.1 Um).(for CT only)
v)	Multiple chopped impulse test on Primary winding.
vi)	In addition to routine tests as per IEC/IS, measurement of partial discharge in continuation with power frequency withstand test required for 400 kV current transformer. ISF (Instrument Security Factor) test will be done as part of Routine acceptance test

TABLE-I

CORE DETAILS OF 765V 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/ 1000/500/1	-----	PS	3000/2000/ 1000/500	15/ 10/ 5 /2.5 Ohm	20/ 30/ 60/120
2	3000/ 2000/ 1000/500/1	-----	PS	3000/2000/ 1000/500	15/ 10/ 5 /2.5 Ohm	20/ 30/ 60/120

Physical arrangement of CTs shall be as per Protection SLD.

CORE DETAILS OF 765kV CTs-Protection (GIS) CT-B

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

CT No.	Current Ratio (A)	Output Burden (VA)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk
1	3000/ 2000/ 1000/500/1	-----	PS	3000/2000/ 1000/500	15/ 10/ 5 Ohm	20/ 30/ 60/120
2	3000/ 2000/ 1000/500/1	-----	PS	3000/2000/ 1000/500	15/ 10/ 5/2.5 Ohm	20/ 30/ 60/120

CORE DETAILS OF 765kV CTs-Protection (GIS) CT-C (GT/ Bus reactor/ Tie Transformer)

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

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

Physical arrangement of CTs shall be as per Protection SLD.

CORE DETAILS OF 765kV CTs-Protection (GIS) CT-C CTL (Line Side)

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

CT No.	Current Ratio (A)	Output Burden (VA) (*)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk
1	3000/ 2000/ 1000/500/1 (Main#1)	-----	PS	3000/2000/ 1000	15/ 10/ 5/2.5 Ohm	20/ 30/ 60/120
2	3000/ 2000/ 1000/500/1 (Main#1)	-----	PS	3000/2000/ 1000	15/ 10/ 5/2.5 Ohm	20/ 30/ 60/120
3	3000/ 2000/ 1000/ 500/1 ABT Metering (EM), PMU	20/20/20/20	0.2S, ISF<5	-	-	-
4	3000/ 2000/ 1000/ 500/1 ABT Metering (EM-Main, Check)	20/20/20/20	0.2S, ISF<5	-	-	-

CORE DETAILS OF 132V CTs-Protection (GIS) CT-A & 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 2000A.

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	2000/ 1000/ 500/1	-----	PS	2000/1000/ 5000	15/ 10/ 5 Ohm	20/ 30/ 60
2	2000/ 1000/ 5000/1	-----	PS	2000/1000/ 51000	15/ 10/ 5 Ohm	20/ 30/ 60
3	2000/ 1000/ 500/ , (EM)	20/20/20/20	0.2S, ISF<5			

Physical arrangement of CTs shall be as per Protection SLD.

SECTION-2

CORE DETAILS OF 132kV CTs-Protection (GIS) CT-C (ST)

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	2000/ 1000/ 500/ , (EM)	20/20/20/20	0.2S, ISF<5	-	-	-

Physical arrangement of CTs shall be as per Protection SLD.

CORE DETAILS OF 132V CT-Protection (AIS) CT

Following details shall be applicable for all protection class CT cores.
The rated extended primary current of the CTs shall be 120% continuous of 2000A.

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	2000/ 1000/ 500/1	-----	PS	2000/1000/ 5000	15/ 10/ 5 Ohm	20/ 30/ 60
2	2000/ 1000/ 5000/1	-----	PS	2000/1000/ 51000	15/ 10/ 5 Ohm	20/ 30/ 60
3	2000/ 1000/ 500/ 1, (EM)	20/20/20/20	0.2S, ISF<5			
4	2000/ 1000/ 500/1	-----	PS	2000/1000/ 5000	15/ 10/ 5 Ohm	20/ 30/ 60
5	2000/ 1000/ 5000/1	-----	PS	2000/1000/ 51000	15/ 10/ 5 Ohm	20/ 30/ 60

Physical arrangement of CTs shall be as per Protection SLD.

Note : The Knee point Voltage(Vk) & Max CT sec winding Resistance , Exciting current values mentioned are min / max values are of Typical values. These values will be finalized during detailed engg stages per the requirement of Numerical relays based on protection philosophy adopted. The supporting calculation for burden to be furnished during detail engineering.

CORE DETAILS OF 765kV VT, 132KV (GIS)			TABLE – II
Primary Voltage : 400/ v3 for Primary I,II,III			
Application	Rated Secondary Voltage (V)	Accuracy	Output Burden – Maximum (*)
Protection	110/v3	3P	50 VA
Protection	110/v3	3P	50 VA
Metering	110/v3	0.2	50 VA
The accuracy of 0.2 on secondary III should be maintained through the entire burden range up to total simultaneous burden 50 VA on all the three windings without any adjustments during operation.			
* The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system for better sensitivity and accuracy .The supporting calculation for burden to be furnished during detail engineering.			

CORE DETAILS OF 765kV CVT(AIS)				TABLE – II
Primary Voltage : 400/ v3 for Primary I,II,III				
Secondary Core	Application	Rated Secondary Voltage (V)	Accuracy	Output Burden – Maximum (*)
I	Protection	110/v3	3P	50 VA
II	Protection	110/v3	3P	50 VA
III	Metering	110/v3	0.2	50 VA
IV	ABT Metering	110/v3	0.2	50VA
The accuracy of 0.2 on secondary III should be maintained through the entire burden range up to total simultaneous burden 50 VA on all the three windings without any adjustments during operation.				
* The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system for better sensitivity and accuracy .The supporting calculation for burden to be furnished during detail engineering.				

CORE DETAILS OF 33kV CT if applicable								
CT No.	Core No.	Application	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	1	Tie HV REF	1000/ 1	-----	PS	1000V	5	30
2	1	Tie LV REF	2000/ 1	-----	PS	2000V	10	30
	2	Tie BACKUP E/F	2000/ 1	15	5P20	-----	-----	-----

Note: The rated extended primary current of the CTs shall be 120% continuous of rated current.

6.00.00 SURGE ARRESTOR:

6.01.00 **GENERAL:**

6.01.01 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.

6.01.02 Arrestors shall be hermetically sealed 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.

6.02.02 The reference current of SAs shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

6.02.03 The SAs shall be capable of withstanding meteorological and short circuit forces under site conditions.

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

6.03.01 Each Surge Arrester (SA) shall be hermetically sealed single phase unit.

6.03.02	The non linear blocks shall be sintered metal oxide material. The SA construction shall be robust with excellent mechanical and electrical properties.
6.03.03	SAs shall have pressure relief devices and arc diverting ports suitable for preventing shattering of porcelain housing and to provide path for flow of rated fault currents in the event of SA failure.
6.03.04	The SA shall not fail due to porcelain contamination.
6.03.05	Seals shall be effectively maintained even when SA discharges rated lightning current.
6.03.06	Outer insulator of Surge arrestor shall be of Polymer type. The SA shall not fail due to polymer contamination. Polymer housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to maximum design value for SA. The cantilever strength of the complete assembled surge arrestor is min.350kg for 765KV or as per the actual calculation which ever is higher shall be provided for 765kV and 132kV system .
6.03.07	The end fittings shall be non-magnetic and of corrosion proof material. The metal flanges shall be fixed with the porcelain by cement or other materials so as to withstand the forces experienced in normal operation and provide continuous sealing for entry of moisture for a period of minimum 20 years. 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 non linear zinc oxide, heavy duty, station type.
b)	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.
c)	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.
6.05.02	SAs shall be provided with grading and/or corona rings as required.

6.05.03 i)Self contained discharge counters, suitably enclosed for outdoor use (IP:55 degree of protection) and requiring no auxiliary or battery supply shall be fitted with each SA alongwith 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:**

6.06.01 **General :**

a)	System neutral earthing	Effectively earthed
b)	Installation	Outdoor
c)	i) Nominal discharge current	i)20kA of 8/20 microsec. Wave (765kV) ii)10 kA of 8/20 microsec. Wave (132kV)
	ii) Discharge current at which insulation coord. is done	i)20 kA of 8/20 microsec. Wave(765kV) ii)10kA of 8/20 micro wave wave(132kV)
d)	Rated frequency	50 Hz

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e)	Current for pressure relief test	i)50 kArms (765kV), 31.5kArms (132kV),
f)	Prospective symmetrical fault current	i)50 kArms for 1 second (765kV) 31.5 kArms for 1 second (132kV)
g)	Low current long duration test value (2000 micro sec.)	As per IEC
h)	i)Pressure relief class	: As per IEC
	ii)Long Duration discharge class	: Class #3 or 4
i)	Partial discharge at 1.05 MCOV (Continuous operating voltage)	Not more than 50 p.C.
j)	Siesmic acceleration	0.3 g horizontal
k)	Reference ambient temp.	50 deg. C
l)	Minimum total creepage distance (mm)	28000 / 5075 for 765kV / 132kV respectively.

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

6.06.02 **765 kV class Surge Arrestor (Typical Parameters):**

a)	Rated system voltage	800 kV
b)	Rated arrestor voltage	624 kV
c)	Minimum discharge capability	13kJ/kV or corresponding to minimum discharge characteristics given in clause m) below whichever is higher.
d)	Continuous operating voltage (COV) at 50 deg. C	490 kV rms
e)	Min. Switching surge residual voltage at 1 kA	1180 kVp

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f)	Maximum residual voltage at	
	i) 20kA nominal discharge current	1480 kVp
g)	Steep fronted wave residual voltage at 20kA	1480 kVp
h)	High current short duration test value (4/10 microsec. wave)	100 kAp
j)	Switching Impulse withstand voltage of arrestor housing	As per IEC
k)	Impulse withstand voltage of arrestor Housing with 1.2/50 micro sec. wave.	As per IEC
l)	RIV at 508 kV (rms)	Less than 2500 micro volts
m)	Long duration discharge class	5

n) The surge arrestors are provided to protect the following equipment whose insulation levels are indicated in the **Table# 3** given below. The contractor shall carry out the insulation coordination studies for deciding the location of the surge arrestors.

TABLE#3:

Sl.no	Equipment to be Protected	Lightning impulse(kVp)	Switching impulse(kVp)
a)	Power Transformer	± 1950	± 1550
b)	Instrument Transformer	± 2100	± 1550
c)	Reactor	± 1950	± 1550
d)	CB/isolator (Ph to ground)	± 2100	± 1550
	Across open contacts	± 2100(± 455)	± 1175(±650)

o) Surge arrestors shall be capable of discharge on severe re-energisation switching surges on 800KV, 350KM long line with Surge impedance of 270 ohms and capacitance of 13nf/Km and over voltage factor of 1.9p.u. Surge arrestor shall be capable of discharging energy equipment to class# 5 of IEC for a 800 kV system on

two successive operations followed immediately by 50 Hz energisation with a sequential voltage profile as specified below:

1000 kVp for 3 peaks
910 kVp for 0.1 second
885 kVp for 1 second
866 kVp for 10 seconds

6.06.03 **132 kV class Surge Arrestor:**

a)	Rated system voltage	145 kV
b)	Rated arrestor voltage	120 kV (Not less than)
c)	Nominal discharge current	10 kA of 8/20 micro sec.
d	Minimum discharge capability	5 kilo joule/kV (referred to rated arrestor voltage corresponding to minimum discharge character-istics)
e)	Continuous operating voltage at 50^0 C.	102 kV (rms)
f)	Max. Switching surge residual voltage (1 kA)	280 kVp(max)
g)	Max. residual voltage at	
	i) 1 kA	280 kVp
h)	Max. steep current residual voltage at 10 kA	380 kVp
i)	Long duration discharge class (2 successive shots)	3
j)	Current for Pressure relief test	31.5kArms
k)	High current short duration test value (4/10 micro sec.)	100 kAp
l)	One minute power frequency withstand voltage of arrestor housing (dry and wet)	275 kV (rms)

m)	Impulse withstand voltage of arrestor housing with 1.2/50 micro sec. Wave	650 kV (Peak)
n)	Radio interference voltage at 92kV	Not more than 1000 micro volt
o)	Partial discharge at 1.05 MCOV (continuous operating voltage)	Not more than 50 p.c.

The surge arrestors are provided to protect the following equipment whose insulation levels are indicated in the **Table# 4** given below. The contractor shall carry out the insulation coordination studies for deciding the location of the surge arrestors.

Table #4 :

Sl.no	Equipment to be Protected	Lightning impulse(kVp)
a)	Power Transformer	± 650
b)	Instrument Transformer	± 650
d)	CB/isolator (Ph to ground)	± 1650
	Across open contacts	± 750

6.07.00 **TESTS**

6.07.01 Surge arrestor (GIS) shall be type tested in accordance with clause no. 1.12.00

6.07.02 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:**

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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.

7.02.02 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.

Sl.No	Description
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.

7.03.03 The post insulator shall conform to following type tests as applicable according to voltage class:

a) Switching Impulse withstand test (dry & wet)

b) Lightning Impulse withstand test (dry)

c) Power frequency withstand test (dry & wet)

d) Measurement of RIV

e) Corona extinction voltage test

f) Test for deflection under load.

g) Test for mechanical strength,

7.04.00 **PARAMETERS:**

7.04.01 765 kV class Bus Post Insulator :

Sl.no	Description	
a)	Type	Solid core
b)	Dry and wet one min.power frequency voltage	830kV rms
c)	Dry impulse withstand positive and negative(kVp)	+-2100
d)	Wet switching surge withstand (kVp)	+-1550
e)	Total min.cantilever strength(kg)	800
f	Min. torsional moment(kg- m)	600
g	Total height of insulator(mm)	3650
h	Min Creepage level (Very Heavy)	31mm/kV

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.

7.04.02.

132 kV class Bus Post Insulators:

Sl.no	Description	
a)	Type	Solid core
b)	Dry and wet one min.power frequency voltage	275kV rms

c)	Dry impulse withstand positive and negative(kVp)	650
d)	Wet switching surge withstand (kVp)	NA
e)	Total min.cantilever strength(kg)	800
f	Min. torsional moment(kg- m)	500
g	Total height of insulator(mm)	1500

7.04.03. 33kV BUS POST INSULATOR

a) Type : Solid core

b) Voltage class (kV) : 36

c) Rated Insulation levels

i. Rated one minute power frequency withstand voltage : 70kV (rms)

ii. Rated lightning impulse withstand voltage : 170kV (Peak)

d) Total min. cantilever strength (kg) : As per IEC 60273

e) Min. torsional moment (Nm) : As per IEC 60273

f) Minimum total creepage distance (mm) :31mm/kV

8.00.00 WAVE TRAP:

8.01.00 **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.

8.02.00 **LOCATION OF EQUIPMENT**

8.02.01 Wave Traps as specified under this section shall be installed at the respective transmission line bays as indicated in single line diagram. The foundation shall be provided for all the three phases. The wave traps shall be installed in two phases in such a way that it should match with the location of wave traps on the phases of other side of the transmission line.

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8.03.00	**TECHNICAL REQUIREMENTS**
8.03.01	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.
8.03.02	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.
8.03.03	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.
8.03.04	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 neither enter into operation nor remain in operation, following transient actuation by the power frequency voltage developed across the line trap by the 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.
8.03.05	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.
8.03.06	The lightning arrester provided with the Wave trap shall be subject to routine and acceptance tests as per IEC – 60099.
8.03.07	The Wave trap on 765kV lines shall show no visual corona at extinction voltage of 508kVrms respectively. Suitable corona rings shall be incorporated in the line trap for 765kV .
8.03.08	Wave trap shall be equipped with bird barriers.
8.03.09	Wave trap shall preferably be spray painted with light admiralty Grey paint (shade 697 of IS-5) or may have its natural epoxy colour.

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

Sl.no	Description	765KV
a)	Nominal discharge current of protective device	20kA
b)	Type of tunning	Broad band
c)	Rated Blocking band width	50-500KHZ for 1mH, 90-500 KHz for 0.5mH
d)	inductance	8800 pf / 4400pf , 1.0 mH / 0.5 mH (matching with the remote end wave trap rating.)
e)	Radio interference voltage level at 508kV	Not > than2500micro volts

8.03.11 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.

Sl.No	Description
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

8.04.00 **WAVE TRAP MOUNTING:**

8.04.01 The Wave Traps 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 metre.

8.04.02 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.

9.01.02 There shall be no negative tolerance on OD and thickness of the tube. Other tolerances shall be as per IS:2678 and 2673.

9.01.03 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.

For 765kV:

a)	size	4.5"IPS(EH Type)
b)	Outer diameter	120mm with no negative tolerance
c)	Thickness of tube	12 mm with no negative tolerance
d)	Cross-sectional area	4071.5sq. mm.
e)	weight	11.034kg/m

For 132kV:

a)	size	3"IPS(EH Type)
b)	Outer diameter	88.90mm with no negative tolerance
c)	Thickness of tube	7.62 mm with no negative tolerance
d)	Cross-sectional area	1947 sq. mm.
e)	weight	7.7kg/m

9.02.00 **AAC Bull CONDUCTOR for 765kV:**

a)	Code and standard & Name	IS:398, MOOSE ACSR
b)	Overall diameter	38.25mm
c)	Strands and wire diameter of	
	a) Aluminium	61/4.25mm
	b)steel	7/3.53mm
d)	Ultimate tensile strength	139.0kN minimum

Note : Bidder may use latest equivalent conductor.

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ACSR CONDUCTOR for 132kV

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

Note : Conductor parameters are Typical . Bidder may use latest equivalent higher rating conductor.

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.

9.03.03 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.

9.03.04 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.

9.03.05 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.

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

9.03.07 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.

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.

9.04.02 In one span, Tension string assembly at one end shall be supplied with suitable turn buckle.

9.04.03 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)	: 430mm minimum or as required to meet the total creepage.
e. Power frequency withstand voltage	: 85 kV (dry), 50kV (wet)

9.04.04 Insulator string :

The insulator string shall meet the following parameters

		765kV
a)	Type	Porcelain type/ composite type
b)	Creepage distance	28000mm
c)	PF withstand voltage	830 KV 1 min(rms) (dry and wet)
d)	L / I withstand voltage	+/- 2100 KV
e)	S / I Withstand voltage	+/- 1550 KV
f)	Pollution level(as per IEC 71)	Very Heavy . 31mm/kV
g)	No. of disc insulator (for porcelain)	min 66 nos.
h)	Electro mechanical strength	210 kN/ String

		132kV
a)	Type	Porcelain type/ composite type
i)	Creepage distance	5075 mm
j)	PF withstand voltage	275kV 1 min(rms) (dry and wet)
k)	L / I withstand voltage	+/- 650 KV
l)	S / I Withstand voltage	……
m)	Pollution level(as per IEC 71)	Very Heavy.31mm/kV
n)	No. of disc insulator (for porcelain)	12 nos.
o)	Electro mechanical strength	120kN/string

SECTION-2

TECHNICAL PARAMETERS FOR SF6/ AIR BUSHING:

		765kV	132kV
a)	Rated Voltage (kVrms)	800kVrms	145kVrms
b)	Rated Current (Amp)	……..As per SLD……..	
c)	1.2/ 50 micro second Impulse voltage (L/I Withstand voltage)	± 2100kVp	± 630kVp
d)	250/2500 micro second switching Impulse voltage	± 1550kVp	---------
e)	One minute power Frequency withstand voltage	960kVrms	275kVrms
f)	Minimum total Creepage Distance (mm)	28000	5075
g)	Minimum Cantilever Strength (kN)	10	5

9.05.00 **SPACERS:**

9.05.01 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.

9.05.02 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.

9.05.03 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
i)	Protective coating for storage	Boiled linseed oil to avoid wet storage stains (white rust)

The earth wire shall be preformed and post formed quality.

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.

9.08.02 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.

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

9.08.04 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.

9.08.05	Post type insulators shall consist of a porcelain 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.
9.08.06	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.
9.08.07	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.
9.08.08	In accordance with the requirements stipulated elsewhere, bushings, 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.
9.09.00	**CABINETS, BOXES, BAY MARSHALLING BOX , 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.
9.09.02	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.
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 **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.

TERMINAL BLOCKS:

i)They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

ii)The terminal blocks shall be of 850 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

iii)Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:

a) All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
b) AC & DC power supply -Two 16 sq.mm. aluminium conductor.
c) Circuits Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor

9.12.00 **CABLE RACKS INCLUDING SUPPORTS, TRAYS AND ACCESSORIES:**

i) Cable Support Structures & Accessories :

The Contractor shall fabricate and install mounting arrangements for the cable tray supports or use the flexible cable tray supports and required accessories with bolted arrangement and installation of all the cables in Cable tray in the trenches / above ground.. These mounting shall be fabricated from structural steel members (channels, angles and flats) of the required size.

ii) Cable Trays:

a)Hot dip galvanised ladder type , perforated type cable trays of adequate width are to be provided for cables in the control room building, out door, above ground cable tray arrangement.

b)Aux. power cables are to be laid on the top tray and DC control cables in bottom trays. Cable trays shall be designed to carry cables load without bending and proper tray supports shall be provided at every 1000mm interval .

c)Cable trays having power and control cable are spaced at Min.300 mm and between control cable trays, the spacing is min.225 mm. For tray lengths more than 2.5 m coupler plates are to be used for joining the two standard tray lengths. Suitable 'L' and 'T' bends are included under the scope of this contract

d) Cable trays shall be made of 2 mm thick sheet steel having a slotted rung spacing of 250 mm. Height of cable tray channel shall be 75 mm and the standard length of trays shall be 2.5 mt

e)All nuts, bolts, washers etc. to be supplied by the Contractor shall be hot dip galvanised after fabrication.

f)The Contractor shall perform all tests and inspection to ensure that material and workmanship are according to the relevant standards

For Detailed specification Refer Chapter B-10 (cabling , earthing, lighting) of Part-B, Section-VI.

9.13.00 **Wiring:**

All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows: a) All circuits except CT circuits 2.5 sq.mm b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor.

9.14.00 **CABLE GLANDS AND LUGS:**

9.14.01 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components.

used in cable glands shall be neoprene and off tested quality. Required number of backing glands to close unused openings in gland plates shall also be provided.

9.14.02 The cable glands shall be tested as per BS:6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

9.14.03 Cables lugs shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

9.15.00 **CONDUITS, PIPES AND ACCESSORIES :**

9.15.01 The Contractor 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 The size of the conduit/pipe shall be selected on the basis of maximum 40% fill criterion. 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 portion and entrance of moisture and foreign material.

9.15.02 Rigid conduits shall be flow-coat metal conduits. The outer surface of the 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 galvanised. All rigid conduits/ pipes shall be of a reputed make.

9.15.03 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

9.16.00 **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	**BAY EQUIPMENT:**
10.04.01	The disposition of equipment to be supplied are shown in enclosed tender drawings.
10.04.02	The Contractor shall prepare layout drawings and submit the same for approval of the Employer. The approval of drg. shall not absolve Contractor from his responsibility regarding designing & engineering of switchyard and Contractor shall be fully responsible for all works covered in the scope of this specification.
10.05.00	**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.
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.
10.05.03	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.
10.05.04	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.
b)	Where, assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense. The contractor shall strictly follow manufacturer's recommendations for handling and erection of equipment.
c)	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.
d)	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.
e)	Cutting of the pipes wherever required shall be such as to avoid flaring of the ends. Hence only a proper pipe cutting tool shall be used. Hack saw shall not be used.
f)	For cleaning the inside and outside of hollow insulators only Muslin or leather cloth shall be used.
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 1000mm 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	Cables shall be generally located adjoining the electrical equipment through the pipe insert embedded in the ground. In the case of equipment located away from cable trench either pipe inserts shall be embedded in the ground connecting the cable trench and the equipment or in case the distance is small, notch/opening shall be provided. In all these cases necessary bending radii as recommended by the cable supplier shall be maintained.

