PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

1.	For any **technical clarification**, please contact Mr. Akhilesh Kumar, Dy. Manager (TBEM). Contact No. 0120-06748528; e-mail: akhileshk@bhel.in	
2.	For any **commercial clarification**, please contact Mr. Sandeep, Dy. Manager (TBMM). Contact No. 0120-6748540; e-mail: kumar.sandeep@bhel.in	
3.	**Terms of Payment:**	
(Supply & Services)	As per GTC of GeM (Payment due date shall be 60 Days) Supply Payment: a) 95% of payment from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows: • LR / GR duly endorsed by BHEL Site Official. • Material Receipt Certificate issued by BHEL Site Official. • GST Compliant Tax Invoice • Packing List (Case-wise) • Copy of Transit Insurance Certificate from underwriters. • Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management • Guarantee Certificate • Copy of Performance Bank Guarantee (PBG) • Certificate of acceptance of Type Test Reports issued by BHEL Engineering Management wherever specifically mentioned in the Purchase Order b) 5% of payment days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows: • Certificate of successful completion of Supervision of Erection, Testing & Commissioning at Site if it is in the scope of the supplier or Certificate of successful completion of Testing & Commissioning at Site if it is in the scope of the supplier. • Certificate of completion of final documentation as per Purchase Order / Technical Specification issued by BHEL Engineering Management **Note:** In-case commissioning is delayed beyond reason not attributable to supplier. Supplier may claim the balance 05% of supply portion after 12 months from the date of last delivery or from the date 28.08.2022, whichever is later, upon submission of BG with equivalent amount and the certificate endorsed by BHEL Site In-Charge citing the details that the “delay in commissioning is not attributable to supplier”. ***Vendor has to submit the duly signed check-list along with Bill.*** **Payment terms for supervision of ETC:** 100% payment along with applicable GST within 60 days from the date of receipt of complete GST compliant Tax invoice along with certificate of successful completion of Testing & Commissioning at Site issued by BHEL Site Official / Construction Management in 3 sets (Original + 2 copies). **Note:** Vendor to quote minimum 02% for supervision portion else BHEL will recalculate prices of contract & fix the prices of supervision charges as two (02) % of total ex-works value of supply portion and it will be deemed as acceptable to L1 bidder.	

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

4.	**Terms of Delivery:**
As per GeM. However, unloading at site is in the scope of BHEL. Bidders to quote price accordingly.	
5.	**Delivery Time:**
32 Weeks (224 days) from the date of PO by BHEL as per Activity schedule (Annexure-A). Early Delivery is acceptable. **Note:** In case, BHEL's delivery requirement is not met by vendor(s), then a chance may be given to all such vendors to review their quoted delivery schedule in line with BHEL's delivery requirement. However, if vendor fails to meet the requisite delivery plan, then BHEL reserves the right not to consider the offer of such vendor(s).	
6.	**Prices:**
The quoted prices shall be on **Firm basis including packing and forwarding charges**. Price to be quoted as inclusive of GST. i.e. Ex-Works + F&I + GST.	
7.	**Liquidated Damage of delayed Delivery:**
As per GeM terms and conditions.	
8.	**Item & BOQ:**
BOQ: As per Annexure-C of Section-1 of Technical specification.	
9.	**Technical Specification:**