10.07.04	Cabling in the control room shall be done on ladder type cable trays with supports at an interval of 1000mm.
10.07.05	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 burried in the ground at a depth of 300mm.
10.08.00	**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.
10.09.00	**STORAGE OF EQUIPMENT**: Contractor is responsible for the proper storage and maintenance of all materials/equipment entrusted to him. The Contractor shall provide & construct adequate storage shed for proper storage of equipment. Sensitive equipment shall be stored indoors. All equipment during storage shall be protected against damage due to acts of nature or accidents. Contractor shall take all required steps to carryout subsequent inspection of materials/equipment stored as well as erected until the same is taken over by the Employer. The storage instruction of the equipment manufacturers/Engineer-in-Charge shall be strictly adhered to.
	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.

ii. 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.

iii. 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.

u) 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
Rod Electrode	40mm dia, 3000mm	Mild steel
G.I. Earthwire	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 burried atleast 600mm below finished grade level unless stated otherwise.

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

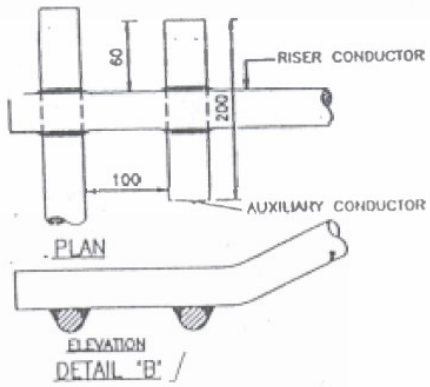
iii. Wherever earthing conductors cross cable trenches, underground service ducts, pipes, tunnels, railway tracks etc., it shall be laid atleast 300mm below them and shall be re-routed in case it fouls with equipment/structure foundations.

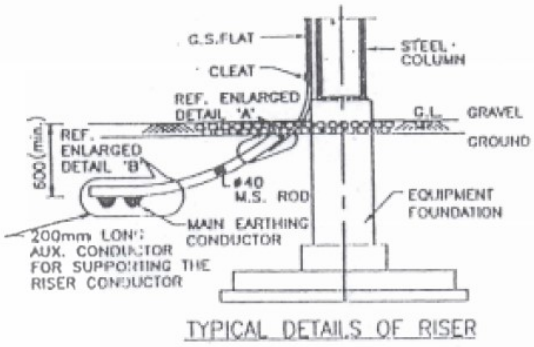
iv. Tap connections from the earthing grid to the equipment/structure to be earthed, shall be terminated on the earthing terminals of the equipment/structure, if the equipment is available at the time of laying the grid. Otherwise, “earth insert” with

		temporary wooden cover or “earth riser” shall be provided near the equipment foundation/pedestal for future connections to the equipment earthing terminals.
	v.	Earthing conductor along their run on cable trench ladder columns, beams, walls, etc. shall be supported by suitable welding/cleating at intervals of 750mm. Earthing conductors along cable trenches shall be on the wall nearer to the equipment. 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.
	vi.	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.
	vii.	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.
	viii.	Earthing conductors crossing the road shall be either installed in hume pipes or laid at greater depth to suit the site conditions.
	ix.	Earthing conductors embedded in the concrete fibre shall have approximately 50mm concrete cover.
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. In case earthing pads are not provided on the item to be earthed, same shall be provided in consultation with engineer.
	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. Apart from intermediate connections, beginning points shall also be connected to earthing system.
	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.

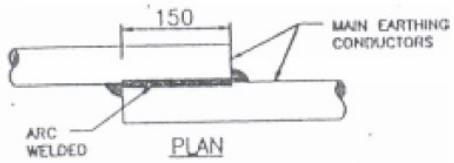
	v.	Wherever earthing conductor crosses or runs along metallic structures such as gas, water, steam, conduits, etc. and steel reinforcement in concrete it shall be bonded to the same.
	vi.	Cable and cable boxes/glands, lockout switches etc. shall be connected to the earthing conductor running alongwith 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 burried 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.
	x.	Equipment earthing (Riser & welding of two conductors) shall be done as per standard drawing enclosed in this part.
h)		**JOINTING:**
	i.	Earthing connections with equipment earthing pads shall be of bolted type. Contact surfaces shall be free from scales, paint, enamel, grease, rust or dirt. Two bolts shall be provided for making each connection. Equipment bolted connections, after being checked and tested, shall be painted with anti-corrosive paint/compound.
	ii.	Connection between equipment earthing lead and between main earthing conductors shall be welded/brazed type. For rust protections, the welds should be treated with red lead and afterwards thickly coated with bitumen compound to prevent corrosion.
	iii.	Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingression.
	iv.	Resistance of the joint shall not be more than the resistance of the equivalent length of the conductor.
	v.	All ground connections shall be made by electric arc welding. All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on it. Artificial cooling shall not be allowed.

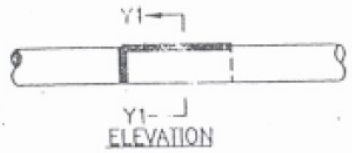
vi.	Bending of large diameter rod/thick conductor shall be done preferably by gas heating.
vii.	All arc welding with large diameter conductors shall be done with low hydrogen content electrodes.
i)	**POWER CABLE EARTHING:**
	Metallic sheaths and armour of all multi core power cables shall be earthed 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:**
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.

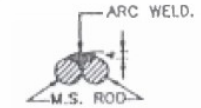




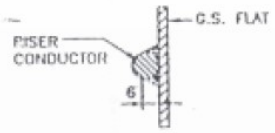
TYPICAL DETAILS OF RISER



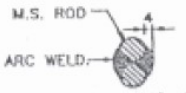




SECTION Y1–Y1

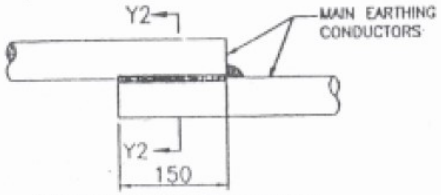


SECTION Y3–Y3



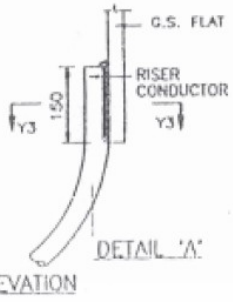
SECTION Y2–Y2

(CONDUCTOR IN HORIZONTAL PLANE)



CONDUCTOR IN VERTICAL PLANE

TYPICAL OVERLAPPING JOINT OF TWO CONDUCTORS



ELEVATION

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

EQUIPMENT EARTHING DETAILS

STANDARD DRAWING

SECTION-2

F

11.00.00 SITE TESTING AND COMMISSIONING:

11.01.00 **INTRODUCTION:**

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

1.00.00 **SPARES**

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-

1.01.00 **MANDATORY SPARES**

(a) The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

(b) The Employer reserves the right to buy any or all the mandatory spares parts.

(c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

(d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

(e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

1.02.00 **RECOMMENDED SPARES**

(a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in this Section-VI, Part-A and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.

(b) Price of recommended spars will not be used for evaluation of the bids. The price of these spares will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

1.03.00 **START-UP & COMMISSIONING SPARES**

	Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.
1.04.00	The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.
2.00.00	The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
3.00.00	All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
4.00.00	All the spares (both recommended and mandatory) shall be manufactured alongwith the main equipment components as a continuous operation as per same specification and quality plan.
5.00.00	The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.
6.00.00	Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
7.00.00	All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.
8.00.00	The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
9.00.00	The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
10.00.00	In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and

	delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.
11.00.00	The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer atleast 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/ procurement of such items.
12.00.00	Material Codification The bidder to provide datasheets/ assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all necessary assistance in this regard.
13.00.00	Bidder shall not indicate “Not Applicable” against any of the spare (except for those items for which “if applicable” is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules. Bidder shall not mention any remark other than price value in relevant price schedule.

NTPC Limited

(A Government of India Enterprise)

NABINAGAR SUPER THERMAL POWER PROJECT
STAGE - II (3x800MW)

PART - C

GENERAL TECHNICAL REQUIREMENTS

SECTION – VI

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

BIDDING DOCUMENT NO.:CS-0371-001-2

1.00.00 **INTRODUCTION**

This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.

2.00.00 **BRAND NAME**

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item 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.

3.00.00 **NOT USED**

4.00.00 **COMPLETENESS OF FACILITIES**

4.01.00 Bidders may note that this is a EPC Package contract. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.

4.02.00 All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All same standard components/ parts of same equipment provided, shall be interchangeable with one another.

4.03.00 For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.

5.00.00 **CODES & STANDARDS**

5.01.00 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 as of 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 and Climate Change (MoEFCC), 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) CERC (Indian Electricity Grid Code) Regulations, 2023

(w) CEA (Flexible Operation of Coal Based Thermal Power Generating Units) Regulations, 2023

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

5.02.00 Unless covered otherwise in the specifications, the latest editions (as applicable the date fifteen (15) days prior to the date of bid submission), 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)/ European Norm (EN)

n) Expansion Joint Manufacturers Association (EJMA)

o) Heat Exchange Institute (HEI)

p) IEEE standard

q) JEC standard

5.03.00	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.
5.04.00	As regards highly standardized equipments 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.
5.05.00	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.
5.06.00	Two (2) English language copies of all national and international codes and/or standards used in the design of the plant and equipment shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.
5.07.00	In case of any change in codes, standards & regulations between the date fifteen (15) days prior to the date of bid submission and the date when vendors proceed with fabrication 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.
5.08.00	A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification.
6.00.00	**EQUIPMENT FUNCTIONAL GUARANTEE**
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A & B of Technical Specifications. These guarantees shall supplement the general functional guarantees provisions covered under Defect liabilities Section-IV, General Conditions of Contract.
6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.

7.00.00 **DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS**

7.01.00 **DESIGN OF FACILITIES**

All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.

The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best coordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.

7.02.00 **MAINTENANCE AND AVILABILITY CONSIDERATIONS**

Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.

Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path, turbine & equipments, inspection of the steam path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.

Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.

8.00.00 **DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR**

8.01.00 Bidders may note that this is an **EPC Package contract**. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of

mechanical, electrical and power systems, control & instrumentation, civil & structural works as per the scope.

Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated.

The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.

A comprehensive engineering and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in **Annexure-VI** to this Part-C, Section-VI of the Technical Specification.

8.03.00 The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:

8.03.01 A) **BASIC ENGINEERING DOCUMENTATION**

Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

i) System description of all the mechanical, electrical, control & instrumentation & civil systems.

ii) Technology scan for each system / sub-system & equipment.

iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.

iv) Optimization studies including thermal cycle optimization.

v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations along with all calculations justifying and identifying the sizing and the design margins.

vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.

vii) Water Balance diagram.

viii) Operation Philosophy and the control philosophy of the Main Plant and other plants.

ix) General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in the bidder's scope.

x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area, transformer yard, switchyard and other areas included in the scope of the bidder.

xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalized with the Employer.

B) **DETAILED ENGINEERING DOCUMENTS**

i) General layout plan of the station.

ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.

iii) Flow diagram, Process and Instrumentation diagrams along with write up and system description.

iv) Start-up curves for boiler and both turbines and boiler combined together as a unit for various start-ups, viz. Cold, Warm and Hot start up.

v) Piping isometric, composite layout and fabrication drawings, design philosophy & design parameter selection for each piping system, Pressure drop calculation & flash tank sizing calculation.

vi) Piping engineering diagrams, pipe and fittings schedules, System-wise or P&ID wise prepared pipe schedule, valve schedule, insulation schedule, hanger and support schedule and Piping isometric /

fabrication isometric drawings for pipe size 65mm NB and above with BOM, Painting schedule. Hanger / support arrangement drawing with BOM, Valve GA drawings, Layout drawings for site routed piping (i.e. for pipe sizes below 65NB) along with BOM (and submission of the same to the employer / project manager before start of work) and System wise stress analysis / dynamic analysis report (including input) along with stress isometric drawing / sketch marked with node points. Also As-Built drawing for information & Records: (i) Piping fabrication isometric drawing (ii) composite piping layout drawing (iii) Hanger / Support arrangement drawing.

vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors.

viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like Mills, Fans, BFPs, CEPs, Heaters/ Deaerators, Water cooled Condensers, Vacuum pumps etc.

ix) Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.

x) Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes.

xi) Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser, design ramp rates of SG and TG and heat exchanger thermal calculations etc.).

xii) Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.

xiii) Comprehensive list of all Terminal Points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc.

xiv) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.

xv) Protection system diagrams and relay settings.

xvi) Cables schedules and interconnection diagrams.

xvii) Cable routing plan.

xviii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.

xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points.

xx) Sequence and protection interlock schemes.

xxi) Type test reports, insulation co-ordination study report and power system stability study report.

xxii) Control system configuration diagrams and card circuit diagrams and maintenance details.

xxiii) Detailed DDCMIS system manuals.

xxiv) Detailed flow chart for digital control system.

xv) Mimic diagram layout, Assignment for other application engg.

xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the scope of the bidder civil calculation sheets including structural analysis and design alongwith output results.

xxvii) Underground facilities, levelling, sanitary, land scaping drawings.

xxviii) Geotechnical investigation and site survey reports (if and as applicable).

xxix) Model study reports wherever applicable.

xxx) Functional & guarantee test procedures and test reports.

xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.

xxxii) BOP documents such as P&IDs, Sizing calculations for various equipment's, performance curves, datasheet etc. (For CHP, AHP, PU, Water System etc.) shall be as per MDL.

xxxiii) Bidder shall submit all tabulated design calculations/ data (e.g. Pipe schedule, valve schedule, etc.), in both EXCEL format as well as in PDF format to enable NTPC for fast review /approval.

8.03.02 **INSTRUCTION MANUALS**

The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipments covered under the Contract by the end of one year from the date of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Employer the Instruction Manuals shall be submitted as indicated in **Annexure-IV.** The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.

A) ERECTION MANUALS

The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of a 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 tools, tackles, heavy equipments like cranes, dozers, etc.

f) Bill of Materials

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.

B) OPERATION & 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 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 equipments, 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 2.0 - Plant Operation: To contain the following sections specific to the equipment supplied

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

(b) Limiting values of all protection settings.

(c) Various settings of annunciation/interlocks provided.

(d) Startup and shut down procedure for equipment alongwith 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 alongwith 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 3.0 - 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 expectancy & 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.

8.03.03 After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in **Annexure-VI**. 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 **Annexure-VI**.

8.03.03 **PLANT HANDBOOK AND PROJECT COMPLETION REPORT**

8.03.03.01 **PLANT HANDBOOK**

The Contractor shall submit to the Employer a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including:

i) Design and performance data.

ii) Process & Instrumentation diagrams.

iii) Single line diagrams.

iv) Sequence & Protection Interlock Schemes.

v) Alarm and trip values.

vi) Performance Curves.

vii) General layout plan and layout of main plant building and auxiliary buildings

viii) Important Do's & Don't's

The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook, complete in all respects, shall be submitted three (3) months before start-up and commissioning activities.

8.03.03.02 **PROJECT COMPLETION REPORT**

The Contractor shall submit a Project Completion Report at the time of handing over the plant.

8.03.04 **DRAWINGS**

a) i) All the plant layouts shall be made in a computerized 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check.

ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per **Annexure-VI** of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC.

Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through the above site.

The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or. std formats.

iii) Final copies of the approved drawings along with the requisite number of hard copies shall be submitted as per **Annexure-VI** of Part-C.

iv) Contractor shall prepare the model of all the facilities located within plant boundary covering facilities in Main Plant Block area and Balance of plant (BOP) area in an integrated & intelligent 3D software solution. Main Plant Block area shall include Transformer Yard, Air Cooled Condenser Block, TG building (including all facilities), Boiler area, ESP area, chimney area, FGD area and any other facility located in main plant block. BOP area shall include all facilities pertaining to AHP, CHP, LHP, GHP, DM PT plant, pipe & cable racks and any other facility located within plant boundary.

All piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), General Arrangement drawings and RCC layout of major buildings and structural arrangement drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer’s review along with the 3D review model to enable NTPC to review and approve these drawings.

Contractor shall prepare and provide 3D design review model (network ready, which shall include visual interference check, walk-through

animation, video simulation for major equipment placement and removal, visual effect, photo realism etc.), which is extracted from intelligent 3D model and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as & when required by employer.

Observations of NTPC during the 3D model review to be incorporated and revised editable model to be submitted to NTPC within 2 weeks.

The complete 3D data (editable model) which shall be utilised for all future detailed engineering related to maintenance, operation, R&M, efficiency improvement of the project etc. Complete 3D model along with as built GADs, layout, isometrics, reports extracted and 3D models for all disciplines, with any other document generated from 3D model and naming conventions with as-built updates along with complete reference databases, component catalogues for all the size range shall be handed over to owner. Apart from the 3D Model, all drawings like GADs, Isometrics etc. extracted from the model shall also be submitted by the Contractor in Electronic form. 3D model along with complete Project databases shall be submitted at each model review stage and as final as-built. The contractor shall also submit all the configuration files, customization files, templates, and all referenced databases.

All input files of software used for design of Equipments / Piping like CAESAR2 files, input files for Pressure vessel design, datasheets etc., shall be handed over to NTPC as per NTPC specifications for handover of Engineering Information.

Further, two Licenses of the used 3D Modelling Software (One for Engineering View and One for Site View) shall be provided along with compatible Hardware for possible review and study of the Model Files being submitted by the Bidder Time to time.

All software and hardware shall be supplied by the bidder within 3 months of NOA. The 3D modelling software shall preferably be the same software bidder will be using for preparation of 3D model or it shall have all editable features to edit the model supplied by bidder on time-to-time basis.

All software provided shall necessarily include cost for perpetual license(s) for use on all the machines and an Annual maintenance contract (AMC) which shall include software upgrades as & when

released by the software agency for a period of three years after warranty/guarantee period.

Handover Plan: There shall be continuous handover of documents and data at various stages of the project including rules and trigger points for handover of data to NTPC shall be at 30%, 60% and 90 % of 3D model stage.

Database backup shall be taken every month and handed over to NTPC.

b) All documents/text information shall be in the latest version of MS Office/MS Excel/PDF format as applicable.

c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.

d) Each drawing submitted by the Contractor (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, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

e) The drawings submitted by the Contractor (or their sub vendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.

Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission **in line with suggestive MDL**.

Further, space shall be identified on each drawing for Approval stamp and electronic signature.

f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general

conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated, or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.

g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.

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

i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalized Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.

Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.

j) As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to “as built” conditions and submit no. of copies as per **Annexure VI**.

k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.

l) The Contractor shall submit adequate prints of drawing / data / document as per Annexure-VI. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.

m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under this specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.

8.03.05 **e-Learning Package:**

e-learning packages shall be supplied for the equipment / system for the following Steam Turbine Generator & auxiliaries and Steam Generator & auxiliaries along with associated electrical and C&I system.

8.03.05.01 Steam Turbine Generator & Auxiliaries

Steam Turbine including stop valves, control valves, overload valves and cross over piping. Steam Turbine Auxiliary Systems including Quick Closing and Ordinary NRVs, Turbine gland sealing system, Lubricating oil system and its purification system, Centralized oil storage and its purification system, Control fluid and its purification system, governing and protection system, exhaust hood spray cooling system, drainage and vent system, turbine preservation system, HP/LP Bypass system.

Generator and Auxiliary System including Generator, complete hydrogen cooling, carbon dioxide and nitrogen gas systems as applicable, complete seal oil system, complete water-cooling system where applicable and complete excitation system.

Condensing Plant including Condenser, Condenser air evacuation system and Condenser on load tube cleaning system /any other cleaning system as applicable etc.

Drip Pump along with all accessories as applicable, Condensate Extraction Pumps along with all accessories, Deaerator level Control Station, Feed Water Heating Plant including Drain Cooler, low pressure heaters, deaerator and feed storage tank, high pressure heaters and associated accessories, Boiler Feed Pumps along with all accessories, Drive Turbine for Boiler Feed Pump along with all accessories, Feed regulating station, Make up system to Condenser, Gland Steam Condenser Recirculation System, Turbine Hall EOT Cranes and EOT Crane for Boiler Feed Pump as applicable.

8.03.05.02 **Steam Generator & Auxiliaries**

Furnace/evaporator, separator & drain collection vessel, superheater, reheater, economiser, startup recirculation & drain system, desuperheating spray system, safety valves, soot blowing system, draft plant including FD & ID fans, PA fan, air preheaters, SCAPH, coal preparation and firing system including raw coal feeder and pulverisers, coal burners, fuel oil system and oil burners, Electrostatic precipitator, NOx control system and Flue gas desulphurisation system, Aux. PRDS system.

8.03.05.03 These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI), NTPC located at Noida. The Project Manager / Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI.

1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information / requirement with respect to above activities for the supplied equipment / system .

2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above.

a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc.

b. The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc.

c. The operation course(s) should include instructions on the permissive, interlocks, physical check-ups, start-up, shutdown and protections etc.

d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling.

Depth of coverage of above courses shall be as specified for **"Instruction Manuals"** in above clauses. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.

3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of Project Manager / EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site.

The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit.

4. e-Learning course broad requirements:

a. The courses shall be web-based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.

b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices.

c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.

d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.

e. Each course shall have every physical and functional detail of the equipment / system supplied.

f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.

g. There shall be an option for self-assessment test after every course. In case the user doesn't opt for self-assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz.

h. If Java and Flash, as applicable, are not available in the system to run the package, then there shall be a prompt message for updation of the same.

i. Each course shall have self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.

j. The course shall contain a chapter titled 'Introduction/overview' that explains the purpose of the course.

k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it.

l. The system shall provide the user with the ability to select the information with a Cursor.

m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop-up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function.

n. Every course shall contain the 3D design/drawing/exploded view/360^0 turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio.

o. The users shall be able to control audio sound level associated with the courses.

p. Drawings / text in the courses shall be scalable (Zoom In/ Out).

q. The user shall have the capability to record a **bookmark** to mark displayed information for later recall, whenever he accesses the same course next time.

Notes:

1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.
2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system.
3. The vendor shall get the approval of one sample course from Project Manager / EIC before proceeding for further courses.

8.04.00 **Provision for Fail Safe operation of vital Equipments.**

All the Plant and equipments / Systems supplied under the contract shall be designed following "Fail Safe" concept. In case of failure of Power supply like Electric power, Hydraulic pressure, Pneumatic pressure, Vacuum etc. the system should be designed in such a way that the equipment/Valves/dampers etc. shall always move/remains (as applicable) to safest position as per system requirement to ensure safety of Man and Machinery.

8.05.00 **Engineering Co-ordination Procedure**

8.05.01 The following principal coordinators will be identified by respective organizations after award of contract:

NTPC Engineering Coordinator (NTPC EC):

Name :

Designation :

Address :

a) Postal :

b) Telegraphic / e-Mail :

c) FAX : TELEPHONE :

Contractor's/ Vendor's Engineering Coordinator (VENDOR EC):

Name :

Designation :

Address :

a) Postal :

b) Telegraphic / e-Mail :

c) FAX : TELEPHONE :

8.05.02 All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.

8.05.03 Contractor's/Vendor's Drawing Submission and Approval Procedure:

a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings".

b) Not used

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

d) Not used

e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.

f) **Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission.**

g) The Contractor shall submit drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within three (3) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized 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/ modification as noted.
CATEGORY -IV	For information and records.

h) After Rev 0 comments, the drawing will be locked in the system. Contractor will review the Rev 0 comments within 7 days & furnish the Comment Reply Sheet (CRS) to NTPC as an agenda point for TCM. TCM shall be conducted with Contractor on non-agreed comments of CRS. System will not allow Contractor to submit approval category drawings before the scheduled submission date. However, documents may be unlocked on case to case basis. Based on resolution of all comments and agreements, the document will be approved in TCM itself. The contractor will revise the document based on the resolutions and certify that all the resolutions has been taken care of. Based on this certification, the document will be opened and submitted by contractor in the system for approval as Rev 01 within 10 days of TCM.

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

j) It is the responsibility of the Contractor/ Vendor to get all the drawings approved in Category I & 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.

k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing.

l) These comments will be taken care by the contractor while submitting the revised drawing.

The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.

8.06.00 **ENGINEERING PROGRESS AND EXCEPTION REPORT**

8.06.01 The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including

a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission

b) Drawings which were not submitted as per agreed schedule.

8.06.02	The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.
9.00.00	**TECHNICAL CO-ORDINATION MEETING**
9.01.00	The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA / HYDERABAD / PROJECT SITE or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.
9.02.00	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the comments of the Employer shall be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.
9.02.01	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.
9.02.02	Should any drawing remain unapproved for more than four (4) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.
9.03.0	Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.
10.00.00	**DESIGN IMPROVEMENTS** The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

11.00.00 **EQUIPMENT BASES**

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

12.00.00 **PROTECTIVE GUARDS**

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.

13.00.00 **LUBRICANTS, SERVO FLUIDS AND CHEMICALS**

13.01.00 All the first fill and one year's topping requirement of consumables such as greases, oils, lubricants, servo fluids / control fluids, gases (excluding H_2, CO_2 and N_2 for Generator) etc. which will be required to put the equipment covered under the scope of specifications into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

Bidder scope shall include supply of H_2, CO_2 and N_2 as applicable for the Generator till successful commissioning of Generator.

Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases etc. (as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.

13.02.00 As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible. However, the lube oil for Main Turbine, Drive Turbine, TDBFP and MDBFP shall be kept same in view of ease of operation and maintenance.

Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.

14.00.00	**LUBRICATION**
14.01.00	Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.
15.00.00	**MATERIAL OF CONSTRUCTION**
15.01.00	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.
16.00.00	**RATING PLATES, NAME PLATES & LABELS**
16.01.00	Each main and auxiliary item of plant 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.
16.02.00	Each item of plant shall be provided with a nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in the appropriate section of the technical specifications.
16.03.00	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 colored lettering engraved on the back.
16.04.00	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.
16.05.00	Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support.
16.06.00	Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non-pressure parts such as the yoke by a stainless-steel wire. The direction of flow shall also be marked on the body.
16.07.00	Safety and relief valves shall be provided with the following:

a) Manufacturer's identification.

b) Nominal inlet and outlet sizes in mm.

c) Set pressure in Kg/cm^2 (abs).

d) Blowdown and accumulation as percentage of set pressure.

e) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.

16.08.00 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.

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

17.00.00 **TOOLS AND TACKLES**

The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder along with the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning, and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.

18.00.00 **WELDING**

18.01.00 If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.

19.00.00 **COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES**

19.01.00 All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.

20.00.00 **PROTECTION AND PRESERVATIVE SHOP COATING**

20.01.00 **PROTECTION**

All coated surfaces shall be protected against abrasion, impact, discoloration, and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a non-metallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be. The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.

20.02.00 **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.

20.03.00 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor 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.

20.04.00 All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.

20.05.00 All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.

20.06.00 Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.

21.00.00 **QUALITY ASSURANCE PROGRAMME**

21.01.00 To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finalized during detailed engineering with employer / authorized representative after discussion. 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:

a) His organization structure for the management and implementation of the proposed quality assurance programme

b) Quality System Manual

c) Design Control System

d) Documentation Control System

e) Qualification data for Bidder's key Personnel.

f) 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.

g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

h) Control of non-conforming items and system for corrective actions.

i) Inspection and test procedure both for manufacturing and field activities.

j) Control of calibration and testing of measuring testing equipments.

k) System for Quality Audits.

l) System for indication and appraisal of inspection status.

m) System for authorizing release of manufactured product to the Employer.

n) System for handling storage and delivery.

o) System for maintenance of records, and

p) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component. Format for the same is attached as **Annexure VIII**.

22.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

22.01.00 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 contractor 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 contractor's responsibility to draw up and implement such a programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to the Employer for approval. Schedule of finalization of such Quality Plans shall be finalized during detailed engineering as per attached Annexure-VIII and format No QS-01-QAI-P-1/F3. The monthly progress report shall be furnished.

22.02.00 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 Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organization, 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 through C-folders, a web-based system of NTPC ERP, for review and approval.

22.03.00 Field Quality Plans will detail out for all the equipment, the quality practices, and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.

22.04.00 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. 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 authorized representative and beyond which the work will not proceed without consent of Employer 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.

22.05.00	The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at **Annexure-V.** The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.
22.06.00	The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities.
22.07.00	No material shall be despatched from the manufacturer's works before the same is accepted by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Dispatch Clearance Certificate (MDCC / CHP Clearance).
22.08.00	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.
22.09.00	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. All welding/brazing procedures shall be submitted to the Employer or its authorized representative prior to carrying out the welding/brazing.
22.10.00	All brazers, welders and welding operators employed on any part of the contract either in Contractor'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. All welding / brazing procedures qualified / used at shop, will be made available to NTPC during audit / inspection. Procedures to be qualified at site will be submitted to NTPC.
22.11.00	Not Used.
22.12.00	For all IBR pressure parts and high-pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping shall be as per the relevant code. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding

22.13.00	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
22.14.00	No welding shall be carried out on cast iron components for repair.
22.15.00	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
22.16.00	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/ISO:9712 (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 40 mm shall be Ultrasonically tested.
22.17.00	The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-vendors proposed by the Main contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalized with the Employer, shall be subject to Employer's approval on enclosed format as **Annexure-III**. List of NTPC approved sub vendors against similar Pkg/items is attached as Section-VI, Part-B, Indicative sub-vendor list. The contractor’s proposal for any new sub vendor for any of the items identified in indicative sub-vendor list shall necessarily be furnished in the sub vendor questionnaire & main Contractor Evaluation report format attached as Annexure- VII with all relevant documents and main contractor's own physical assessment report(physical for domestic manufacturers and physical/document review as applicable for foreign manufacturer) assessed as per their quality management system for NTPC review and acceptance. New sub vendor proposal will only be considered for NTPC review, provided the proposal is received sufficiently in time: 90 days prior to ordering date of a Bought-Out Items/Start of Manufacturing so as not to impede the progress of the contract.

Main contractor shall submit the documentation as mentioned below:

i. Duly Filled Main supplier Evaluation Report.
ii. Duly Filled Sub-Supplier Questionnaire.
iii. Factory Registration Certificate.
iv. Overall Organization Chart with Manpower details (Design, Manufacturing, Quality etc.)
v. Supply reference list of the Sub-Supplier indicating similar product supply order reference no., customer name, rating of product, date /year of supply, date / year of commissioning.
vi. List of Manufacturing Equipment available with sub vendor.
vii. List of Testing Equipment available with sub vendor.
viii. Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any.
ix. Details of Outsourced Manufacturing Processes, if any.
x. Quality control exercised during receipt, in-process & final inspection.
xi. Compliance of Statutory requirements (As applicable)

After first submission of proposal to NTPC, in absence of relevant documents/ Incompleteness of the proposal, the main contractor will be given a period of maximum 07 days to submit the compliance of the NTPC comments. In case of noncompliance, it will be presumed that the main contractor is not serious about pursuing the proposal & the proposal will be foreclosed.

Major checks and quality requirements as mentioned below shall necessarily be assessed by the main contractor and complied with documentary support in case the same is not the part of their Quality management system.

The proposed Sub vendor will be assessed broadly on following mandatory criteria:

i) Quality Management System Compliance including raw material/BOI control, traceability & control over outsources process.
ii) Design Capabilities (As applicable)
iii) Manufacturing, Testing & Storage Facility
iv) Processing Capabilities
v) Supply Experience indicating similar product supply order reference no., customer name, rating of product, date /year of supply, date / year of commissioning.
vi) Safety Aspect

In case of major observations or non-compliance observed during sub vendor works visit (Jointly with the main contractor) with respect to the submitted documents, proposed sub vendor will not be considered for acceptance and Main contractor will be solely responsible in such cases.

Monthly progress reports on sub-vendor detail. Submission / approval shall be furnished preferably on enclosed format at Annexure-IV. Such vendor approval shall

	not relieve the contractor from any obligation, duty, or responsibility under the contract.
22.18.00	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organization, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalized with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within two (2) weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.
22.19.00	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities at manufacturing works/project site. The contractor shall provide all necessary assistance to enable the Employer to carry out such audit and surveillance.
22.20.00	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his subcontractor'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. Contractor shall carry out all tests/inspection required to establish that the items/equipment 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.
22.21.00	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 Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
22.22.00	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

22.23.00	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorized representative.
22.24.00	**Environmental Stress Screening** Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be furnished for NTPC acceptance.
22.25.00	The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / 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.
22.26.00	**Software Reliability / Quality Certification** Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β-version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.
23.00.00	**QUALITY ASSURANCE DOCUMENTS**
23.01.00	The Contractor shall be required to submit the QA Documentation in soft copies, as identified in respective quality plan with tick (✓)mark.
23.01.01	Each QA Documentation shall have a project specific Cover Sheet bearing the 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 despatch. However, **soft copies will be furnished** not later than two (2) weeks.
23.02.00	Typical contents of QA Documentation is as below: - (a.) Quality Plan (b.) Material mill test reports on components as specified by the specification and

approved Quality Plans.

(c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

(d.) 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.

(e.) Heat Treatment Certificate/Record (Time- temperature Chart)

(f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).

(g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.

(h.) Certificate of Conformance (COC) wherever applicable.

(i.) MDCC

23.03.00 Similarly, the contractor shall be required to submit soft copies containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

23.04.00 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.

(a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

(b.) If the quality document is unsatisfactory, the Supplier shall endeavor 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.

(c.) 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 the applicable section when it is effectively completed. The submission of QA documentation package shall not be later than two (2) weeks after the dispatch of equipment.

23.05.00 **TRANSMISSION OF QA DOCUMENTATION**

On release of QA Documentation by Inspector, one set of quality documents shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than two (2) weeks after the date of the last delivery of equipment.

24.00.00 **PROJECT MANAGER'S SUPERVISION**

24.01.00 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Settlement of Disputes' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.

24.02.00 The work shall be performed under the supervision of the Project Manager.

The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

(a.) Interpretation of all the terms and conditions of these documents and specifications

(b.) Review and interpretation of all the Contractor's drawing, engineering data, etc.

(c.) Witness or his authorized representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract.

(d.) Inspect, accept, or reject any equipment, material and work under the contract.

(e.) Issue certificate of acceptance and/or progressive payment and final payment certificates

(f.) Review and suggest modifications and improvement in completion schedules from time to time, and

(g.) Supervise Quality Assurance Programme implementation at all stages of the works.

25.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

25.01.00 The word 'Inspector' shall mean the Project Manager and/or his authorized 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.

25.02.00 The Project Manager or his duly authorized 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 Contractor shall obtain for the Project Manager and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

25.03.00 The Contractor shall give the Project Manager/Inspector (15 days for domestic) / (45 days for foreign) written notice of any material being ready for testing. Such tests shall be to the Contractor'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 (15 days for domestic) / (45 days for foreign) of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor 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.

25.04.00 The Project Manager or Inspector shall within 15 days from the date of inspection as defined herein give notice in writing to the Contractor, 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 Contractor 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.

25.05.00 When the factory tests have been completed at the Contractor'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. Failure on the part of Project Manager /Inspector to issue such a certificate shall not prevent the Contractor 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.
25.06.00	In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, 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 authorized representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorized representative to accomplish testing.
25.07.00	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.
25.08.00	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no. 25.03.00 - of this chapter, the Contractor 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 the beginning of each calendar month.
25.09.00	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor 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 equipment in the presence of Project Manager / Inspector.
25.10.00	**ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME**
25.10.01	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 **(Annexure-III).**
25.10.02	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at **Annexure-IV.**
25.10.03	Field Welding Schedule Format enclosed at **Annexure-V.**
25.10.04	Main contractor evaluation report (MCER) and Sub vendor Questionnaire enclosed at **Annexure VII**.

25.10.05 QA&I modalities and QA Co-ordination procedure (QACP) enclosed at **Annexure-VIII**.

25.11.00 **TESTING OF MAJOR DESIGN FEATURES:**

The major design features of the system shall be demonstrated by the Contractor at the Contractor's works, or any other place mutually agreed within Six months from the date of Sub-QR/Provenness approval. These are the system function tests, which have a major impact on the detailed system design & finalization of important engineering documents like configuration, functional grouping, BOM etc., but do not require a fully engineered system for conductance. The bidder shall identify these features & include detailed test procedures in the Sub-QR/Provenness proposal, which shall be finalized during discussions with the bidder. The developments and any augmentation of standard features undertaken by the Bidder to fulfill the various specification requirements shall also be tested during these major design tests. This shall include but not be limited to the following.

a) System accuracy tests of DDCMIS for the various types of inputs identified in Part-B.

b) Loop reaction time for sample loops/ logics.

c) SOE functionality tests.

d) Server changeover.

e) Various response times, having serious implication on operation & maintenance philosophy.

f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load.

g) Connectivity of Switchgear DDCMIS with Switchgear Relay Network.

The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer.

If any of the envisaged tests have been carried out by Bidder in a previous NTPC project, then the same need not be specifically conducted by the Bidder for this project, provided it is clearly established by the Bidder & accepted by the Employer that there is no difference between the system offered for this

project & the previous NTPC project with respect to the test. However, even in such a case, test report of the previous project shall be submitted by the Bidder as a part of MDFT (Major Design Feature Test) test report.

25.12.00 **DEMONSTRATION OF APPLICATION ENGINEERING**

25.12.01 Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following.

(i) Logics/Loops:

a) Drive logics implementation for each type of binary drive along with its display in HMI.

b) Sequence implementation along with its display in HMI.

c) Single non-cascade controller implementation.

d) Cascade loop implementation.

e) Master slave implementation with different slave combinations.

f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable.

(ii) HMI Functions:

a) LVS Annunciation.

b) Graphics.

c) HSR

d) Logs/Reports.

e) Calculations (Basic & Performance Calculations).

25.12.02 The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.

After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as

part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.

25.12.03 During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.

26.00.00 **PRE-COMMISSIONING AND COMMISSIONING FACILITIES**

26.01.00 (a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications.

(b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.

(c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness.

(d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.

(e) The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by Employer.

(f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant

rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.

26.01.00 Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain:

(1.) Biodata including experience of Commissioning Engineers.
(2.) Role and responsibilities of the Commissioning Organization members.
(3.) Expected duration of posting of the above Commissioning Engineers at site.

26.02.00 **Initial Operation**

(a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.

(b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the contractor shall conduct the trial run as per clause 26.05.00 to demonstrate the compliance to the requirements as stipulated in the CERC (Indian Electricity Grid Code) Regulations, 2023.

The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.

The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.

(c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation.

(d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations,

necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.

26.03.00 **Guarantee Tests**

a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. To conduct such tests, the contractor's Commissioning, start-up Engineer shall make the unit ready before start of initial operation. Such test shall be conducted along with the Initial Operations.

b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.

c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition, the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.

d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.

e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.

26.04.00 Before start of commissioning of critical equipment, Commissioning Clearance Certificate (CCC) to be submitted by Main contractor. List of the critical equipments **and CCC format will be provided along with QA Coordination procedure.**

26.05.00 Trial Run:

Trial run shall be conducted during the initial operation of the unit(s). Definition and provisions related to "trial run" shall be governed by CERC (Indian Electricity Grid Code) Regulations, 2023.

a. Contractor shall demonstrate the following as per the requirements of CERC (Indian Electricity Grid Code) Regulations, 2023:

   i. Operation at a load of fifty-five (55) percent of MCR as per the CEA Technical Standards for Construction for a sustained period of four (4) hours.

ii. Ramp-up from fifty-five (55) percent of MCR to MCR at a ramp rate of at least one (1) percent of MCR per minute, in one step or two steps (with stabilization period of 30 minutes between two steps), and sustained operation at MCR for one (1) hour.

iii. Demonstrate overload capability with the valve wide open as per the CEA Technical Standards for Construction and sustained operation at that level for atleast five (5) minutes.

iv. Ramp-down from MCR to fifty-five (55) percent of MCR at a ramp rate of at least one (1) percent of MCR per minute, in one or two steps (with stabilization period of 30 minutes between two steps).

v. Primary response through injecting a frequency test signal with a step change of ± 0.1 Hz at 55%, 60%, 75% and 100% load. Provision of injecting external frequency test signal in control system for primary frequency response testing shall be in the contractor's scope.

vi. Reactive power capability as per the generator capability curve as provided by OEM considering over-excitation and under-excitation limiter settings and prevailing grid condition. These are the minimum test to be carried out as per the Indian Electricity Grid Code Regulations, 2023. Any other relevant clauses related to system performance or tests specified elsewhere in the specifications shall also be applicable.

b. The contractor shall demonstrate the continuous operation capability of the Unit(s) at MCR as per regulations 22 of CERC (Indian Electricity Grid Code) Regulations, 2023.

27.00.00 **TAKING OVER**

Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such a certificate shall not unreasonably be withheld, nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

28.00.00 **TRAINING OF EMPLOYER'S PERSONNEL**

28.01.00 The scope of service under training of Employer's engineers shall include a training module covering the areas of Operation & Maintenance.

Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Employer:

(a) Training for Steam Generator & ESP Equipment, TG & Auxiliaries and related equipments.

(b) Training for Electric Systems including VFD and Electric power supply system.

(c) Training for other SG/TG related C&I systems/equipments including training on Flame Monitoring System, Furnace and Flame Viewing System, Turbine Supervisory System (TSS) including vibration analyzer, vibration monitoring system axial shift, eccentricity measurements etc. for Main Turbine, BFP Turbine etc. Burner management study, control loop study, misc. system for SG C&I, EHTC, Turbine stress control system, Turbine protection system, ATRS, instrumentation etc.

c1: Training on Engineering, Model building, pre-testing, Post -test fine tuning of Advance process control systems with faculty having experience of at least 5 years in Model Process Control.

(d) Training for special packages specified elsewhere in Technical Specification, Section-VI.

(e) Training for various C&I systems/equipment supplied includes the following:

i) DDCMIS - Human Machine Interface – Hardware & Operating System

ii) DDCMIS-Human Machine Interface System Engineering & Application Software.

iii) DDCMIS – Control System Hardware and Control system Application Software.

iv) DDCMIS – Operator Training: Use of the system at Works + at site.

v) DDCMIS – Specialized Network security.

(f) Training for power cycle piping/critical piping.

(g) Training for UPS systems Annunciation system, SWAS, PA system, flue gas analyzers, CCTV and 24 VDC system.

(h) Training on following aspects of fieldbus (i) Hardware & Software features (ii) System design, diagnostic and testing (iii) maintenance, troubleshooting and fault analysis.

(i) Training on Non-Intrusive hardwired Electric Actuator and Fieldbus based Electric Actuator along with detail training on Foundation Fieldbus/ Profibus interface used in actuator

(k) Training for numerical relays & networking systems supplied under MV & LT switchgear system.

(l) Training courses on offered PLC system in the following areas:

(a.) Operator training

(b.) Hardware Maintenance training

(c.) Software training

(d.) Any other specialized training as required for system operation and maintenance.

(m) Training for Ash Handling System & Coal Handling Plant Equipment and Auxiliaries

Area	Topics	Mandays
Ash Handling Plant	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ash handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Ash handling plant Visit to Manufacturer's Work - Manufacturing process of Ash handling equipment - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	300
Coal Handling Plant	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Coal handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Coal handling plant Visit to Manufacturer's Work - Manufacturing process of Coal handling equipment - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	150

n) Training for UF Membranes, RO membranes, Zero Liquid Discharge (ZLD) Chlorine Di-Oxide (ClO_2) generation & dosing system, Condensate Polishing Plant (CPU) and CW Treatment System.

Area	Topics	MANDAYS
UF Membranes	**Product design** -Basic design features -Theory & principle of operation -Latest technological trends in Ultrafiltration membranes and design -CIP & CEB of UF system **Plant Visit** -Operational feedback -O&M history/problems related to UF membranes **Visit to Manufacturer's Work** -Manufacturing process of UF membranes and equipment -Testing facilities **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	**7**

Area	Topics	MANDAYS
RO membranes	**Product design** -Basic design features -Theory & principle of operation -Latest technological trends in RO membranes and design -Failure analysis, types of failures, causes &	**7**

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	its evaluation, remedies -CIP of RO system **Plant Visit** -Operational feedback -O&M history/problems related to RO membranes **Visit to Manufacturer's Work** -Manufacturing process of RO membranes and equipment -Testing facilities **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	
Zero Liquid Discharge (ZLD)	**System Design** - Plant water optimization and Scheme to achieve the ZLD - Basic design features - Latest technological trends for ZLD in Thermal Power Plant **Plant Visit** - Operational feedback - O&M history/problems related to plant	**5**
Chlorine Di-Oxide (ClO_2) generation & dosing system	**System/Product Design** - Basic design features - Theory & principle of operation - Latest technological trends in Chlorine Di-Oxide (ClO2) generation & dosing system and design aspects & Selection criteria. **Plant Visit** - Operational feedback - O&M history/ problems related to ClO2 plant **Performance Test of generator** **-** Generator capacity performance testing. **Operation & Maintenance of Plant** -Trouble shooting and fault analysis	**5**

	-Familiarization of special maintenance techniques -Special tool and tackles familiarization	
Condensate Polishing Plant (CPU)	**System/Product Design** - Basic design features including Pre-filters - Theory & principle of operation - Latest technological trends in CPU & Pre-filters and design aspects & Selection criteria. **Plant Visit** - Operational feedback - O&M history / problems related to CPU plant **Visit to Manufacturer's Work** -Manufacturing process of pre-filters and major equipment -Testing facilities **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	**3**
CW Treatment System	**System/Product Design** - Basic design features - Theory & principle of operation - Latest technological trends and design aspects & Selection criteria. **Operation & Maintenance of Plant** - Operational feedback - O&M history / problems related to plant - Trouble shooting and fault analysis Familiarization of special maintenance techniques - Special tool and tackles familiarization	**3**
Note: One week shall constitute of five (5) man days.		

(o) Training for Electrical System

Area	Topics	MANDAYS

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Generator	Product design -Design aspects of associated auxiliary systems - Familiarisation with cooling medium and arrangements, winding and core support systems Plant Visit -Operational feedback -O&M history/problems related to Insulation system Visit to Manufacturer's Work -Manufacturing process of core, winding bars, Assembly -Testing facilities Operation & Maintenance (Site) -Trouble shooting and fault analysis - Storage and Familiarization of special maintenance techniques -Special tool and tackles familiarization	60 (15+15+30)

Excitation systems including AVR	System Design - Design features of various sub systems, Exciter PMG - Excitation transformers, Controllers and different limiters - PSS and associated system studies Plant Visit - Operational feedback - O&M history/problems related to Excitation systems - Familiarization with various equipment functioning at reference plant Visit to Manufacturer's Work -Manufacturing process for various equipment of excitation systems -Testing facilities Operation & Maintenance (At site) -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization Performance Test of generator - Generator capacity performance testing.	60 (15+15+30)
MV VFD (If applicable)	System/Product Design - Basic design features - Theory & principle of operation Plant Visit - Operational feedback - O&M history/ problems related to VFD - Familiarization with various equipment functioning at reference plant Operation & Maintenance (At Site) -Trouble shooting and fault analysis - Familiarization of special maintenance techniques -Special tool and tackles familiarization	90 (15+15+60)
MV and LT switchgear	System/Product Design - Basic design features. - Relay configurations and hands on practices of logics and settings preparation - Preparation of CID/ICD/SCD files through	150 (45+15+90).

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	relay software tools and Goose configurations. - Interfacing/communication of relay with software. - Secondary injection testing of protection functions. - Familiarisation of IMCC and Interface with DCS Plant Visit - Operational feedback - O&M history / problems Visit to Manufacturer's Work -Manufacturing process of equipment -Testing facilities Operation & Maintenance (At site) -Trouble shooting and fault analysis -Familiarization of Switchgear, IMCC and interface with DCS, relays and interfacing software. -Special tool and tackles familiarization	
MDBFP, CW and BMCP Motors	System/Product Design - Basic design features of stator core and rotor core, winding insulation and cooling arrangements - Theory & principle of operation - Study of forces and Vibration. - Diagnostic and testing Plant Visit - Operational feedback - O&M history / problems Visit to Manufacturer's Work -Manufacturing process of equipment -Testing facilities Operation & Maintenance (At site) - O&M practices Familiarization of special maintenance techniques - Special tool and tackles familiarization	45 (15+15+15)

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Relays and Substation Automation System	System/Product Design - Basic design features. - Relay configurations and hands on practices of logics and settings preparation - Preparation of CID/ICD/SCD files through relay software tools and Goose configurations. - Interfacing/communication of relay with software. - Secondary injection/ Sampled value testing of protection functions. - Familiarisation of SAS and Cyber security Features. Plant Visit - Operational feedback - O&M history / problems Operation & Maintenance (At site) -Trouble shooting and fault analysis -Familiarization of relay configuration, settings and interfacing software. -Familiarization of SAS Hardware, software and Application software. - Secondary injection/ Sampled value testing of protection functions. - Familiarisation of cyber security features	75 (30+15+30)
AIS and bay equipment's	Operation & Maintenance (At site) -Erection, Storage and handling of bay equipment -Familiarization of special maintenance techniques -Special tool and tackles familiarization	30 (0+15+15)
Note: One week shall constitute of five (5) man days.		

(p) Training on Erection methodologies for all the Sub-packages, System and Equipments associated with the EPC Package, including a visit to power plant construction site.

The exact details, extent and schedule for training shall be as finalized during detailed engineering and shall be subject to Employer's approval.

28.03.00	The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering entire scope for the package. This shall cover all disciplines viz, Mechanical, Electrical, C&I , QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design software of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing erection, welding etc.
28.04.00	Contractor shall also arrange for training of Employer's personnel in respect of fire detection and protection systems and other Balance of Plant equipments.
28.05.00	Contractor shall provide training on application of PAUT (Phased array ultrasonic testing) and TOFD (Time of flight diffraction) techniques for two weeks (at least 80 Hours). The training shall be arranged at least six months prior to the start of erection works of SG & TG works.
28.06.00	Exact details, extent of training and the training schedule shall be finalized based on the Bidder's proposal within two (2) months from placement of award.
28.07.00	In all the above cases, the lodging and boarding of the Employer's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.
28.08.00	Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award. **Note**: 1. For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person. 2. The total man months in each area shall be divided into suitable number of modules which shall be discussed and finalized during post award stage. 3. Duration of each module shall not be less than 10 (ten) working days out of which 20 % shall be for plant/manufacturers' works visits and 80% shall be classroom training. 4. A) Location of classroom training for engineering shall be at Design/Engineering office. B) Classroom training for erection/O&M shall be at location of Manufacturers' works.
28.09.00	**TRAINING REQUIRED IN MAN MONTH**

Area	Engineering (Man months)	Erection (Man months)	O&M (Man months)
Steam Turbine Generator and its Auxiliaries	5.5	8.0	21
Steam Generator and its Auxiliaries	5.5	8.0	20.5
Station C&I (Control and Instrumentation)	3.5	5.5	10
Ash Handling Plant	2.0	3.0	5.0
Coal Handling Plant	1.0	1.5	2.5
UF Membranes, RO Membranes, ZLD, Chlorine Di Oxide (ClO2) generation & dosing system, Condensate Polishing Plant (CPU), CW Treatment System	0.2	0.3	0.5
Electrical systems consisting of generators, Excitation systems, VFD, Motors, MV/LV switchgears, relays, SAS and Switchyard	4.5	3.5	9
Total	**22.2**	**29.8**	**68.5**

29.00.00 **SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION**

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

i) Working platforms should be fenced and shall have means of access.

ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

30.00.00 **NOISE LEVEL**

The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) meter horizontally from the nearest surface of any equipment/machine, furnished and installed under these

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specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for

i) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA.

ii) Regulating drain valves in which case it shall be limited to 90 dBA-115 dBA.

iii) Mill noise which will be limited to 85-90 dBA.

iv) TG unit in which case it shall not exceed 90 dBA.

v) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 90 dBA.

vi) For BFP Motor, Noise level shall be within the limit of 90 dBA.

31.00.00 **PACKAGING, TRANSPORTATION AND STORAGE**

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 Contractor shall be responsible for any loss or damage during transportation, handling and storage at site due to improper packing and preservation. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways, or any other agency concerned in India well before effecting dispatch of equipment. Before dispatching, 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 dispatch of materials for transportation.

In addition to above, the contractor shall take all necessary measures for storage of all electronic equipment / systems at site in a dust free Air-conditioned space ensuring proper temperature & humidity.

32.00.00 **ELECTRICAL EQUIPMENTS/ENCLOSURES**

32.01.00 All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.

33.00.00 **INSTRUMENTATION AND CONTROL**

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

33.01.00 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.

All scales and charts shall be calibrated and printed in Metric Units as follows:

1	Temperature	-	Degree centigrade (deg C)
2.	Pressure	-	Kilograms per square centimetre (Kg/cm^2). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.
3.	Draught	-	Millimetres of water column (mm wc).
4.	Vacuum	-	Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).
5.	Flow (Gas)	-	Tonnes/ hour
6.	Flow (Steam)	-	Tonnes/ hour
7.	Flow (Liquid)	-	Tonnes / hour
8.	Flow base	-	760 mm Hg. 15 deg.C
9.	Density	-	Grams per cubic centimetre.

33.02.00 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.

34.00.00 **ELECTRICAL NOISE CONTROL**

The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment and services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).

35.00.00 **SURGE PROTECTION FOR SOLID STATE EQUIPMENT**

All solid-state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated, and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.

36.00.00 **INSTRUMENT AIR SYSTEM**

The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.

Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.

37.00.00 **TAPPING POINTS FOR MEASUREMENTS**

Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.

For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about the thread standard to be adopted.

The following shall be provided on equipment by the Bidder. The standard which is to be adopted will be intimated to the Contractor.

i) Temperature test pockets with stub and thermowell

ii) Pressure test pockets

38.00.00 **SYSTEM DOCUMENTATION**

The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum

documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification.

The exact format, submission schedule and contents of various documents shall be as finalized during detailed engineering stage.

38.01.00 Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.

39.00.00 **MAINTENANCE MANUALS OF ELECTRONIC MODULES**

The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc. as required to do the testing and maintenance of the electronic modules.

Backup & Restoration Procedures of DDCMIS, Station LAN & Advance Process Control shall be provided.

40.00.00 **MAKE IN INDIA REQUIREMENTS**

a) The bidder shall follow Indian laws, regulations and standards. There shall not be any restriction in terms of compliance to codes & standards of foreign origin only. The compliance to equivalent/better Indian as well as other codes & standards, wherever available, shall also be acceptable.

b) The technologies/ products offered shall be environmentally friendly, consuming less energy, and safe, energy efficient, durable and long lasting under the prescribed operational conditions.

c)	The bidder/its sub vendor/supplier shall ensure supply of spares, materials and technological support for the entire life of the project.
d)	The bidder shall list out the products and components producing Toxic E-waste and other waste as specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled/ disposed of by the contractor and for this, the bidder has to establish recycling/disposal unit as specified. Bidder shall also comply with Plastic Waste Management Rules, 2016, as amended from time to time, and facilitate EPR (Extended Producer Responsibility) registration of Employer before import of plastic packaging product or products with plastic packaging or carry bags or multi-layered packaging or plastic sheets or like.
e)	The equipment/ material sourced from foreign companies will be tested in accredited labs in India before acceptance wherever such facilities are available. The testing shall be carried out in accordance with MOP extant order/guidelines.
f)	The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.
g)	All applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.
h)	Wherever required, the foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of Employer.
i)	To protect the security, integrity and reliability of equipment in this package, it is essential to remove vulnerabilities arising out of the possibility of cyber-attack through malware/ Trojans etc. embedded in imported equipments. This requirement shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in this package. Contractor shall comply all the requirements of Order No 25-11/6/2018-PG, dated 02/07/2020 (attached as **Appendix-I**), issued by Ministry of Power, Government of India and its subsequent amendments/revisions. Contractor shall furnish declaration

	of compliance of MOP order dated 02/07/2020 requirements with dispatch of equipment/ item. Further, Contractor shall furnish back up testing certificates, whenever Employer asks the same.
j)	All equipment/materials/parts/items required in this package which are domestically manufactured with sufficient domestic capacity as identified in Annexure-I of MOP order dated 16/11/2021 including its subsequent revisions (copy attached as **Appendix-II**) shall necessarily be sourced from the class-I local suppliers only as per the extant provisions of the Public Procurement (Preference to Make in India) Orders issued by DPIIT and MoP. Any violation w.r.t Make in India and minimum local content (MLC) requirements as specified shall be sole responsibility of the Bidder.

Appendix-I

No.25-11/6/2018-PG
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg, New Delhi – 110001
Tele Fax: 011-23730264
*****

Dated 02/07/2020

ORDER

Power Supply System is a sensitive and critical infrastructure that supports not only our **national defence**, **vital emergency services** including health, disaster response, **critical national infrastructure** including classified data & communication services, defence installations and manufacturing establishments, logistics services but also the **entire economy** and the **day-to-day life** of the citizens of the country. Any danger or threat to Power Supply System can have catastrophic effects and has the potential to cripple the entire country. Therefore, the Power Sector is **a strategic and critical sector.**

The vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment. Hence, **to protect the security, integrity and reliability of the strategically important and critical Power Supply System & Network** in the country, the following directions are hereby issued :-

(1) All equipment, components, and parts imported for use in the Power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards.

(2) All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MoP).

(3) Any import of equipment/components/parts from "prior reference" countries as specified or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these "prior reference" countries will require prior permission of the Government of India

(4) Where the equipment/components/parts are imported from "prior reference" countries, with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MoP).

This order shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in power supply system or any activity directly or indirectly related to power supply system.

This issues with the approval of Hon'ble Minister of State for Power and New & Renewable Energy (Independent Charge).

(Goutam Ghosh)
Director
Tel: 011-23716674

To:
1. All Ministries/Departments of Government of India (As per list)
2. Secretary (Coordination),Cabinet Secretariat
3. Vice Chairman, NITI Aayog
4. Comptroller and Auditor General of India
5. Chairperson, CEA
6. CMDs of CPSEs/Chairman of DVC & BBMB/MD, EESL/DG,NPTI/DG,CPRI/DG,BEE/
7. All ASs/JSs/EA, MoP

Copy:
1. PS to Hon'ble PM, Prime Minister's Office
2. PS to Hon'ble MOS(IC) for Power and NRE
3. Sr. PPS to Secretary(Power)

SECTION-3

Appendix-II

No. A-1/2021-FSC-Part(5)
Government of India
Ministry of Power
Shram Shakti Bhawan, New Delhi
Dated: 16th November, 2021

ORDER

Subject: Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Power Sector.

Reference: Department for Promotion of Industry and Internal Trade (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 16.09.2020.

The Government of India, Department for Promotion of Industry and Internal Trade (DPIIT) issued Public Procurement (Preference to Make in India), Order 2017, for encouraging 'Make in India' and promoting manufacturing and production of goods and services in India with a view to enhancing income and employment. Subsequently, DPIIT vide order No. P-45021/2/2017-PP (BE-II) dated 4th June, 2020 and further vide order dated 16th September, 2020 have issued the revised Public Procurement (Preference to Make in India) Order 2017.

2. In light of the Public Procurement (Preference to Make in India) Order 2017, this Ministry had notified purchase preference (linked with local content) for Hydro and Transmission sectors vide Order No. 11/05/2018-Coord dated 20.12.2018, for Thermal sector vide Order dated 28.12.2018 and for Distribution sector vide Order dated 17.03.2020. Further, a combined order dated 04.04.2020 was also issued in supersession of all previous orders to indicate equipment/material/components for which there was sufficient local capacity and competition and also to indicate conditions for including suitably in the tenders to be issued by the procurers. In furtherance of Para 19 of the DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 04.06.2020, Ministry of Power (MoP) issued a revised comprehensive Order dated 28.07.2020 (Annexure-I amended by order dated 17.09.2020).

3. DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 16.09.2020 has further revised its order dated 04.06.2020. Therefore, in supersession of all the aforementioned orders including order No.10/1/2019-St.Th. (Part-II) dated 20.03.2020 issued by this Ministry, the following has been decided:

i. For the purpose of this order, the definitions of various terms used in the order, and provisions relating to (i) Eligibility of 'Class-I local supplier'/'Class-II local supplier'/'Non-local suppliers' for different types of procurement, (ii) purchase preference (iii) exemption to small purchases and (iv) margin of purchase preference shall be the same as in DPIIT order dated 16.09.2020, referred to above and extracts of the same is given at **Appendix**.

ii. In procurement of all goods and services or works in respect of which there is sufficient local capacity and local competition as in **Annexure-I,** only "Class–I local supplier" shall be eligible to bid irrespective of purchase value. "Class-I local supplier" is a supplier or service provider whose goods, services or works offered for procurement meets the Minimum Local Content (MLC) as prescribed in Annexure-I of this order. "Class-II local supplier" means a

supplier, as defined by DPIIT in its Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020.

iii. In the procurement of all goods and services or works other than those listed in Annexure-I, only "Class-I local supplier" and "Class-II local supplier" as defined in the order of this Ministry herewith shall be eligible to bid in procurement undertaken by procuring entities, except when Global Tender Enquiry has been issued. In Global tender enquiries, "Non-local suppliers" shall also be eligible to bid along with "Class-I local suppliers" and "Class-II local suppliers". In procurement of all goods, services or works not covered by sub-para 3(ii) above, and with estimated value of purchases less than Rs. 200 crores, in accordance with Rule 161(iv) of GFR, 2017, Global Tender Enquiry(GTE) shall not be issued except with the approval of the competent authority as designated by Department of Expenditure.

iv. For the purpose of this order, 'Works' means all works as per Rule 130 of GFR- 2017, and will also include *'turnkey works'*, Engineering, Procurement and Construction (EPC) contracts and service contracts including System Integrator (SI) contracts.

4. The list of items, in respect of which, local capacity with sufficient competition exists as per **Annexure-I,** will be reviewed at regular intervals with a view to increase number of items in this list and also to increase the MLC for each item, wherever it is less than 100%.

5. Purchase preference shall be given to local suppliers in accordance with **para 3A** of DPIIT Order dated 16.09.2020, and extracts of the same are given at **Appendix**.

6. Further, it has been decided to constitute a committee for independent verification of self-declarations and auditor's / accountant's certificates on random basis and in the case of complaints. The composition of the committee is given below:

Member (Planning), Central Electricity Authority (CEA)	Chairperson
Chief Engineer (PSETD), CEA	Member
Chief Engineer (HETD), CEA	Member
Chief Engineer (TETD), CEA	Member
Chief Engineer (DP&R), CEA	Member
As may be co-opted by CEA	External Expert
Chief Engineer (R&D), CEA	Convener

7. Further, it has also been decided to constitute a committee to examine the grievances in consultation with stakeholders and recommend appropriate actions to the Competent Authority in MoP. The composition of the Committee is given below:

Chairperson, CEA	Chairperson
Member (Hydro), CEA	Member

SECTION-3

Member (Power System), CEA	Member
Member (Thermal), CEA	Convener

8. The complaint fee of Rs. 2 Lakhs or 1% of the value of the local item being procured (subject to maximum of Rs. 5 Lakhs), whichever is higher, shall be paid in the form of Demand Draft, drawn in favour of **PAO, CEA, New Delhi.** In case the complaint is found to be incorrect, the complaint fee shall be forfeited. In case, the complaint is upheld and found to be substantially correct, the deposited fee of the complainant would be refunded without any interest.

9. All other conditions, not stipulated in this order, shall be as laid down in the DPIIT's order No. P-45021/2/2017-PP (BE-II) dated 16.09.2020.

10. This order shall be applicable in respect of the procurement made by all attached or subordinate offices or autonomous bodies under the Government of India including Government Companies as defined in the Companies Act, and /or the States and Local Bodies making procurement under all Central Schemes/ Central Sector Schemes where the Scheme is fully or partially funded by the Government of India. The aforesaid orders shall also be applicable in respect of projects wherein funding of goods, services or works is by Power Finance Corporation (PFC) /Rural Electrification Corporation (REC) and any Financial Institution in which Government of India/ State Government share exists. This order shall be applicable to Tariff Based Competitive Bidding (TBCB) projects also. Procuring entities as defined in the DPIIT's Order dated 16.09.2020 are advised to revise their tender documents to fully comply with the said DPIIT's Order and the subsequent Orders that would be issued in this regard by DPIIT/ this Ministry from time to time.

11. All tenders for procurement by Central Government Agencies or the States and Local Bodies, as the case may be, have to be certified for compliance of the Public Procurement (Preference to Make in India) 'PPP-MII' Order by the concerned procurement officer of the Government Organization before uploading the same on the portal.

12. Exemption from meeting the stipulated local content is allowed as per clause 13 and 13A of PPP-MII Order dated 16.09.2020, if the manufacturer declares that the item is manufactured in India under a License from a foreign Manufacturer who holds Intellectual Property Rights (IPRs) and there is Transfer of Technology (ToT) with phasing to increase Minimum Local Content. For such items, if any CPSE under the administration of Ministry of Power requests exemption for any item, it shall be considered by Ministry of Power, on case to case basis.

13. In order to further encourage Make in India initiatives and promote manufacturing and production of goods and services in India, general guidelines as enclosed at **Annexure-II** may be adopted in an appropriate manner according to the circumstances by the procuring entities in their tendering process.

14. The procurers may specify the higher values of MLC than those specified in this Order in respect of goods, services or works covered in their tenders and award the weightage to the product of higher MLC for which they have to specify the criteria beforehand in their tender. The values given in Annexure-I are the minimum prescribed values for becoming a class-I local supplier for the products indicated therein.

15. This issues with the approval of Hon'ble Minister for Power and New & Renewable Energy.

(S. Majumdar)
Under Secretary to the Government of India
Tele No. 011- 23356938

To:

1. Secretary to Government of India (All Ministries/ Departments of Government of India) (As per list)
2. Secretary (Coordination), Cabinet Secretariat
3. CEO, NITI Aayog
4. Chief Secretaries of all States/ UTs
5. Comptroller and Auditor General of India
6. Secretary, DPIIT, Chairman of Standing Committee for implementation of Public Procurement Order, 2017
7. Director General, Bureau of Indian Standards (BIS)
8. Joint Secretary, DPIIT, Member-Convener of Standing Committee for implementation of Public Procurement Order, 2017
9. Chairperson, CEA
10. CMDs of CPSEs, CMD NLC, Chairman of DVC/ BBMB/ EESL, DGs of BEE/ CPRI/ NPTI
11. All Additional Secretaries/ JSs/ EA/ CE, Ministry of Power

Copy to:

Director (Technical), NIC with a request to publish the Order on the website of Ministry of Power

APPENDIX

Extracts of important provisions contained in DPIIT Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020

1. **Definitions** *(Para 2 of DPIIT order)*:
'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order.

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for "Class-I Local supplier" under this Order.

'Non-Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order.

'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

'Margin of purchase preference' means the maximum extent to which the price quoted by a 'Class-I local supplier' may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

'Works' means all works as per Rule 130 of GFR- 2017, and will also include *'turnkey works'*.

2. **Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement** *(Para 3 of DPIIT order)*
(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by 3(a)above, and with estimated value of purchases less than Rs 200 crores, in accordance with Rule 161(iv) of GFR, 2017 Global tender enquiry shall not

be issued except with the approval of competent authority as designated by Department of Expenditure.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

3. **Purchase Preference** *(Para 3A of DPIIT order)*

(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under.

(b) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are divisible in nature, the " Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

i. Among all qualified bids, the lowest bid will be termed as L1 If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.

ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder.

(c) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

iii. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1,

iv. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.

v. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.

(d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

4. **Applicability in tenders where contract is to be awarded to multiple bidders** *(Para 3B of DPIIT order)*-
In tenders where contract is to be awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:
a) In case there is sufficient local capacity and competition for the items to be procured, as notified by the Nodal Ministry, only 'Class-I local supplier' shall be eligible to bid. As such, the multiple supplier who would be awarded the contract, should be all and only 'Class-I local suppliers'.

   b) In other cases, 'Class-II local suppliers' and 'Non-Local suppliers' may also participate in the bidding process along with 'Class-I local supplier' as per provisions of this order.

   c) If 'Class-I local supplier' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class-I local supplier' do not qualify for award of the contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class-I local supplier' over 'Class-II local supplier'/'Non-local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class-I local suppliers' taken in totality or considered for award of contract for at least 50% of the tendered quantity.

   d) First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference subject to its meeting the prescribed criteria for award of contract as also the constraints of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier' falling within 20% margin of purchase preference, and so on.

   e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulate in sub-paras above.

5. **Exemption of small purchases** *(Para 4 in DPIIT order)*: Procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

6. **Minimum Local Content** *(Para 5 in DPIIT order)*: The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the local content requirement is minimum 20%. Nodal Ministry/Department may prescribe only a higher percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/'Class-II local supplier'. For the item for which Nodal Ministry/Department has not prescribed higher minimum local content notification under the order, it shall be 50% and 20% for 'Class-I local supplier'/'Class-II local supplier' respectively.

7. Vide DPIIT OM No. P-45021/102/2019-BE-IIPart(1) (E-50310) dated 4.03.2021 services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. shall not be considered as local value addition. Bidders offering imported products will fall under the category of Non- local suppliers. They can't claim themselves as Class-I local suppliers/Class-II local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. as local value addition.

8. **Margin of Purchase Preference** *(Para 6 of DPIIT order)*: The margin of purchase preference shall be 20%.

9. **Specifications in Tenders and other procurement solicitations** *(Para 10 of DPIIT order)*:
   a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.
   b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.
   c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.
   d. **Reciprocity Clause:**
      i. When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of baring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc. it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.
      ii. Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all the items related to that nodal Ministry/Department, except for the list of items published by the Ministry/Department permitting their participation.
      iii. The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchase on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/Department.
      iv. State Governments should be encouraged to incorporate similar provisions in their respective tenders.
      v. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.
   e. Specifying foreign certification/ unreasonable technical specifications/ brands/ models in the bid document is restrictive and discriminatory practice against local

suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/ or for any other reason, the same shall be done only after written approval of Secretary of Department concerned or any other authority having been designated such power by the Secretary of the Department concerned.

f. "All administrative Ministries/Departments whose procurement exceeds Rs. 1000 Crore per annum shall notify/ update their procurement projections every year, including those of PSEs/PSUs, for the next 5 years on their respective website."

Annexure-I

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
	(A) Common items for Transmission, Distribution and Generation Sector	
1	Power Transformers (up to 765 kV, including Generator transformers)	60
2	Instrument Transformer (up to 765 kV)	60
3	Transformer Oil Dry Out System (TODOS)	60
4	Reactors up to 765 kV	60
5	Oil Impregnated Bushing (up to 400 kV)	60
6	Resin Insultated Paper (RIP) bushings (up to 145 kV)	50
7	Circuit Breakers (up to 765 kV AC - Alternating Current)	60
8	Disconnectors/Isolators (up to 765 kV AC)	60
9	Wave trap (up to 765 kV AC)	60
10	Oil Filled Distribution Transformers up to & Including 33 kV [Cold Rolled Grain Oriented (CRGO)/Amorphous, Aluminium/Copper wound]	60
11	Dry Type Distribution Transformer upto and including 33 kV (CRGO/Amorphous, Aluminium/Copper wound)	60
12	Conventional Conductor	60
13	Accessories for Conventional conductors	60
14	High Temperature/High Temperature Low Sag (HTLS) conductors (such as Composite core, GAP, ACSS, INVAR, AL59) and Accessories	60
15	Optical ground wire (OPGW) – all designs	60
16	Fiber OpticTerminal Equipment (FOTE) for OPGW	50
17	OPGW related Hardware and Accessories	60
18	Remote Terminal Unit (RTU)	50
19	Power Cables and accessories up to 33 kV	60
20	Control cables including accessories	60
21	XLPE Cables up to 220 kV	60
22	Substation Structures	60
23	Transmission Line Towers	60
24	Porcelain (Disc/Long Rod) Insulators	60
25	Bus Post Insulators (Porcelain)	60
26	Porcelain Disc Insulators with Room Temperature Vulcanisation (RTV) coating	50
27	Porcelain Longrod Insulators withRoom Temperature Vulcanisation (RTV) coating	50
28	Hardware Fittings for Porcelain Insulators	60
29	Composite/Polymeric Long Rod Insulators	60
30	Hardware Fittings for Polymer Insulators	60
31	Bird Flight Diverter (BFD)	60
32	Power Line Carrier Communication (PLCC) System (up to 800 kV)	60
33	Gas Insulated Switchgear (up to 400 kV AC)	60
34	Gas Insulated Switchgear (above 400 kV AC)	50
35	Surge/Lightning Arrester (up to 765 kV AC)	60
36	Power Capacitors	60
37	Packaged Sub-station (6.6 kV to 33 kV)	60
38	Ring Main Unit (RMU) (up to 33 kV)	60
39	Medium Voltage (MV) GIS Panels (up to 33 kV)	60
40	Automation and Control System/Supervisory Control and data Acquisition (SCADA) System in Power System	50
41	Control and Relay Panel (including Digital/Numerical Relays)	50
42	Electrical Motors 0.37 kW to 1 MW	60
43	Energy Meters excluding smart meters	50
44	Control & power cables and Accessories (up to 1.1 kV)	60
45	Diesel Generating (DG) set	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
46	DC system (DC Battery & Battery Charger)	60
47	AC & DC Distribution Board	60
48	Indoor Air Insulated Switchgear (AIS) upto 33 kV	60
49	Poles (PCC, PSCC, Rolled Steel Joist, Rail Pole, Spun, Steel Tubular)	60
50	Material for Grounding/earthing system	60
51	Illumination system	60
52	Overhead Fault Sensing Indicator (FSI)	50
53	Power Quality Meters	50
54	Auxilliary Relays	50
55	Load Break Switch	50
	(B) Hydro Sector	
56	Hydro Turbine & Associated equipment	
	a) Francis Turbine	60
	b) Kaplan Turbine	60
	c) Pelton Turbine	50
57	Main Inlet Valve & Associated Equipment	60
58	Penstock Protection Valve and Associated Equipment	60
59	Governing system & Accessories	60
60	Generator for Hydro Project & Associated Equipment	60
61	Static Excitation System	60
62	Workshop Equipment	60
63	Cooling Water System	60
64	Compressed Air System	60
65	Drainage/Dewatering System	60
66	Fire Protection System	60
67	Heating, Ventilation & Air Conditioning System (HVAC)	60
68	Oil Handling System	60
69	Mechanical Balance of Plant (BOP) Items	60
	(C) Thermal Sector	
	Boiler Auxiliaries	
70	Air Pre-Heater	60
71	Steam Coil Air Pre Heater (SCAPH)	60
72	Steam soot blowers [wall blowers & Long Retractable Soot Blower (LRSB)]	60
73	Auxiliary Steam Pressure Reducing & Desuperheating (PRDS)	60
74	Fuel oil system	60
75	Seal air Fan	60
76	Ducts and dampers	60
77	Duct expansion joints	60
78	Blowdown tanks	60
79	Coal burners and oil burners	60
80	Coal mills	60
81	Gear Box of Coal Mill	50
82	Coal feeders	60
83	Primary Air Fans	60
84	Forced Draft Fans	60
85	Induced Draft Fans	60
86	Forced Draft (FD)/Induced Draft (ID)/ Primary Air (PA) Fan Servo Motor Assembly	50
87	Tubes (Carbon Steel)	50
88	Steam pipes (Carbon Steel)	50
89	Steam drum	50
90	Separator	50
91	Selective Catalytic Reduction (SCR)	50

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
	Electro-Static Precipitators (ESPs)	
92	Casing	60
93	Electrodes	60
94	Rapping System	60
95	Hopper Heaters	60
96	Transformer Rectifiers	60
97	Insulators	60
	Turbine & Auxiliaries	
98	Turbine (High Pressure/Intermediate Pressure/Low Pressure)	50
99	Condensate Extraction Pumps	60
100	Condenser On line Tube Cleaning System (COLTC)	60
101	Debris filters	60
102	Deaerator	60
103	Drain Cooler and Flash Tank	60
104	ECW Pump	50
105	Plate Heat Exchanger	50
106	Self- cleaning filters	50
107	Condensate Polishing Units (CPUs)	60
108	Chemical Dosing System	60
109	Oil Filter	60
110	Gland Steam Condenser	60
111	Oil Purifying Centrifuge	50
112	Water Cooled Condenser	50
113	Boiler Feed Pumps (BFPs)	50
	Generator and Auxillieries	
114	Generator (including Seal Oil System, Hydrogen Cooling System, Stator water cooling system)	60
	Electrical Works	
115	Control and metering equipment	60
	Control & Instrumentation System (C&I System)	
116	Thermocouples	50
117	Measuring instruments [Resistance Temperature Detectors (RTDs)], Local gauges	50
118	Actuators (Pneumatic and conventional electric)	50
119	Interplant Communication/ Public Address (PA) system except IP based	50
	Coal Handling Plant	
120	Conveyors	60
121	Wagon Tippler	60
122	Side Arm Charger	60
123	Paddle feeder	60
124	Crushers & Screens	60
125	Dust suppression (dry fog & plain water) system	60
126	Air Compressors	50
127	Magnetic separators & metal detectors	60
128	Coal Sampling System	60
129	Stacker cum reclaimer	60
130	Belt weighing & monitoring system.	60
131	Wheel & axle assembly (without bearings) for Bottom Opening Bottom Release (BOBR) Wagons	60
	Ash Handling System	
132	Clinker grinder	60
133	Water jet ejectors	60
134	Scrapper chain conveyor	60
135	Dry fly ash vacuum extraction system	60
136	Pressure pneumatic conveying system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
137	Ash water & ash slurry pumps	60
138	Compressors, air dryers & air receivers	50
139	Ash water recovery system	60
	Raw Water Intake & Supply System	
140	Travelling water screens	60
141	Raw water supply pumps	60
142	Valves, RE joints etc.	60
	Water Treatment System and Effluent Treatment System	
143	Clarification plant	60
144	Filtration plant	60
145	Ultra filtration plant	50
146	Reverse Osmosis (RO) plant and its membrane	55
147	De-Mineralised water plant (DM Plant)	60
148	Chlorination plant	60
149	Chemical dosing system	60
150	Effluent Treatment Plant	60
	Circulationg Water (CW) & Auxiliary Circulating Water (ACW) System	
151	CW & ACW Pumps	60
152	Butter Fly (BF) valves, Non-return Valves (NRVs) etc.	60
153	Rubber Expansion (RE) joints	60
154	Air release valves	60
	Cooling Towers (NDCT/ IDCT)-Natural-Draft and Induced Draft Cooling Tower	
155	Water Distribution System	60
156	Spray nozzles	60
157	Packing	60
158	Drift eliminators	60
159	Cooling Tower (CT) Fans (for Induced Draft Cooling Towers IDCT)	60
160	Gear boxes, shafts & motors (for IDCT)	60
	Air Conditioning & Ventilation System	
161	Split & window air conditioners	60
162	Chilling/ condensing unit [upto 500 ton of refrigeration(TR)]	55
163	Air Handling Unit (AHU) and Fresh air unit	60
164	Cooling Towers	60
165	Air Washing Units (AWUs), axial fans, roof extractors	60
166	Ducts, louvers & dampers	60
	Flue Gas Desulphurization (FGD)	
167	Spray Nozzles,	50
168	Spray header	50
169	Oxidation Blowers	50
170	Limestone wet Ball Mill	50
171	Slurry Handling Pumps for FGD system	50
172	Booster Fans for FGD system	50
173	Carbon Steel Ducts and Dampers for FGD	60
174	Storage Tanks and Silos	60
175	Process Water Pump for FGD system	50
	(D) Other Common Items	
	Fire protection and detection system	
176	Motor driven fire water pumps	60
177	Diesel engine driven fire water pumps	60
178	Hydrant system for the power plant.	60
179	High velocity water spray system	60
180	Medium velocity water spray system	60
181	Foam protection system	60
182	Inert gas flooding system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
183	Fire tenders	60
184	Portable fire-extinguishers	60
185	Cranes, EOT cranes, gantry crane & chain pulley blocks etc.	60
186	Elevator	60

(E) Minimum Local Content percentages in Engineering, Procurement & Construction (EPC) / Turnkey project

In case the contract is awarded through the EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local supplier. In addition, MLC for complete EPC project may also be prescribed as below:

	(1) Package Based Works	Minimum Local Content (%)
1	Boiler	60
2	TG System (Water Cooled Condenser)	60
3	Ash Handling Plant	60
4	Coal Handling Plant	60
5	Electro-static Precipitator (ESP)	60
6	Circulating Water (CW) System	60
7	Cooling Tower	60
8	Water Treatment System	60
9	Air Conditioning System (below 500TR)	60
10	Flue Gas Desusphurisation (FGD) System	60
11	Station Control & Instrumentation (C&I)	50
12	Hydro Power Projects (Electro-Mechanical Works)	60
	Gas based generation	
	Overall Gas Turbine Package (on finished Product basis)	
13	< 44 MW	60
14	44 –145 MW	50
	Overall Combined Cycle Gas Turbine (CCGT) Package (on finished Product basis)	
15	< 44 MW	60
16	44 – 145 MW	60
17	> 150 MW	60
	(2) Project as a whole	
1	Works and service contracts in Power Sector	60
2	Transmission Line with Conventional conductors (ACSR, AAAC, AL-59 etc.)	60
3	Transmission Line with High temperature Low Sag (HTLS) conductors	60
4	HVAC Substation Air Insulated (AIS)	60
5	HVAC Substation Gas Insulated (GIS)	60
6	HVDC Substation	60
7	Distribution Sector	60

Annexure-II

General guidelines to be adopted selectively in an appropriate manner by the procuring entities in their tender documents.

1. The bidder shall have to be an entity registered in India in accordance with law.
2. The bids shall be in the language as prescribed by the tenderer/procurer.
3. The bids shall be in Indian Rupees (INR) (in respect of local content only).
4. Indian subsidiaries of foreign bidders shall have to meet the qualifying criteria in terms of capability, competency, financial position, past performance etc.
5. The bidder shall follow Indian laws, regulations and standards.
6. To be eligible for participation in the bid, foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India as may be specified by the tenderer/ procurer.
7. Similar or better technology than the technology offered in respect of material, equipment and process involved shall be transferred to India. Along with the transfer of technology, adequate training in the respective field shall also be provided.
8. Country of origin of the equipment/material shall be provided in the bid.
9. For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for more than _____ years (to be specified by the procurer).
10. The technologies/ products offered shall be environmental friendly, consuming less energy, safe, energy efficient, durable and long lasting under the prescribed operational conditions.
11. The supplier shall ensure supply of spares, materials and technological support for the entire life of the project.
12. The manufacturers/ supplier shall list out the products and components producing Toxic E-waste and other waste as may be specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ supplier and for this, the Manufacturer/supplier along with procurer has to establish recycling / disposal unit **or** as may be specified.
13. Minimum Local Content requirement for goods, services or works shall be in accordance with the conditions laid down in respective Order(s) of the sectors on Public Procurement (Preference to Make in India) to provide for purchase preference (linked with local content).

14. The equipment/ material sourced from foreign companies may be tested in accredited labs in India before acceptance wherever such facilities are available.
15. The Tender fee and the Bank Guarantee (BG) shall be in Indian Rupees only.
16. The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.
17. Applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.
18. Statutory laws/regulations including the labour and environmental laws shall be strictly complied with during supply, storage, erection, commissioning and operation process. A regular compliance report shall be submitted to the procurer/appropriate Authorities.
19. Formation of new joint venture in India shall be permitted only with the Indian companies.
20. Tendering by the agent shall not be accepted.
21. In case local testing is not considered necessary by the procurer, theoriginal test report in the language prescribed by the procurer may be accepted. The translated test report shall not be accepted unless it is notarised.
22. Certification/compliance as per the Indian Standards/ International Standards/ Indian Regulations/ specified Standards shall be mandatory, where ever applicable.
23. Quality assurance of the product shall be carried out by the procurer or an independent third party agency appointed by the procurer. Manufacturing Quality Plan as approved by the procurer shall be followed by the manufacturer/supplier.
24. Wherever required by the procurer, foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of utilities.
25. Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.

LIST OF CODES AND STANDARDS

Indian Standards	Title	International and Internationally recognized standards
IS:277	Galvanised steel sheets (plain or corrugated)	
IS:655	Specification for metal air duct	
IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952
IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Associa-tion of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 Part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573: Part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc: No. BU/4 Rev
IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1.

SECTION-3

IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387: 1957)
IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387: 1967 BS 1387 :1967 BS 1740 :1965
IS:2825	Code for unfired vessels	
IS:1520	Horizontal centrifugal pumps for clear cold and fresh water	
IS:1600	Code for practice for performance of constant speed IC Engines for general purpose	
IS:1601	Specification for perform-ance of constant speed IC Engines for general Purpose	
IS:1893	Criteria for earthquake resistant design of structures	
IS1978-1971	Line Pipe April 1969.	API Standards 5L
IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954
IS:2266	Steel wire ropes for general engineering purposes	BS :302: 1968
IS:2312	Propellant type Ventilation fans	
IS:2365	Steel wire suspension ropes for lifts and hoists	BS: 1957

IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963
IS:3354	Outline dimensions for electric lifts.	
IS:3401	Silica gel	
IS:3588	Specification for electrical axial flow fans	
IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)	
IS:3677	Unbonded rock and slag wool for thermal insulation	
IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
IS:3895	Specification for monocrystallines semiconductor rectifier cells and stacks	
IS:3963	Roof extractor unit	
IS:3975	Mild steel wires, strips and tapes for armouring cables	
IS:4503	Shell and tube type heat Exchanger	

IS:4540	Specification for monory-stallines rectifire assembly equipment	
IS:4671	Expanded polystyrene for thermal insulation purpose	
IS:4736	Hot dip zinc coating on steel tubes	
IS:4894	Centrifugal fans	
IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)	
IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958
IS:6392	Steel pipe flanges	BS 4504 : 1969
IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956
IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524
IS:7373	Specification for wrought aluminium and aluminium sheet and strips	
IS:7938	Air receivers for compressed air installation	
ISO:1217	Displacement compressor-Acceplance test	
ASHRAE-33 and air heating coils.	Methods of testing for rating of forced circulation air cooling	
ASHRAE-52-76 particle matter.	Air cleaning device used in general ventilation for removing	

ASHRAE-22-72	Method of testing for rating of water cooled refrigerant condensers.
ASHRAE 23-67	Methods of testing for rating of positive displacement refrigerant compressors.
ARI-450-6	Standard for water cooled refrigerant condensers.
ARI-550	Standard for centrifugal water chilling packages.
ARI-410	Standard for forced circulation air cooling and air heating coils
ARI-430/435	Central station AHU/Application of Central Station AHU
BS:848 (Part-1,2)	Fans
BS:400	Low carbon steel cylinders for the storage & transport of permanent gases.
BS:401	Low carbon steel cylinders for the storage & transport of liquified gases.
CTI Code ACT-105	Acceptance test code for Water Cooling Tower.
ANSI-31.5	Refrigerant piping
ASME-PTC-23-1958	Atmospheric Water Cooling Equipment
AMCA A-21C	Test Code for air moving devices
API:618	Reciprocating Compressor for general refinary services.

HYDRAULIC INSTITUTE STANDARDS.

HYDRANT SYSTEM MANUALS OF TAC.

TAC MANUALS OF SPRAY SYSTEM

NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.

INDIAN EXPLOSIVES ACT.

INDIAN FACTORIES ACT.

STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.

CODE AND STANDARD FOR CIVIL WORKS

Some of the applicable Standards, Codes and references are as follows:

Excavation & Filling

IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.

IS: 4701	Code of practice for earthwork on canals.
IS: 9758	Guidelines for Dewatering during construction.
IS: 10379	Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.

Properties, Storage and Handling of Common Building Materials

IS: 269	Specification for ordinary Portland cement, 33 grade.
IS: 383	Specification for coarse and fine aggregates from natural sources for concrete.
IS: 432	Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.
IS: 455	Specification for Portland slag cement.
IS: 702	Specification for Industrial bitumen.
IS: 712	Specification for building limes.
IS: 808	Rolled steel Beam channel and angle sections.
IS: 1077	Specification for common burnt clay building bricks.
IS: 1161	Specification of steel tubes for structural purposes.
IS: 1363	Hexagon head Bolts, Screws and nuts of production grade C.
IS: 1364	Hexagon head Bolts, Screws and Nuts of Production grade A & B.
IS: 1367	Technical supply conditions for Threaded fasteners.
IS: 1489	Specification for Portland-pozzolana cement:
(Part-I)	Fly ash based.

(Part-II)	Calcined clay based.
IS: 1542	Specification for sand for plaster.
IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.
IS: 1786	Specification for high strength deformed bars for concrete reinforcement.
IS: 2062	Specification for steel for general structural purposes.
IS: 2116	Specification for sand for masonry mortars.
IS: 2386 (Parts-I to VIII)	Testing of aggregates for concrete.
IS: 3150	Hexagonal wire netting for general purpose.
IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.
IS: 3812	Specification for fly ash, for use as pozzolana and admixture.
IS: 4031	Methods of physical tests for hydraulic cement.
IS: 4032	Methods of chemical analysis of hydraulic cement.
IS: 4082	Recommendations on stacking and storage of construction materials at site.
IS: 8112	Specification for 43 grade ordinary portland cement.
IS: 8500	Medium and high strength structural steel.
IS: 12269	53 grade ordinary portland cement.
IS: 12894	Specification for Fly ash lime bricks.

Cast-In-Situ Concrete and Allied Works

IS: 280	Specification for mild steel wire for general engineering purposes.
IS: 456	Code of practice for plain and reinforced concrete.

	IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.
	IS: 516	Method of test for strength of concrete.
	IS: 650	Specification for standard sand for testing of cement.
	IS: 1199	Methods of sampling and analysis of concrete.
	IS: 1791	General requirements for batch type concrete mixers.
	IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).
	IS: 2204	Code of practice for construction of reinforced concrete shell roof.
	IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.
	IS: 2438	Specification for roller pan mixer.
	IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
	IS: 2505	General requirements for concrete vibrators, immersion type.
	IS: 2506	General requirements for concrete vibrators, screed board type.
	IS: 2514	Specification for concrete vibrating tables.
	IS: 2645	Specification for Integral cement water proofing compounds.
	IS: 2722	Specification for portable swing weigh batches for concrete. (single and double bucket type)
	IS: 2750	Specification for Steel scaffolding.
	IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
	IS: 3025	Methods of sampling and test waste water.
	IS: 3366	Specification for Pan vibrators.
	IS: 3370	Code of practice for concrete structures for the storage of

(Part I to IV)	liquids.
IS: 3414	Code of practice for design and installation of joints in buildings.
IS: 3550	Methods of test for routine control for water used in industry.
IS: 3558	Code of practice for use of immersion vibrators for consolidating concrete.
IS: 4014 (Parts I & II)	Code of practice for steel tubular scaffolding.
IS: 4326	Code of practice for earthquake resistant design and construction of buildings.
IS: 4461	Code of practice for joints in surface hydro-electric power stations.
IS: 4656	Specification for form vibrators for concrete.
IS: 4925	Specification for batching and mixing plant.
IS: 4990	Specification for plywood for concrete shuttering work.
IS: 4995 (Parts I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.
IS: 5256	Code or practice for sealing joints in concrete lining on canals.
IS: 5525	Recommendations for detailing reinforcement in reinforced concrete work.
IS: 5624	Specification for foundation bolts.
IS: 6461	Glossary of terms relating to cement concrete.
IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.
IS: 6509	Code of practice for installation of joints in concrete pavements.
IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)
IS: 9012	Recommended practice for shot concreting.
IS: 9103	Specification for admixtures for concrete.

IS: 9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.
IS: 10262	Recommended guidelines for concrete mix design.
IS: 11384	Code of practice for composite construction in structural steel and concrete.
IS: 11504	Criteria for structural design of reinforced concrete natural draught cooling towers.
IS: 12118	Specification for two-parts poly sulphide.
IS: 12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.
IS: 13311	Method of non-destructive testing of concrete.
Part-1	Ultrasonic pulse velocity.
Part-2	Rebound hammer.
SP:23	Handbook of concrete mixes
SP: 24	Explanatory Handbook on IS: 456-1978
SP: 34	Handbook on concrete reinforcement and detailing.

Precast Concrete Works

SP: 7(Part VI / Sec.7)	National Building Code- Structural design of prefabrication and systems building.
IS: 10297	Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.
IS: 10505	Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.

Masonry and Allied Works

IS: 1905	Code of Practice for Structural Safety of Buildings-Masonry walls.
IS: 2212	Code of Practice for Brickwork.

IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.
SP: 20	Explanatory handbook on masonry code.

Sheeting Works

IS:277	Galvanised steel sheets (plain or corrugated).
IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.
IS: 513	Cold-rolled carbon steel sheets.
IS: 730	Specification for fixing accessories for corrugated sheet roofing.
IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.
IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.
IS: 3007	Code of practice for laying of asbestos cement sheets.
IS: 5913	Methods of test for asbestos cement products.
IS: 7178	Technical supply conditions for tapping screw.
IS: 8183	Bonded mineral wool.
IS: 8869	Washers for corrugated sheet roofing.
IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.
IS: 12866	Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced).
IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.

Fabrication and Erection of Structural Steel Work

IS: 2016	Specification for plain washers.
IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.

IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.
IS: 3502	Specifications for chequered plate.
IS: 6911	Specification for stainless steel plate, sheet and strip.
IS: 3757	Specification for high strength structural bolts
IS: 6623	Specification for high strength structural nuts.
IS: 6649	High Tensile friction grip washers.
IS: 800	Code of practice for use of structural steel in general building construction.
IS: 816	Code of practice for use of Metal Arc Welding for General Construction.
IS: 4000	Code of practice for assembly of structural joints using high tensile friction grip fasteners.
IS: 9595	Code of procedure of Manual Metal Arc Welding of Mild Steel.
IS: 817	Code of practice for Training and Testing of Metal Arc Welders.
IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).
IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.
IS: 9006	Recommended Practice for Welding of Clad Steel.
IS: 7215	Tolerances for fabrication steel structures.
IS: 12843	Tolerance for erection of structural steel.
IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.
SP: 6 (Part 1 to 7)	ISI Handbook for structural Engineers.

IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.
IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube
IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.
IS : 2595	Code of Practice for Radio graphic testing.
IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.
IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.
IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.
IS : 3658	Code of practice for Liquid penetrant Flaw Detection.
IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.

Plastering and Allied Works

IS : 1635	Code of practice for field slaking of Building lime and preparation of putty.
IS : 1661	Application of cement and cement lime plaster finishes.
IS : 2333	Plaster-of-paris.
IS : 2402	Code of practice for external rendered finishes.
IS : 2547	Gypsum building plaster.
IS : 3150	Hexagonal wire netting for general purpose.

Acid and Alkali Resistant Lining

IS : 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.
IS : 412	Specification for expanded metal steel sheets for general purpose.

IS : 4441	Code of practice for use of silicate type chemical resistant mortars.
IS : 4443	Code of practice for use of resin type chemical resistant mortars.
IS : 4456	Method of test for chemical resistant tiles. (Part I & II)
IS : 4457	Specification for ceramic unglazed vitreous acid resistant tiles.
IS : 4832	Specification for chemical resistant mortars.
	Part I Silicate type
	Part II Resin type
	Part III Sulphur type
IS : 4860	Specification for acid resistant bricks.
IS : 9510	Specification for bitumasitc, Acid resisting grade.

Water Supply, Drainage and Sanitation

IS : 458	Specification for concrete pipes.
IS : 554	Dimensions for pipe threads, where pressure tight joints are made on thread.
IS : 651	Specification for salt glazed stoneware pipes.
IS : 774	Flushing cisterns for water closets and urinals.
IS : 775	Cast iron brackets and supports for wash basins and sinks.
IS : 778	Copper alloy gate, globe and check valves for water works purposes.
IS : 781	Cast copper alloy screw down bib taps and stop valves for water services.
IS : 782	Caulking lead.
IS : 783	Code of practice for laying of concrete pipes.

IS : 1172	Basic requirements for water supply, drainage and sanitation.
IS : 1230	Cast iron rain water pipes and fittings.
IS : 1239	Mild steel tubes, tubulars and other wrought steel fittings.
IS : 1536	Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.
IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.
IS : 1538	Cast iron fittings for pressure pipe for water, gas and sewage.
IS : 1703	Ball valves (horizontal plunger type) including float for water supply purposes.
IS : 1726	Cast iron manhole covers and frames.
IS : 1729	Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.
IS : 1742	Code of practice for building drainage.
IS : 1795	Pillar taps for water supply purposes.
IS : 1879	Malleable cast iron pipe fittings.
IS : 2064	Code of practice for selection, installation and maintenance of sanitary appliances.
IS : 2065	Code of practice for water supply in building.
IS : 2326	Automatic flushing cisterns for urinals.
IS : 2470 (Part-I & II)	Code of practice for installation of septic tanks.
IS : 2501	Copper tubes for general engineering purposes.
IS : 2548	Plastic seat and cover for water-closets.
IS : 2556 (Part 1 to 15)	Vitreous sanitary appliances (vitreous china).
IS : 2963	Non-ferrous waste fittings for wash basins and sinks.

IS : 3114	Code of practice for laying of cast iron pipes.
IS : 3311	Waste plug and its accessories for sinks and wash basins.
IS : 3438	Silvered glass mirrors for general purposes.
IS : 3486	Cast iron spigot and socket drain pipes.
IS : 3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).
IS : 3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
IS : 4111 (Part I to IV)	Code of practice for ancillary structure in sewerage system.
IS : 4127	Code of practice for laying of glazed stone-ware pipes.
IS : 4764	Tolerance limits for sewage effluents discharged into inland-surface waters.
IS : 4827	Electro plated coating of nickel and chromium on copper and copper alloys.
IS : 5329	Code of practice for sanitary pipe work above ground for buildings.
IS : 5382	Rubber sealing rings for gas mains, water mains and sewers.
IS : 5822	Code of practice for laying of welded steel pipes for water supply.
IS : 5961	Cast iron grating for drainage purpose.
IS : 7740	Code of practice for road gullies.
IS : 8931	Cast copper alloy fancy bib taps and stop valves for water services.
IS : 8934	Cast copper alloy fancy pillar taps for water services.
IS : 9762	Polyethylene floats for ball valves.
IS : 10446	Glossary of terms for water supply and sanitation.

IS : 10592	Industrial emergency showers, eye and face fountains and combination units.
IS : 12592	Specification for precast concrete manhole covers and frames.
IS : 12701	Rotational moulded polyethylene water storage tanks.
SP: 35	Handbook on water supply and drainage.
-	Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.

Doors, Windows and Allied Works

IS : 204	Tower Bolts
Part-I	Ferrous metals.
Part-II	Nonferrous metals.
IS : 208	Door Handles.
IS : 281	Mild steel sliding door bolts for use with padlocks.
IS : 362	Parliament Hinges.
IS : 420	Specification for putty, for use on metal frames.
IS : 1003 Part-I door	Specification for timber panelled and glazed shutters- (Part-I) shutters.
IS : 1038	Steel doors, windows and ventilators.
IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
IS : 1341	Steel butt hinges.
IS : 1361	Steel windows for industrial buildings.
IS : 1823	Floor door stoppers.
IS : 1868	Anodic coatings on Aluminium and its alloys.
IS : 2202 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels

IS:2209	Mortice locks (vertical type).
IS:2553	Safety glass
IS:2835	Flat transparent sheet glass.
IS:3548	Code of practice for glazing in buildings.
IS:3564	Door closers (Hydraulically regulated).
IS : 3614	Fire check doors; plate, metal covered and rolling type.
IS:4351	Steel door frames.
IS:5187	Flush bolts.
IS:5437	Wired and figured glass
IS:6248	Metal rolling shutters and rolling grills.
IS:6315	Floor springs (hydraulically regulated) for heavy doors.
IS:7196	Hold fasts.
IS:7452	Hot rolled steel sections for doors, windows and ventilators.
IS:10019	Mild steel stays and fasteners.
IS:10451	Steel sliding shutters (top hung type).
IS:10521	Collapsible gates.

Roof Water Proofing and Allied Works

IS:1203	Methods of testing tar and bitumen.
IS:1322	Specification for bitumen felts for water proofing and damp proofing.
IS:1346	Code of practice for water proofing of roofs with bitumen felts.
IS:1580	Specification for bituminous compound for water proofing and caulking purposes.

IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.

Floor Finishes and Allied Works

IS:1237	Specification for cement concrete flooring tiles.
IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.
IS:2114	Code of practice for laying in-situ terrazzo floor finish.
IS:2571	Code of practice for laying in-situ cement concrete flooring.
IS:3462	Specification for unbacked flexible PVC flooring.
IS:4971	Recommendations for selection of industrial floor finishes.
IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.
IS:8042	Specification for white portland cement.
IS:13801	Specification for chequered cement concrete flooring tiles.

Painting and Allied Works

IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.
IS:1477	Code of practice for painting of ferrous metals in buildings.
Part-I	Pretreatment.
Part-II	Painting.
IS:1650	Specification for colours for building and decorative finishes.
IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.
IS:2338	Code of practice for finishing of wood and wood based materials.
Part-I	Operations and workmanship
Part-II	Schedules

IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.
Part-I	Operations and workmanship.
Part-II	Schedule.
IS:2524	Code of practice for painting of nonferrous metals in buildings.
Part-I	Pretreatment.
Part-II	Painting.
IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.
IS:2933	Specification enamel paint, under coating and finishing.
IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.
IS:5410	Specification for cement paint
IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use
IS:6278	Code of practices for white washing and colour washing.
IS:10403	Glossary of terms relating to building finishes.

Piling and Foundation

IS:1080	Code of practice for design and construction of simple spread foundations.
IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.
IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).
IS:2950 (Part-I)	Code of practice for designs and construction of Raft foundation.
IS:2974 (Part-I TO V)	Code of practice for design and construction of machine foundations.
IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.
IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.

Part-I	Shallow foundations.
Part-II	Deep foundations.
IS:12070	Code of practice for design and construction of shallow foundations on rocks.
DIN:4024	Flexible supporting structures for machines with rotating machines.
VDI:2056	Criteria for assessing mechanical vibrations of machines.
VDI:2060	Criteria for assessing rotating imbalances in machines.
Stop Log and Trash Rack	
IS:4622	Recommendations for fixed - wheel gates structural design.
IS:5620	Recommendations for structural design criteria for low head slide gates.
IS:11388	Recommendations for design of trash rack for intakes.
IS:11855	General requirements for rubber seals for hydraulic gates.
Roads	
IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.
IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.
IRC:16	Specification for priming of base course with bituminous primers.
IRC:19	Standard specifications and code of practice for water bound macadam.
IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).
IRC:34	Recommendations for road construction in waterlogged areas.
IRC:36	Recommended practice for the construction of earth embankments for road works.
IRC:37	Guidelines for the Design of flexible pavements.
IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
IRC:73	Geometric design standards for rural (non-urban) highways.
IRC:86	Geometric Design standards for urban roads in plains.
IRC:SP:13	Guidelines for the design of small bridges & culverts.
IRC - Public-	Ministry of Surface Transport (Roads Wing), Specifications

ation	for road and bridge works.
IS:73	Specification for paving bitumen
Loadings	
IS:875	Code of practice for design loads other than earthquake) for
(Pt. I to V)	buildings and structures.
IS:1893	Criteria for earthquake resistant design of structures.
IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.
IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.
M.O.T.	Deptt. of railways Bridge Rules.
Safety	
IS:3696	Safety code for scaffolds and ladders.
(Part I & II)	
IS:3764	Safety code for excavation work.
IS:4081	Safety code for blasting and related drilling operations.
IS:4130	Safety code for demolition of buildings.
IS:5121	Safety code for piling and other deep foundations.
IS:5916	Safety code for construction involving use of hot bituminous materials.
IS:7205	Safety code for erection on structural steelwork.
IS:7293	Safety code for working with construction machinery.
IS:7969	Safety code for handling and storage of building materials
IS:11769	Guidelines for safe use of products containing asbestos.

- Indian Explosives Act. 1940 as updated.

Architectural design of buildings

SP:7	National Building Code of India
SP:41	Handbook on functional requirements of buildings (other than industrial buildings)

Miscellaneous

IS:802 (Relevant parts)	Code of practice for use of structural steel in overhead transmission line towers.
IS:803	Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.
IS:10430	Creteria for design of lined canals and liner for selection of type of lining.
IS:11592	Code of practice for selection and design of belt conveyors.
IS:12867	PVC handrails covers.
CIRIA Publication	Design and construction of buried thin-wall pipes.

REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION

The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.

Temperature Measurements

1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.
3. Temperature measuremnet by electrical Resistance thermometers - IS:2806.
4. Thermometer - element - Platinum resistance - IS:2848.

Pressure Measurements

1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964).
   b) Electonic transmitters BS:6447.
2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.
3. Process operated switch devices (Pr. Switch) BS-6134.

SECTION-3

Flow Measurements

Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II.

Measurement of fluid flow in closed conduits - BS-1042.

Electronic Measuring Instrument & Control Hardware/ Software

1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319.
2. Safety requirements for electrical and electronic measuring and controling instrument - ANSI C 39.5 - 1974.
3. Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975.
4. Dynamic response testing of process control instrumentation ISA - S 26 (1968).
5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472.
6. Printed circuit boards - IPC TM - 650, IEC 326 C.
7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973.
8. Edge socket connectors - IEC 130-11.
9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.
10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980).
11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R).
12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990.
13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989.
14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985.
15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.

16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985.

17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985.

18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984.

19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983.

20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978.

21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987.

22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.

Instrument Switches and Contact

1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000.

2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600.

Enclosures

1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13).

2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972).

3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962.

Apparatus, enclosures and installation practices in hazardous area

1. Classification of hazardous area - NFPA 70 - 1984, Article 500.

2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973.

3. Instrinsically safe apparatus - NFPA 493 1978.

4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982.

5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.

Sampling System

1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316.
2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977.
3. Water and steam in power cycle - ASME PTC 19.11.
4. Standard methods of sampling system - ASTM D 1066-99.

Annunciators

1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979.
2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472
3. Damp heat cycling test - IS:2106
4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78

Protections

1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989.
2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973.
3. Turbine water damage prevention - ASME TDP-1-1980.
4. Boiler safety interlocks - NFPA Section 85 B - 1984, 85 C - 1991.

UPS System

1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973.
2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983.
3. Surge withstand capability test - ANSI C 37.90 1 -1989.
4. Performance testing of UPS - IEC 146.
5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.

6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985.

7. Printed Circuit Board - IPC TM 650, IEC 326C.

8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973.

Control Valves

1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985.

2. Face to face dimensions of control valves - ANSI B 16.00 - 1973.

3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2).

4. Codes for pressure piping - ANSI B 31.1

5. Control Valve leak class - ISA RP 39.6

Process Connection & Piping

1. Codes for pressure piping "power piping" - ANSI B 31.1.

2. Seamless carbon steel pipe ASTM - A - 106.

3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182.

4. Material for socket welded fittings - ASTM - A - 105.

5. Seamless ferritic alloy steep pipe - ASTM - A - 335.

6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234.

7. Composition bronze of ounce metal castings - ASTM - B - 62.

8. Seamless Copper tube, bright annealed - ASTM - B - 168.

9. Seamless copper tube - ASTM - B - 75.

10. Dimension of fittings - ANSI - B - 16.11.

11. Valves flanged and butt welding ends - ANSI - B - 16.34.

Instrument Tubing

1. Seamless carbon steel pipe - ASTM - A 106.

2. Material of socketweld fittings - ASTM - A105.

3. Dimensions of fittings - ANSI - B - 16.11.

4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1.

Cables

1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992.

2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815.

3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorugh 2/83.

4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6).

5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977.

6. Rules for Testing insulated cables and flexible cables : VVDE - 0472

7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)

8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81.

9. Oxygen index and temperature index test - ASTM D - 2863.

10. Smoke density measurement test - ASTMD - 2843.

11. Acid gas generation test - IEC - 754 - 1.

12. Swedish Chimney test - SEN - 4241475 (F3).

13. Teflon (FEP) insulation & sheath test - ASTMD - 2116.

14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784.

15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I).

Cable Trays, Conduits

1. Guide for design and installation of cable systems in power generating staiton (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984.

2. -do- Test Standards. NEMA VE-1-1979.

3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTMA - 386-78.

Public Address System

1. Specifications for lod speakers - IS:7741 (Part-I, II and III)
2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301
3. Specification for Public Address Amplifiers - IS:10426.
4. Code of practice for outdoor installation of PA system - IS:1982.
5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881.
6. Basic environmental testing procedures for electronic and electrical items - IS:9000.
7. Characteristics and methods of measurements for sound system equipment - IS:9302
8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732
9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II)
10. Fittings for rigid steel conduits for electrical wiring - IS:2667
11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147.

Vibration Monitoring System

1. API 670 - 1994
2. BS : 4675 Part-2

ANNEXURE-III

एनटीपीसी NTPC	**Project :** **Stage ::** **Package :** **Supplier :** **Contractor No. :**	**LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL** **SUB-SYSTEM :**	**DOC. NO.:** **REV. NO.:** **DATE :** **PAGE : OF**

S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – **For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list alongwith the condition of approval, if any.**

DR **– For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list.**

NOTED **– For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED.'**

QP/INSPN CATEGORY:

CAT-I **: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.**

CAT-II **: For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.**

CAT-III **: For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.**

UNITS/WORKS **: Place of manufacturing Place of Main Supplier of multi units/works.**

FORMAT NO.: QS-01-QAI-P-1/F3-R0 1/1 Engg. Div. / QA&I

SECTION-3

ANNEXURE-IV

एनटीपीसी NTPC	Project : Stage :: Package : Contractor : Contractor No. :	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL

DOC. NO.:
REV. NO.:
DATE :
PAGE : OF

S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-mission	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks

FORMAT 1/1 Engg. Div. / QA&I

SECTION-3

एनटीपीसी NTPC	Project : Stage : Contractor : Contractor No. : System :	FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code: ……

DOC. NO.:
REV. NO.:
DATE :
PAGE : OF

Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	

NOTES:

SIGNATURE

FORMAT	1/1	**Engg. Div. / QA&I**

SECTION-3

S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	3	-
	▪ Other Drawings/Documents (A0 & A1 sizes)	3	-
	▪ P&ID (All sizes)	3	-
	a) Final drawings/documents (Directly to site)	3	2
	b) "As Built" Drawing/Documents (Directly to site)	3	2
	c) Analysis reports of Equipments / piping / structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	3 sets	2
3	Operation & Maintenance manual i) First Submission	0	--
	ii) Final Submission (Directly to site)	3 sets	2
4	Plant Hand Book i) Final Submission	1	1
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	3 sets	2

SECTION-3

S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	1 sets	--
	ii) Approved Copies (Direct to Site)	3 sets	2
7	Project Completion Report (Directly to site)	3 sets	2

CORPORATE QUALITY ASSURANCE/ कॉरपोरेट गुणवत्ता आश्वासन

MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT

मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट

Annexure - VII

Ref No: संदर्भ सं.:			***Date:*** तिथिः		
i.	***Main Contractor*** मुख्य संविदाकार				
ii.	***Project*** परियोजना				
iii.	***Package Name*** पैकेज का नाम		***Package No*** पैकेज सं.		
iv.	***Proposed Item/Scope of Sub-contracting*** उप-संविदा(अनुबंध) का प्रस्तावित मद/ दायरा				
v.	***Item covered under*** *निम्नलिखित के अंतर्गत शामिल मद*	***Schedule-1*** */अनुसूची- 1*	☐	***As per contract clause No-*** *अनुबंध के अनुसार खंड सं.-- -*	
		Schedule-2 *अनुसूची- -2*	☐		
vi.	***If item is Schedule-1 and proposed sub-vendor is indigenous, Main Contractor to explain how the contractual provisions will be fulfilled*** /यदि मद अनुसूची -**1** है और प्रस्तावित उप-विक्रेता स्वदेशी है, तो मुख्य संविदाकार को स्पष्ट करना होगा कि संविदा/अनुबंध के प्रावधान कैसे पूरे किए जाएंगे				
vii.	***Name and Address of the proposed Sub-vendor's works*** /प्रस्तावित सब-वेंडर का नाम तथा पता				
viii.	***PO placement date/ Start of manufacturing (if self-manufactured) as per L2 network*** **पीओ नियोजन की तिथि / एल-** 2 **नेटवर्क के अनुसार विनिर्माण (यदि स्व-निर्मित है) की शुरुआत**				

ix.	***Item Description (Type/Size/Rating/Scope of Sub-Contracting)*** मद का विवरण (प्रकार / आकार / रेटिंग / उप-अनुबंध का दायरा)	***Total quantity of proposed item envisaged in this package (Nos/ Running Meters/ Kgs/ Tons etc)*** इस पैकेज में परिकल्पित प्रस्तावित मद की कुल मात्रा (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि)	***Quantity proposed to be procured from proposed sub-vendor (Nos/ Running Meters /Kgs /Tons etc)*** प्रस्तावित उप-विक्रेता (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि) से खरीदी जाने वाली मात्रा	***Timeline for quantity requirements as per project schedule & whether the proposed Sub-vendor equipped with adequate capacity to supply proposed order quantity in time*** / परियोजना समय सूची के अनुसार मात्रा आवश्यकताओं के लिए समय-सीमा और क्या प्रस्तावित उप-विक्रेता समय पर प्रस्तावित मांग की मात्रा की आपूर्ति करने में पूरी तरह से सक्षम है

x.	***Supply experience of the proposed sub-vendor (including supplies to Main Contractor, if any) for similar item/scope of sub-contracting, for last 3 years (Note:- Only relevant experience details w.r.t. proposed item/scope of subcontracting to be brought out here)*** पिछले **3** वर्षों के लिए उप-अनुबंध के समान मद / दायरे के लिए प्रस्तावित सब-वेंडर (मुख्य संविदाकार हेतु आपूर्ति, यदि कोई हो, सहित) का आपूर्ति अनुभव (नोट: - उप-अनुबंध के प्रस्तावित मद / दायरे के संबंध में केवल प्रासंगिक अनुभव के विवरण का उल्लेख हो

SECTION-3

MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT
मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट

Annexure - VII

	Project/Package परियोजना/पैकेज	***Customer Name*** ग्राहक का नाम	***Supplied Item (Type/Rating/Model /Capacity/Size etc)*** आपूर्त्तित मद (प्रकार/रेटिंग /मॉडल /क्षमता/आकार आदि)	***PO ref no/date*** पीओ संदर्भ सं. /तिथि	***Supplied Quantity*** आपूर्ति की मात्रा	***Date of Supply*** आपूर्त्ति की तिथि

We confirm that as per our physical assessment, the proposed sub-vendor has requisite capabilities & supply experience and is suitable for supplying the proposed item/scope of sub-contracting/हम अपने भौतिक आकलन के अनुसार इस बात की पुष्टि करते हैं कि, प्रस्तावित उप-विक्रेता के पास अपेक्षित क्षमता और आपूर्ति करने का अनुभव है और उप-अनुबंध के दायरे /प्रस्तावित मद की आपूर्ति के लिए उपयुक्त है।

Pl. refer the attached the Physical assessment report.

कृपया संलग्न भौतिक आकलन रिपोर्ट देखें।

Name: नाम:		***Desig:*** पद:		***Contact No:*** दूरभाष सं.:		***Sign:*** हस्ताक्षर:		***Date:*** तिथि:	

Company's Seal/Stamp:- कंपनी का मुहर:-

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SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली

Annexure - VII

I.	***Item/Scope of Sub-contracting*** **उप-संविदा(अनुबंध) का मद/ दायरा**	
II.	***Address of the registered office*** पंजीकृत कार्यालय का पता	***Details of Contact Person*** संपर्क व्यक्ति का विवरण ***(Name, Designation, Mobile, Email)*** (नाम, पदनाम, मोबाइल, ईमेल)
III.	***Name and Address of the proposed Sub-vendor's works where item is being manufactured*** प्रस्तावित उप-विक्रेता के कार्यों का नाम और पता, जहां मद का निर्माण किया जा रहा है	***Details of Contact Person:*** संपर्क व्यक्ति का विवरण ***(Name, Designation, Mobile, Email)*** (नाम, पदनाम, मोबाइल, ईमेल)
IV.	***Annual Production Capacity for proposed item/scope of sub-contracting*** **उप-संविदा(अनुबंध)** के प्रस्तावित मद / दायरे के लिए वार्षिक उत्पादन क्षमता	
V.	***Annual production for last 3 years for proposed item/scope of sub-contracting*** **उप-संविदा(अनुबंध)** के प्रस्तावित मद / दायरे के लिए पिछले 3 वर्षों का वार्षिक उत्पादन	
VI.	***Details of proposed works*** **प्रस्तावित कार्यों का विवरण**	
1.	***Year of establishment of present works*** वर्तमान फैक्टरी की स्थापना का वर्ष	
2.	***Year of commencement of manufacturing at above works*** उपरोक्त फैक्टरी में निर्माण कार्य शुरू होने का वर्ष	
3.	***Details of change in Works address in past (if any*** पूर्व में फैक्टरी स्थल में परिवर्तन का विवरण (यदि कोई हो))	
4.	***Total Area*** कुल क्षेत्र	
	Covered Area शामिल क्षेत्र	
5.	***Factory License/Registration Certificate*** (as applicable) फैक्टरी लाइसेंस/ पंजीकरण प्रमाण पत्र	***Details attached at Annexure – F2.1*** विवरण अनुलग्नक- एफ 2.1 पर संलग्न है
6.	***Design/ Research & development set-up*** डिजाइन / अनुसंधान और विकास सेटअप ***(No. of manpower, their qualification, machines & tools employed etc.)*** (श्रमिकों की संख्या, उनकी योग्यता, मशीन और उपलब्ध उपकरण आदि)	***Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design)*** ***Details attached at Annexure – F2.2*** ***(if applicable)*** लागू / लागू नहीं, अगर विनिर्माण मुख्य संविदाकार / खरीददार के डिजाइन के अनुसार है) विवरण अनुलग्नक –एफ 2.2 पर संलग्न है। (यदि लागू हो)
7.	***Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)*** मैनपावर विवरण के साथ समग्र संगठन का चार्ट(डिजाइन / विनिर्माण / गुणवत्ता आदि)	***Details attached at Annexure – F2.3*** विवरण अनुलग्नक – F2.3 में संलग्न है।
8.	***After sales service set up in India, in case of foreign sub-vendor(Location, Contact Person, Contact details etc.)*** भारत	***Applicable / Not applicable*** लागू / लागू नहीं

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	में बिक्री सेवा की स्थापना के बाद, विदेशी उप-विक्रेता के मामले में(स्थल , संपर्क व्यक्ति, संपर्क विवरण आदि)	***Details attached at Annexure – F2.4*** विवरण अनुलग्नक -2.4 पर संलग्न है।
9.	***Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any*** फ्लोचार्ट सहित विनिर्माण प्रक्रिया निष्पादन योजना , जिसमें आउटसोर्स प्रक्रिया, यदि कोई हो, सहित कच्चे माल से तैयार उत्पाद तक विनिर्माण के विभिन्न चरणों को दर्शाया गया हो,	***Details attached at Annexure – F2.5*** विवरण अनुलग्नक - F2.5में संलग्न है।
10.	***Sources of Raw Material/Major Bought Out Item*** कच्चे माल के स्रोत / खरीदे हुए मुख्य मद	***Details attached at Annexure – F2.6*** विवरण अनुलग्नक - F2.6में संलग्न है।
11.	***Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing*** कच्चे माल / खरीदे हुए मद, प्रक्रियाबद्ध, अंतिम परीक्षण, पैकिंग करते समय गुणवत्ता नियंत्रण	***Details attached at Annexure – F2.7*** विवरण अनुलग्नक - F2.7 पर संलग्न है
12.	***Manufacturing facilities (List of machines, special process facilities, material handling etc.)*** विनिर्माण सुविधा(मशीनों की सूची , विशेष प्रक्रिया सुविधाएं, सामग्री रख-रखाव आदि)	***Details attached at Annexure – F2.8*** विवरण अनुलग्नक - F2.8में संलग्न है।
13.	***Testing facilities (List of testing equipment)*** परीक्षण सुविधाएं(परीक्षण उपकरण की सूची)	***Details attached at Annexure – F2.9*** विवरण अनुलग्नक – F2. 9 में संलग्न है।
14.	***If manufacturing process involves fabrication then-*** यदि निर्माण प्रक्रिया में फेब्रिकेशन की गई है तो-	***Applicable / Not applicable*** लागू / लागू नहीं ***Details attached at Annexure – F2.10*** विवरण अनुलग्नक - F2.10में संलग्न है। ***(if applicable)*** लागू / लागू नहीं
	List of qualified Welders पात्र वेल्डर की सूची	
	List of qualified NDT personnel with area of specialization विशेषज्ञता के क्षेत्र सहित पात्र एनडीटी कार्मिकों की सूची	
15.	***List of out-sourced manufacturing processes with Sub-Vendors' names & addresses*** सब-वेंडर द्वारा बाह्य स्रोतों (उनके नाम और पते सहित)से करवाएं गए निर्माण प्रक्रियाओं की सूची	***Applicable / Not applicable*** लागू / लागू नहीं ***Details attached at Annexure. –F2.11*** विवरण अनुलग्नक - F2.10में संलग्न है। ***(if applicable)*** (यदि लागू हो)
16.	***Supply reference list including recent supplies*** नवीनतम आपूर्ति सहित आपूर्ति संदर्भ सूची	***Details attached at Annexure – F2.12*** विवरण अनुलग्नक - F2.12 में संलग्न है। ***(as per format given below)*** (नीचे दिए गए प्रारूप के अनुसार)

Project/ package परियोजना /पैकेज	***Customer Name*** ग्राहक का नाम	***Supplied Item (Type/Rating/Model /Capacity/Size etc)*** आपूर्ति की गई वस्तु (प्रकार / रेटिंग / मॉडल / क्षमता / आकार आदि)	***PO ref no/date*** पीओ संदर्भ सं. / तिथि	***Supplied Quantity*** आपूर्ति की मात्रा	***Date of Supply*** आपूर्ति की तारीख

17.	***Product satisfactory performance feedback letter/certificates/End User Feedback*** उत्पाद के संतोषजनक प्रदर्शन संबंधी फीडबैक पत्र / प्रमाण पत्र / अंतिम उपयोगकर्ता फ़ीडबैक	***Attached at annexure - F2.13*** अनुलग्नक F2. 3पर संलग्न है
18.	***Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product***	***Applicable / Not applicable*** लागू / लागू नहीं

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	(similar or higher rating) प्रस्तावित उत्पाद (एक समान या उच्च रेटिंग वाले) के लिए टाइप टेस्ट रिपोर्ट (टाइप टेस्ट विवरण, रिपोर्ट संख्या, एजेंसी, जांच की तारीख) का सारांश नोट: - रिपोर्ट प्रस्तुत करने की आवश्यकता नहीं है ***Note:- Reports need not to be submitted***	***Details attached at Annexure – F2.14*** विवरण अनुलग्नक - F2.1 4में संलग्न है ***(if applicable)*** (यदि लागू हो)
19.	***Statutory / mandatory certification for the proposed product*** प्रस्तावित उत्पाद के लिए वैधानिक / अनिवार्य प्रमाणीकरण	***Applicable / Not applicable*** लागू / लागू नहीं ***Details attached at Annexure – F2.15*** ***(if applicable)*** (यदि लागू हो)
20.	***Copy of ISO 9001 certificate*** आईएसओ 9001 प्रमाण पत्र की प्रति ***(if available***(यदि उपलब्ध हो)	***Attached at Annexure – F2.16*** अनुलग्नक में संलग्न - F2.1 6 है
21.	***Product technical catalogues for proposed item (if available)*** प्रस्तावित मद के लिए उत्पाद तकनीकी कैटलॉग (यदि उपलब्ध हो)	***Details attached at Annexure – F2.17*** विवरण अनुलग्नक - F2.1 7 में संलग्न है

Name: ***नाम:***		***Desig:*** ***पद:***		***Sign:*** ***हस्ताक्षर:***		***Date:*** ***तिथि:***	

Company's Seal/Stamp:- कंपनी की मुहर / मोहर: -

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1.0 *Sub-Contractors/ Sub-Vendors/ Sub-Suppliers:*

1.1 Any sub-vendor (in addition to Indicative Vendor List part of bid document)suggested by bidder except the sub-vendor from land border sharing countries shall be treated under DR (Details Required) category, if required. But the number of sub-vendors in DR category shall be decided on mutually agreed basis during post award discussions.

Sub vendor list shall be tied up during detail engineering inclusive A(approved) & DR(Detail required) along with categorization as per prevailing practice of NTPC CQA.

For the approval of any new sub-vendor, please refer clause no.22.17.00. For the proposal of sub-vendors from land border sharing countries, Bidder shall ensure the compliance of GOI circulars and shall submit such sub-vendor proposal to NTPC for review & acceptance. (Please refer GTR clause no 40.00.00).
In addition to above, for certain System/ Items covered in Technical Specifications, where Sub-QR (Qualifying requirements) are specified, bidder shall confirm that firm purchase order to the Sub Vendors selected/ shortlisted by them for these items/ systems, will only be placed after acceptance by NTPC of the concerned Sub Vendors meeting the specified qualifying requirements.

1.2 For the proposals where status of proposal is in "DR" category (details required), as NTPC does not have any past experience with them in the above mentioned list, Bidder shall furnish the complete details of such proposals, in NTPC Formats , in time bound manner, so as not to impede the progress of the Project/ Works. For details please refer clause no 22.17.00.

1.3. Bidder shall furnish the required details, as detailed out above, of the proposed Manufacturer/ Sub-Vendor, along with their own detailed recommendations, in the NTPC-formats. proposals/ details shall be received only up to 3 months prior to ordering date of the concerned item (L-2 Network/ BOI Schedule), for NTPC review and assessment. Bidder may accordingly plan the submissions.

1.4 Bidder to confirm that the list of Items/ BOI includes all major Items/ BOIs required in their scope of work/ supply. If any Item/ BOI is left out or gets included during detailed engineering, Bidder shall propose the Manufacturers/Sub-Vendors, prior to initiating the procurement action. In such cases also, proposals, with details given above, shall be forwarded in time bound manner, within time limits given above.

1.5 It is understood that in terms of provisions of Cl. 19.1 of GCC (General Conditions of Contract), in case bidder opts for additional Sub - Vendor proposals, over & above the indicative sub vendor list herein (part of bid document), may be given, within sufficient time, so as not to impede the progress of the work. Accordingly, all such proposals along with required details (as given in 1.3 above), shall be received only up to 3 months prior to ordering date of the concerned item/ Scheduled start of the Manufacture of Self Manufactured Item, for NTPC review and assessment.

1.6 It is agreed that wherever "Main Contractor approved Sources" have been mentioned in the Indicative Vendor List (part of bid document), Bidder shall submit to NTPC, the copies of unpriced Purchase Order, on the specific Manufacturer, from whom supply is intended to be made, to enable NTPC to plan for Surveillance Audit of the manufacturer, if desired, prior to issue of Dispatch Clearance of the concerned item.

1.7 Bidder has to furnish System Supplier proposals for various Sub-Systems which are termed as Level-I Vendors. Further, Manufacturer/ Sub-vendor proposals for major items/ components under these systems, are not yet furnished, as the same would

depend on Level-I vendor shortlisted by bidder for such systems. It is agreed that sub vendor proposals for such items/ components (Level-II vendors) shall be made by bidder to NTPC with complete sub vendor details, in such a manner that the proposals can be finalized after award of contract by bidder on Level-I Vendor. It is understood that schedule of such Sub-vendor proposals shall be in accordance with the Project schedule (L-2 Network/ BOI Schedule) taking into consideration the time required for processing sub vendor approvals, by NTPC, enumerated above.

1.8 In the Indicative Sub Vendor List (part of the bid document), against each Item/ Sub-Vendor, the Category of Inspection is also indicated. NTPC reserves the right to conduct Surveillance Inspection/ Audit of the material, which are identified in Cat-II/ Cat-III, to verify the effectiveness of Quality System of bidder and conformance of the offered lot, to the applicable Standards/ requirements.

2.0 *Welding:*

Bidder to ensure that they will submit to NTPC, their approved List of Make/ Brand of Electrodes/ Welding Consumables, to be used during welding at Site. (Applicable only for Qualified Steam Generator Manufacturer and Qualified Steam Turbine Generator Manufacturer). For all other areas, the welding consumable for welding work shall be as per NTPC's rationalized list of welding consumable.

3.0 Bidder to ensure that for Schedule-I/ Schedule-II supplies, orders shall be placed suitably on approved Sub-Vendors' manufacturing location (Foreign/ Indigenous), keeping the Contractual requirements in view.

4.0 Bidder to ensure the requirements of QA Documentation as per GTR clause no.23.00.00 for its completeness and only thereafter submit to NTPC.

5.0 Bidder shall furnish duly filled, below mention QA coordination procedure (QACP) during post award.

QACP (QA Coordination Procedure)

1. **SCOPE OF WORKS**:

   a) **QUALITY ASSURANCE:** Review of main contractor's (and their proposed major sub-contractor's) detailed quality plan (MQP and FQP) including customer hold points for inspection. Review of manufacturer's test /inspection report and test certificates as per approved QP.

   b) **INSPECTION SERVICES:** Witness of stage and final shop inspection /verification of documentation/ performance testing of major equipment as per approved QP and issuance of CHP and MDCC.

   c) **VENDOR/SUB-VENDOR APPROVAL**: Review and approval of major sub-contractors proposed by the Contractor shall be done by Employer QA&I Finalization of inspection category of items being manufactured and supplied by Main Contractor and sub-vendors shall be done by Employer QA&I

2. **SCOPE OF PROCEDURE:**

   a) The scope of this procedure is to explain and elaborate the scope of work of quality assurance & inspection, during the execution of service between employer (QA & Regional Inspection Offices), and bidder for project

   b) Items not covered in Quality Plan are CAT-III items. Such items & items identified as Cat-III in vendor list, shall be treated as non-inspection items and Certificate of Conformance (COC) shall be submitted to employer (QA & Regional Inspection Offices) for review.

3. **DOCUMENTATION TO BE PROVIDED BY bidder:**

   a) Master list of items requiring QP and Type test approval: shall be prepared by main contractor and approved by Employer QA&I Approved Drawings, Data-sheet, Specifications, etc. shall be provided to Employer QA&I by bidder for inspection purpose.

4. **SUBMISSION OF QUALITY PLAN FOR REVIEW, COMMENTS AND APPROVAL:**

   a) Transmittal (In soft) shall indicate the following:

      i. Name of the item/equipment & QP/Document Number as per master list.
      ii. Remarks / Special notes along with reference documents and norms.
      iii. QPs shall be submitted in the prescribed formats of Employer QA&I

   b) All correspondence and submission of Quality Plan, Field Quality Plan and other documents shall be submitted in soft form i.e. Adobe Acrobat file (pdf format) through Dreams 2.0 indicating the identical Name & Number of QP as per 'Master List of Documents' (MDL). Coordinator of Main Contractor shall arrange submission of Master list of QP documents (In Soft – Dreams 2.0) for various equipment, plant & systems to the Employer QA&I coordinator

   c) On review/ comments / approval of QP, QA&I Coordinator shall forward in PDF form (soft) only, to bidder's coordinator in two weeks.

   d) On review of each QP/document shall be categorized in one of the following:
      i. Category-I Approved

      ii. Category-II Approved subject to incorporation of comments and to be resubmitted after incorporation of comments.

      iii. Category-III Disapproved. See comments.

e) Considering the criticality of the project requirement, all out efforts shall be made to re- submit the QPs/documents as early as possible but not later than 2 (two) weeks from the date of receipt of commented QP/documents from Employer QA&I

f) For MQPs and FQPs approved in Cat-II, the work can be proceeded subject to taking care of comments furnished on documents. However, these comments will be taken care of by Main Contractor while submitting the revised QP/documents for final approval in Cat-I along with their explanation, if any (highlighting all the changes).

g) Final inspection & clearance shall only be issued on approved drawings, Data sheets & QP (in Category-I).

5. Field Quality Activity:

a) The Field Quality Plan for Equipment and Services shall be furnished by Contractor and their Vendors and shall include the quality practices and procedures followed by them during various stages of site activities from transport, receipt of material/equipment storage, preservation, pre-erection, and final erection. The Field Quality Plan shall identify the critical stages where involvement of Contractor's representative is required.

b) Erection contractors (For boiler, power cycle piping, ESP, TG) are subjected to NTPC QA approval.

c) Contractor shall submit Field Welding Schedule for site welding activities of pressure parts, pressure vessels, heat exchangers and piping etc. Bidder to ensure that they will submit to NTPC, their approved List of Make/ Brand ofElectrodes/ Welding Consumables, to be used during welding at Site. (Applicable only for Qualified Steam Generator Manufacturer and Qualified Steam Turbine Generator Manufacturer). For all other areas, the welding consumable for welding work shall be as per NTPC's rationalized list of welding consumable.

6. COORDINATORS FOR COMMUNICATION:

a) Bidder's Coordinator, & Employer QA&I Coordinator shall be the focal points for ensuring smooth execution and monitoring of the contract.

b) Bidder OVER ALL COORDINATOR:

	Main Coordinator	**Alternate Coordinator**
Name		
Designation		
Address		
Contact No		
Email		

c) Employer QA&I Coordinator:

	Main Coordinator	**Alternate Coordinator**
Name		
Designation		
Address		
Contact No		
Email		

7. **EMPLOYER QA&I PROGRESS REPORTING:** Bidder's coordinator shall furnish on or before 12th of every calendar month progress report, highlighting QA&I activities in the reporting month, which shall contain the summary of QP/ documents submission and approval status for QP/ documents under approval to Employer QA&I Coordinators for information. Major QA&I hold-ups shall be highlighted in the progress report.

8. CUSTOMER CO-ORDINATION MEETING:

a) To resolve and sort out various QA&I matters and outstanding issues structured contract co-ordination meeting (CCM) shall be held periodically as per notice of bidder /Employer QA&I
b) Bidder may arrange for the participation of his sub-vendors also, if required for the meeting to resolve their respective issues.
c) The venue for the meeting will be the office of Employer/Bidder as decided on case-to-case basis
d) Minutes of Meeting (MOM) will be drafted by the agency at whose office the meeting is held and the same will be finalized and signed by all parties before close of the meeting.

9. CORRESPONDENCE:

a) All correspondences related to this project shall be among coordinators of, QA&I & bidder as indicated in point no: 5.0.

b) **EMPLOYER QA&I CONSULTANT's Regional Inspection Offices:** The list of Inspection Offices along with names and contact / communication details of the Heads of RIOs and the areas of their jurisdiction is placed at. http://qains.ntpc.co.in/inspection/

10. DEVIATION / NON-CONFORMITY DISPOSITIONING:

a) If deviations are observed during inspection, same shall be recorded by Employer inspector in the CHP.
b) Classification of deviations: It would be required to classify a particular deviation as Major or Minor, which shall be done by Employer QA&I applying following criteria:

i) MAJOR Non-conformities: non-conformity is a "Major" non-conformity which prima-face is likely to have bearing on the Performance, Reliability, Safety, Interchangeability, Maintainability, Working life of the material, equipment or service.
ii) MINOR Non-conformities: A non-conformity not categorized as 'Major' is considered as "Minor", i.e. deviation is with respect to the applicable drawings/applicable standards.

c) Dispositioning of Deviation / Non-Conformity:

i) MAJOR:

Any deviation is characterized as "Major", the bidder to submit a justification as to why the same can be accepted with due corrective and preventive action plan. Such justification shall be submitted to the employer/, enabling it (Employer QA&I) to comment on the bidder's justification/proposal for acceptance/rework.

ii) MINOR:

Dispositioning of MINOR deviations shall be done by employer QA&I
Complete details of bidder design dispositioning of the deviation shall be sent by bidder to employer QA&I for proceeding further. QA&I would review the bidder design's dispositioning and either proceed further with acceptance decision or return the dispositioning to bidder for reclassifying it as Major for dispositioning by the CQA.

Format for "Non- Conformity Report for Manufacturing & Inspection Stages" is attached at Annexure VIII.

11. **Type Tests (wherever applicable as per specification or approved QPs / Drawings):** Bidder shall ensure that type tests (wherever applicable) are duly approved/accepted by NTPC Engg (Engg

Consultant) before offering such item for inspection as per QP. Evidence of Type Test approval in such cases shall be furnished by bidder, while raising inspection call.

12. RESPONSIBILITY FOR ISSUING MDCC:

Employer QA&I shall issue MDCC in case of Cat-I and Cat-II items and for Cat-III items Employer QA&I shall issue MDCC directly based on COC of bidder. MDCC shall be issued after checking of vendor approval status, BBU approval, and Type Test (if applicable).

13. **INSPECTION PROCEDURE:** Inspection shall be carried out as detailed:

For Cat-I & II items: where physical inspection (Cat-I) and documents review (Cat-II) envisaged in approved QP by Employer QA&I:

a) INDIGENOUS SUPPLIES:

- For items under inspection Category Cat-I, the concerned Regional Inspection Office under whose jurisdiction the manufacturer is located. Inspecting Engineer or reviewing engineer (in case of waiver of presence of NTPC engineer) shall issue the MDCC/dispatch clearance.

In case, only review of Vendor's inspection report / test certificates by NTPC has beenenvisaged as per approved QP (inspection Category Cat-II), such reports shall be submitted tothe concerned NTPC-RIO, in whose jurisdiction manufacturer is located.

- In case where QP has not been envisaged (inspection category III), all such materials shall be cleared on the basis of Certificate of Conformity (COC) in attached format from bidder, which shall be submitted concerned NTPC-RIO, in whose jurisdiction vendor (main contractor) is located.

b) FOREIGN SUPPLIES:

- For items (inspection Category Cat-I) directly dispatchable to site from foreign manufacturer, the MDCC/dispatch clearance shall be issued by NTPC's inspecting engineer. In case of waiver of presence of NTPC engineer or Cat-II/III, the MDCC shall be issued by CQA Engineer on satisfactory review of test/inspection reports.

For items to be brought to Bidder's works from foreign manufacturer, before final dispatch to site, MDCC shall be issued by relevant Resident Inspector/RIO after satisfactory activities at works and on review of CHP report of NTPC's Inspecting Engineer for inspection at foreign manufacturer's works or on verifying acceptance report of CQA, in case of waiver of presence of NTPC Engineer for inspection at foreign source.

NOTE:

I. Material inspection by RIO-A at the works of sub-contractor in their respective jurisdiction and dispatched to the works of the other sub-contractor for assembly or otherwise in the jurisdiction of RIO-B before final dispatch to project site, shall be accorded dispatch clearance on a CHP clearance report by RIO-A and the CHP of the completed item / equipment will be issued by RIO-B.as per the approved BBU.

II. In case, only review of Vendor's inspection report / test certificates by Employer QA&I has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be duly reviewed by employer (QA&I) for all documents as per approved QP

III. In case of items where QP has not been envisaged at all (inspection category Cat-III), such material shall be cleared and MDCC shall be issued by Employer QA&I -RIO/CQA (for foreign supplies) on the basis of Certificate of Conformity.

14. **DOCUMENTATIONS / INPUTS BY Bidder:** Bidder shall ensure availability of duly approved documents / inputs (e.g. Drawings / Data-Sheets, / Type Test Procedures / Type Test Approvals, Quality Plan, Routine Test Procedures, Reference documents

Codes, Standards, Specifications and Acceptance norms, etc.) at the place and time of inspection for reference of Inspection Engineers. Master list of Drawings, Datasheet, etc. shall also be made

available.

a) **THREE MONTHLY ROLLING INSPECTION PLAN :**To facilitate advance planning of inspection of supplies, in addition to giving inspection notice at identified *CHP stages as per approved QP, Main Contractor Coordinator shall furnish three monthly rolling inspection program every month, indicating schedule dates of inspection at identified CHP stages. Such a program shall be updated each month. Such program shall be confirmed by specific inspection calls in accordance with Clause 12.

b) ***Definition of C.H.P.:** CHP "Customer Hold Point" ('W') is a stage identified by customer in Quality Plan, which is to be offered to customer or its authorized representative by the Vendors, Supplier / Sub-supplier Contractor for witnessing, verification or review, beyond which work will not proceed without written consent of the Inspecting Authority. The reportprepared by the Inspector is called "CHP Report".
Above three-monthly rolling inspections plan for Shop manufactured & BOIs shall befurnished directly to the respective Employer QA&I

c) **INSPECTION AT PACKAGE CONTRACTOR'S SUB-SUPPLIER: Bidder's** coordinator shall ensure that unpriced purchase order for the identified BOI where in Employer QA&I Inspection is required, as per the approved Quality Plan, the unpriced Purchase Order shall be suitably tied-up with their suppliers so that the suppliers offer the identified equipment for Employer QA&I inspection for identified tests / checks. Purchase Order, with detailed Purchase Specification, Delivery conditions QP & reference codes and standards shall be made available at the place of inspection.

d) **Inspection Calls:** Bidder shall give inspection call to the respective Employer QA&I RIO in Windsor-X system. For foreign inspection calls Main Contractor shall give inspection call to Employer QA&I (in Windsor-X system) Coordinators and through email as well, as per following schedule:-

i. Supplier of Indian origin : 15 working days
ii. Supplier of Foreign origin : Call will be raised in two stages
iii. Preliminary Inspection call : 45 days
iv. Final Inspection call : 15 days

Inspection call format is placed at website http://qains.ntpc.co.in/inspection/

e) **Inspection Call Entry on Employer QA&I Inspection Website on Internet:** Bidder can enter the call to the respective RIO on internet on Employer QA&I inspection website named as http://qains.ntpc.co.in/inspection/ through a user ID & password under the menu "Main Supplier". User ID and password has already been known to various Main Contractor units. Bidder will be allotted user ID and password.

f) Co-ordination for Inspection Call:

- Main Contractor shall raise inspection call mentioning all reference documents to the respective Employer QA&I and in Windsor-X system. For foreign inspection calls bidder shall give inspection call to QA&I (in Windsor-X system) Coordinators

- The list of various Employer QA&I RIOs and their address along with their area of jurisdiction is placed at http://qains.ntpc.co.in/inspection/ The call shall include copy of relevant approved QP and Data Sheet, internal test / inspection report, as applicable etc.

- Bidder representative / their authorized TPA (duly accepted to Employer QA&I) shall involve in inspection activity as per agreed documents.

15. **Issue of Final CHP/MDCC/Inspection Report by** Employer **QA&I:** The concerned Regional Inspection Office under whose jurisdiction the manufacturer is located, shall issue the Final CHP/MDCC after successful completion of testing / shop assembly including stage Inspection /Type tests, as required by the approved documents (approved Quality Plan, drawing / data sheet, as applicable), etc. at manufacturer's/ their sub-vendor's works.

METHODOLOGY FOR SAMPLING FOR TESTING OF WELD JOINTS :

Whenever the quantum of check in any NDT is other than 100%, the following guidelines for sampling/resampling procedure for NDT to be followed :

1) The group of welds for sampling shall be based on welding done by a welder in specified continuous time (say work done in a shift or in a day). For further analysis, acceptance or rejection, this group shall be treated as an entity.

2) From the above weld group, the selection of weld joint/weld spot shall be done by NTPC as per the quantum of check specified.

3) For acceptance of the weld group, all samples selected in this group should meet the acceptance norms. In case of any sample(s) beyond acceptance norms, the following actions shall be taken:

3.1 : Rectification of defective welds and re-testing of the repair.

3.2 Re-sampling by NTPC from the same group of welds, with quantum of NDT being double the originally specified quantum (with minimum 2 welds for every defective weld). In case of RT on T-joints, if the defect is found on L-seam done at manufacturing works of pipe produced as per IS 3589, pipe defects shall be rectified, and no re-sampling is envisaged.

4) In case of any weld from the re-sample as per 3.2 above found beyond acceptable norms, the following action shall be taken:

4.1) NDT of all welds of the group which were not tested in first and second samples.

4.2) Repair and re-testing of all defective welds.

4.3) Necessary action on process control and on welder for preventing recurrence.

5) For the purpose of sampling, the weld group shall be defined as number of welds in case of smaller diameter of tubes/pipes (or small welds on structures) while for very large diameter pipes e.g., CW piping or for vessels/long welds, the length of weld may be taken as basic unit. Sampling shall also be accordingly in terms of number of weld joints or length of weld.

6) From the time of readiness of weld group, suitable time limits shall be prescribed for first sampling testing, re-sampling, repairing, re-testing etc. (normally not more than 1 day's backlog should be piled up at every step).

Illustration: Radiography of welds: Welding completed on Day-1 should be tested by Day-2 and repair and re-sampling, of the group should be done by Day-3 and further testing/repair should be done by Day-4.

7) Sampling and re-sampling procedure shall be applicable for all NDT viz RT,UT,DPT,MP.

Note: In case of RT of tube welds with double wall image (elliptical view), number of exposures shall be as per relevant code/ plant standard and will not be less than 2 exposures for each weld.

एनटीपीसी NTPC	**NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES**	**FOR NTPC USE ONLY** **NC NO.(REFER NOTE 7):** **DATE:** **PAGE : 1 OF 2**

(This page to be filled in by Main Contractor)

CONTRACT NO :……

PACKAGE UNIT NO :……

MAIN CONTRACTOR :……

SUB-CONTRACTOR :……

PLACE OF MANUFACTURE:……

CATEGORY OF NON-CONFORMITY

(AS PER NOTE-2) **A** ☐ **B** ☐

DETAILS

ITEM DESCRIPTION:_____ DENTIFICATION NO._____

RANGE/SIZE/TYPE:_____ QUALITY PLAN:_____ CHP **NO:** & CLAUSE NO.

☐

STAGE OF NON-CONFORMITY:
DESIGN (I) / RAW MATERIAL (II) / ASSEMBLY (III)/ IN PROCESS (IV)-(SPECIFY)_____
STORAGE (V) / HANDLING (VI) / TESTING (VII) / ANY OTHER (VIII)-(SPECIFY)

NON-CONFORMITY-DESCRIPTION WITH CAUSE (Attach Relevant Drgs/Details)

PROPOSED DISPOSITION WITH JUSTIFICATION - (FOR CORRECTION)
(Attach details including design calculation, recommendations of qualified designer, if required)

DISPOSITIONING CODE ☐
(AS PER NOTE-6)

STEPS TO PREVENT RECURRANCE-(FOR CORRECTIVE ACTION)

NAME & DESIGN SIG. OF MAIN CONTRACTOR DATE_____ (SEAL)

ENCL:

SECTION-3

	NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES	FOR NTPC USE ONLY
		NC NO.(REFER NOTE 7):
		DATE:
		PAGE : 2 OF 2

NOTES

1. Please read these notes carefully before filling up and attach separate sheet wherever required.

2. Category 'A' non-conformity is a major non-conformity which directly or indirectly adversely affects the performance, reliability, safety, interchangeability, erection, commissioning or working life of the items, equipment or system. All other non-conformities shall be treated as category 'B'.

3. Acceptance of dispositioned non-conformity is without prejudice to NTPC rights under the contract to claim commercial compensation and does not absolve main contractor from his contractual obligations.

4. Obtaining approval of statutory authority, if any, w.r.t. above non-conformity is the responsibility of main contractor.

5. Dispositioning of this non-conformity is for this specific case only and not to be regarded as a precedence.

6. The non-conformance shall be proposed main contractor (Give code at appropriate boxes) and is subjected to review & acceptance by NTPC.
   (01) NC-Rejected (02) NC-Conditionally accepted (specify condition) (03) NC-accepted as it is (04) NC-Accepted with repair

7. NC number - this NC no. shall be allotted by regional inspection office in such a way to have project, package, RIO code, followed by running serial no. of that contract.

Responsibilities of main contractor

1. Ascertain exact nature of non-conformity in consultation with qualified designer (if required) and supporting drawing/details with which non-conformity exists.
2. Identify the cause of non-conformity.
3. Decide on code of Dispositioning as per Note-6 above.
4. Ensure and certify that the product quality, performance, reliability and working life is not affected for minor non-conformities and quantify the extent to which it is affected in the case of category 'A' non-conformities.
5. Implement agreed corrective action in a time-bound program.

Responsibilities of RIO

1. Identify the product appropriately.
2. Finalize the cause of non-conformity and propose corrective action.
3. Interlink with the corresponding CHP.

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

SECTION-3

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

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

SECTION-3

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. **LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR;** **'A'** SHALL BE WITNESSED BY NTPC FQA, **'B'** SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND **'C'** SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)	FOR NTPC USE	DOC. NO.:		REV……
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

QACP (QA Coordination Procedure)

1. **SCOPE OF WORKS**:

   a) **QUALITY ASSURANCE:** Review of main contractor's (and their proposed major sub-contractor's) detailed quality plan (MQP and FQP) including customer hold points for inspection. Review of manufacturer's test /inspection report and test certificates as per approved QP.

   b) **INSPECTION SERVICES:** Witness of stage and final shop inspection /verification of documentation/ performance testing of major equipment as per approved QP and issuance of CHP and MDCC.

   c) **VENDOR/SUB-VENDOR APPROVAL**: Review and approval of major sub-contractors proposed by the Contractor shall be done by Employer QA&I Finalization of inspection category of items being manufactured and supplied by Main Contractor and sub-vendors shall be done by Employer QA&I

2. **SCOPE OF PROCEDURE:**

   a) The scope of this procedure is to explain and elaborate the scope of work of quality assurance & inspection, during the execution of service between employer (QA & Regional Inspection Offices), and bidder for project

   b) Items not covered in Quality Plan are CAT-III items. Such items & items identified as Cat-III in vendor list, shall be treated as non-inspection items and Certificate of Conformance (COC) shall be submitted to employer (QA & Regional Inspection Offices) for review.

3. **DOCUMENTATION TO BE PROVIDED BY bidder:**

   a) Master list of items requiring QP and Type test approval: shall be prepared by main contractor and approved by Employer QA&I Approved Drawings, Datasheet, Specifications, etc. shall be provided to Employer QA&I by bidder for inspection purpose.

4. **SUBMISSION OF QUALITY PLAN FOR REVIEW, COMMENTS AND APPROVAL:**

   a) Transmittal (In soft) shall indicate the following:

      i. Name of the item/equipment & QP/Document Number as per master list.
      ii. Remarks / Special notes along with reference documents and norms.
      iii. QPs shall be submitted in the prescribed formats of Employer QA&I

   b) All correspondence and submission of Quality Plan, Field Quality Plan and other documents shall be submitted in soft form i.e. Adobe Acrobat file (pdf format) through Dreams 2.0 indicating the identical Name & Number of QP as per 'Master List of Documents' (MDL). Coordinator of Main Contractor shall arrange submission of Master list of QP documents (In Soft – Dreams 2.0) for various equipment, plant & systems.

   c) On review/ comments / approval of QP, NTPC Task Force shall forward in PDF form (soft) only, to bidder's coordinator in two weeks.

   d) On review of each QP/document shall be categorized in one of the following:
      i. Category-I Approved

      ii. Category-II Approved subject to incorporation of comments and to be resubmitted after incorporation of comments.

      iii. Category-III Disapproved. See comments.

e) Considering the criticality of the project requirement, all out efforts shall be made to re-submit the QPs/documents as early as possible but not later than 2 (two) weeks from the date of receipt of commented QP/documents from Employer QA&I

f) For MQPs and FQPs approved in Cat-II, the work can be proceeded subject to taking care of comments furnished on documents. However, these comments will be taken care of by Main Contractor while submitting the revised QP/documents for final approval in Cat-I along with their explanation, if any (highlighting all the changes).

g) Final inspection & clearance shall only be issued on approved drawings, Data sheets & QP (in Category-I).

5. Field Quality Activity:

a) The Field Quality Plan for Equipment and Services shall be furnished by Contractor and their Vendors and shall include the quality practices and procedures followed by them during various stages of site activities from transport, receipt of material/equipment storage, preservation, pre-erection, and final erection. The Field Quality Plan shall identify the critical stages where involvement of Contractor's representative is required.

b) Erection contractors (For boiler, power cycle piping, ESP, TG) are subjected to NTPC QA approval.

c) Contractor shall submit Field Welding Schedule for site welding activities of pressure parts, pressure vessels, heat exchangers and piping etc. Bidder to ensure that they will submit to NTPC, their approved List of Make/ Brand of Electrodes/ Welding Consumables, to be used during welding at Site. (Applicable only for Qualified Steam Generator Manufacturer and Qualified Steam Turbine Generator Manufacturer). For all other areas, the welding consumable for welding work shall be as per NTPC's rationalized list of welding consumable.

6. COORDINATORS FOR COMMUNICATION:

a) Bidder's Coordinator, & Employer QA&I Coordinator shall be the focal points for ensuring smooth execution and monitoring of the contract.

b) Bidder OVER ALL COORDINATOR:

	Main Coordinator	**Alternate Coordinator**
Name		
Designation		
Address		
Contact No		
Email		

c) Employer QA&I Coordinator:

	Main Coordinator	**Alternate Coordinator**
Name		
Designation		
Address		
Contact No		
Email		

7. **EMPLOYER QA&I PROGRESS REPORTING:** Bidder's coordinator shall furnish on or before 12th of every calendar month progress report, highlighting QA&I activities in the reporting month, which

shall contain the summary of QP/ documents submission and approval status for QP/ documents under approval to Employer QA&I Coordinators for information. Major QA&I hold-ups shall be highlighted in the progress report.

8. CUSTOMER CO-ORDINATION MEETING:

a) To resolve and sort out various QA&I matters and outstanding issues structured contract co-ordination meeting (CCM) shall be held periodically as per notice of bidder /Employer QA&I
b) Bidder may arrange for the participation of his sub-vendors also, if required for the meeting to resolve their respective issues.
c) The venue for the meeting will be the office of Employer/Bidder as decided on case-to-case basis
d) Minutes of Meeting (MOM) will be drafted by the agency at whose office the meeting is held and the same will be finalized and signed by all parties before close of the meeting.

9. CORRESPONDENCE:

a) All correspondences related to this project shall be among coordinators of, QA&I & bidder as indicated in point no: 6.0.
b) **EMPLOYER QA&I CONSULTANT's Regional Inspection Offices:** The list of Inspection Offices along with names and contact / communication details of the Heads of RIOs and the areas of their jurisdiction is placed at. http://qains.ntpc.co.in/inspection/

10. DEVIATION / NON-CONFORMITY DISPOSITIONING:

a) If deviations are observed during inspection, same shall be recorded by Employer inspector in the CHP.
b) Classification of deviations: It would be required to classify a particular deviation as Major or Minor, which shall be done by Employer QA&I applying following criteria:

i) MAJOR Non-conformities: non-conformity is a "Major" non-conformity which prima-face is likely to have bearing on the Performance, Reliability, Safety, Interchangeability, Maintainability, Working life of the material, equipment or service.
ii) MINOR Non-conformities: A non-conformity not categorized as 'Major' is considered as "Minor", i.e. deviation is with respect to the applicable drawings/applicable standards.

c) Dispositioning of Deviation / Non-Conformity:

i) MAJOR:

Any deviation is characterized as "Major", the bidder to submit a justification as to why the same can be accepted with due corrective and preventive action plan. Such justification shall be submitted to the employer/, enabling it (Employer QA&I) to comment on the bidder's justification/proposal for acceptance/rework.

ii) MINOR:

Dispositioning of MINOR deviations shall be done by employer QA&I

Complete details of bidder design dispositioning of the deviation shall be sent by bidder to employer QA&I for proceeding further. QA&I would review the bidder design's dispositioning and either proceed further with acceptance decision or return the dispositioning to bidder for reclassifying it as Major for dispositioning by the CQA.

Format for "Non- Conformity Report for Manufacturing & Inspection Stages" is attached at Annexure VIII.

11. **Type Tests (wherever applicable as per specification or approved QPs / Drawings):** Bidder shall ensure that type tests (wherever applicable) are duly approved/accepted by NTPC Engg (Engg Consultant) before offering such item for inspection as per QP. Evidence of Type Test approval in such cases shall be furnished by bidder, while raising inspection call.

12. RESPONSIBILITY FOR ISSUING MDCC:

Employer QA&I shall issue MDCC in case of Cat-I and Cat-II items and for Cat-III items Employer QA&I shall issue MDCC directly based on COC of bidder. MDCC shall be issued after checking of vendor approval status, BBU approval, and Type Test (if applicable).

13. **INSPECTION PROCEDURE:** Inspection shall be carried out as detailed:

For Cat-I & II items: where physical inspection (Cat-I) and documents review (Cat-II) envisaged in approved QP by Employer QA&I:

a) INDIGENOUS SUPPLIES:

- For items under inspection Category Cat-I, the concerned Regional Inspection Office under whose jurisdiction the manufacturer is located. Inspecting Engineer or reviewing engineer (in case of waiver of presence of NTPC engineer) shall issue the MDCC/dispatch clearance.
- In case, only review of Vendor's inspection report / test certificates by NTPC has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be submitted to the concerned NTPC-RIO, in whose jurisdiction manufacturer is located.
- In case where QP has not been envisaged (inspection category III), all such materials shall be cleared on the basis of Certificate of Conformity (COC) in attached format from bidder, which shall be submitted concerned NTPC-RIO, in whose jurisdiction vendor (main contractor) is located.

b) FOREIGN SUPPLIES:

- For items (inspection Category Cat-I) directly dispatchable to site from foreign manufacturer, the MDCC/dispatch clearance shall be issued by NTPC's inspecting engineer. In case of waiver of presence of NTPC engineer or Cat-II/III, the MDCC shall be issued by CQA Engineer on satisfactory review of test/inspection reports.

For items to be brought to Bidder's works from foreign manufacturer, before final dispatch to site, MDCC shall be issued by relevant Resident Inspector/RIO after satisfactory activities at works and on review of CHP report of NTPC's Inspecting Engineer for inspection at foreign manufacturer's works or on verifying acceptance report of CQA, in case of waiver of presence of NTPC Engineer for inspection at foreign source.

NOTE:

I. Material inspection by RIO-A at the works of sub-contractor in their respective jurisdiction and dispatched to the works of the other sub-contractor for assembly or otherwise in the jurisdiction of RIO-B before final dispatch to project site, shall be accorded dispatch clearance on a CHP clearance report by RIO-A and the CHP of the completed item / equipment will be issued by RIO-B.as per the approved BBU.

II. In case, only review of Vendor's inspection report / test certificates by Employer QA&I has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be duly reviewed by employer (QA&I) for all documents as per approved QP

III. In case of items where QP has not been envisaged at all (inspection category Cat-III), such material shall be cleared and MDCC shall be issued by Employer QA&I -RIO/CQA (for foreign supplies) on the basis of Certificate of Conformity.

14. **DOCUMENTATIONS / INPUTS BY Bidder:** Bidder shall ensure availability of duly approved documents / inputs (e.g. Drawings / Data-Sheets, / Type Test Procedures / Type Test Approvals, Quality Plan, Routine Test Procedures, Reference documents

Codes, Standards, Specifications and Acceptance norms, etc.) at the place and time of inspection for reference of Inspection Engineers. Master list of Drawings, Datasheet, etc. shall also be made available.

a) **THREE MONTHLY ROLLING INSPECTION PLAN :**To facilitate advance planning of inspection of

supplies, in addition to giving inspection notice at identified *CHP stages as per approved QP, Main Contractor Coordinator shall furnish three monthly rolling inspection program every month, indicating schedule dates of inspection at identified CHP stages. Such a program shall be updated each month. Such program shall be confirmed by specific inspection calls in accordance with Clause 12.

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Above three-monthly rolling inspections plan for Shop manufactured & BOIs shall be furnished directly to the respective Employer QA&I

c) **INSPECTION AT PACKAGE CONTRACTOR'S SUB-SUPPLIER: Bidder's** coordinator shall ensure that unpriced purchase order for the identified BOI where in Employer QA&I Inspection is required, as per the approved Quality Plan, the unpriced Purchase Order shall be suitably tied-up with their suppliers so that the suppliers offer the identified equipment for Employer QA&I inspection for identified tests / checks. Purchase Order, with detailed Purchase Specification, Delivery conditions QP & reference codes and standards shall be made available at the place of inspection.

d) **Inspection Calls:** Bidder shall give inspection call to the respective Employer QA&I RIO in Windsor-X system. For foreign inspection calls Main Contractor shall give inspection call to Employer QA&I (in Windsor-X system) Coordinators and through email as well, as per following schedule:-

i. Supplier of Indian origin : 15 working days
ii. Supplier of Foreign origin : Call will be raised in two stages
iii. Preliminary Inspection call : 45 days
iv. Final Inspection call : 15 days

Inspection call format is placed at website http://qains.ntpc.co.in/inspection/

e) **Inspection Call Entry on Employer QA&I Inspection Website on Internet:** Bidder can enter the call to the respective RIO on internet on Employer QA&I inspection website named as http://qains.ntpc.co.in/inspection/ through a user ID & password under the menu "Main Supplier". User ID and password has already been known to various Main Contractor units. Bidder will be allotted user ID and password.

f) Co-ordination for Inspection Call:

- Main Contractor shall raise inspection call mentioning all reference documents to the respective Employer QA&I and in Windsor-X system. For foreign inspection calls bidder shall give inspection call to QA&I (in Windsor-X system) Coordinators

- The list of various Employer QA&I RIOs and their address along with their area of jurisdiction is placed at http://qains.ntpc.co.in/inspection/ The call shall include copy of relevant approved QP and Data Sheet, internal test / inspection report, as applicable etc.

- Bidder representative / their authorized TPA (duly accepted to Employer QA&I) shall involve in inspection activity as per agreed documents.

15. **Issue of Final CHP/MDCC/Inspection Report by** Employer **QA&I:** The concerned Regional Inspection Office under whose jurisdiction the manufacturer is located, shall issue the Final

CHP/MDCC after successful completion of testing / shop assembly including stage Inspection /Type tests, as required by the approved documents (approved Quality Plan, drawing / data sheet, as applicable), etc. at manufacturer's/ their sub-vendor's works.

METHODOLOGY FOR SAMPLING FOR TESTING OF REPAIRED WELD JOINTS :

Whenever the quantum of check in any NDT is other than 100%, the following guidelines for sampling/resampling procedure for NDT to be followed :

1) The group of welds for sampling shall be based on welding done by a welder in specified continuous time (say work done in a shift or in a day). For further analysis, acceptance or rejection, this group shall be treated as an entity.

2) From the above weld group, the selection of weld joint/weld spot shall be done by NTPC as per the quantum of check specified.

3) For acceptance of the weld group, all samples selected in this group should meet the acceptance norms. In case of any sample(s) beyond acceptance norms, the following actions shall be taken:

3.1 : Rectification of defective welds and re-testing of the repair.

3.2 Re-sampling by NTPC from the same group of welds, with quantum of NDT being double the originally specified quantum (with minimum 2 welds for every defective weld). In case of RT on T-joints, if the defect is found on L-seam done at manufacturing works of pipe produced as per IS 3589, pipe defects shall be rectified, and no re-sampling is envisaged.

4) In case of any weld from the re-sample as per 3.2 above found beyond acceptable norms, the following action shall be taken:

4.1) NDT of all welds of the group which were not tested in first and second samples.

4.2) Repair and re-testing of all defective welds.

4.3) Necessary action on process control and on welder for preventing recurrence.

5) For the purpose of sampling, the weld group shall be defined as number of welds in case of smaller diameter of tubes/pipes (or small welds on structures) while for very large diameter pipes e.g., CW piping or for vessels/long welds, the length of weld may be taken as basic unit. Sampling shall also be accordingly in terms of number of weld joints or length of weld.

6) From the time of readiness of weld group, suitable time limits shall be prescribed for first sampling testing, re-sampling, repairing, re-testing etc. (normally not more than 1 day's backlog should be piled up at every step).

Illustration: Radiography of welds: Welding completed on Day-1 should be tested by Day-2 and repair and re-sampling, of the group should be done by Day-3 and further testing/repair should be done by Day-4.

7) Sampling and re-sampling procedure shall be applicable for all NDT viz RT,UT,DPT,MP.

Note: In case of RT of tube welds with double wall image (elliptical view), number of exposures shall be as per relevant code/ plant standard and will not be less than 2 exposures for each weld.

एनटीपीसी NTPC	**NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES**	**FOR NTPC USE ONLY** **NC NO.(REFER NOTE 7):** **DATE:** **PAGE : 1 OF 2**

(This page to be filled in by Main Contractor)

CONTRACT NO :……

PACKAGE UNIT NO :……

MAIN CONTRACTOR :……

SUB-CONTRACTOR :……

PLACE OF MANUFACTURE:……

CATEGORY OF NON-CONFORMITY

(AS PER NOTE-2) **A** ☐ **B** ☐

DETAILS

ITEM DESCRIPTION:_____ DENTIFICATION NO._____

RANGE/SIZE/TYPE:_____ QUALITY PLAN:_____ CHP **NO:** & CLAUSE NO.

STAGE OF NON-CONFORMITY: ☐

DESIGN (I) / RAW MATERIAL (II) / ASSEMBLY (III)/ IN PROCESS (IV)-(SPECIFY)_____

STORAGE (V) / HANDLING (VI) / TESTING (VII) / ANY OTHER (VIII)-(SPECIFY)

NON-CONFORMITY-DESCRIPTION WITH CAUSE (Attach Relevant Drgs/Details)

PROPOSED DISPOSITION WITH JUSTIFICATION - (FOR CORRECTION) **DISPOSITIONING CODE** ☐

(Attach details including design calculation, recommendations of qualified designer, if required)

(AS PER NOTE-6)

STEPS TO PREVENT RECURRANCE-(FOR CORRECTIVE ACTION)

NAME & DESIGN SIG. OF MAIN CONTRACTOR DATE_____ (SEAL)

ENCL:

SECTION 3B: QACP (QA Coordination Procedure)

	NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES	FOR NTPC USE ONLY
		NC NO.(REFER NOTE 7):
		DATE:
		PAGE : 2 OF 2

NOTES

1. Please read these notes carefully before filling up and attach separate sheet wherever required.

2. Category 'A' non-conformity is a major non-conformity which directly or indirectly adversely affects the performance, reliability, safety, interchangeability, erection, commissioning or working life of the items, equipment or system. All other non-conformities shall be treated as category 'B'.

3. Acceptance of dispositioned non-conformity is without prejudice to NTPC rights under the contract to claim commercial compensation and does not absolve main contractor from his contractual obligations.

4. Obtaining approval of statutory authority, if any, w.r.t. above non-conformity is the responsibility of main contractor.

5. Dispositioning of this non-conformity is for this specific case only and not to be regarded as a precedence.

6. The non-conformance shall be proposed main contractor (Give code at appropriate boxes) and is subjected to review & acceptance by NTPC.
   (01) NC-Rejected (02) NC-Conditionally accepted (specify condition) (03) NC-accepted as it is (04) NC-Accepted with repair

7. NC number - this NC no. shall be allotted by regional inspection office in such a way to have project, package, RIO code, followed by running serial no. of that contract.

Responsibilities of main contractor

1. Ascertain exact nature of non-conformity in consultation with qualified designer (if required) and supporting drawing/details with which non-conformity exists.
2. Identify the cause of non-conformity.
3. Decide on code of Dispositioning as per Note-6 above.
4. Ensure and certify that the product quality, performance, reliability and working life is not affected for minor non-conformities and quantify the extent to which it is affected in the case of category 'A' non-conformities.
5. Implement agreed corrective action in a time-bound program.

Responsibilities of RIO

1. Identify the product appropriately.
2. Finalize the cause of non-conformity and propose corrective action.
3. Interlink with the corresponding CHP.

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV.NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			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"	एनटीपीसी NTPC	DOC. NO.:		REV…… CAT…..
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL
SIGNATURE						

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

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR;
'A' SHALL BE WITNESSED BY NTPC FQA, **'B'** SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND **'C'** SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FOR NTPC USE	DOC. NO.:		REV……
	REVIEWED BY	APPROVED BY	APPROVAL SEAL

ANNEXURE-A: COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

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

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

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

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

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

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

Date: Bidder's Stamp & Signature

ANNEXURE-B: DEVIATION/ CHANGE REQUEST OF TECHNICAL SPECIFICATION

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

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

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

Date: Bidder's Stamp & Signature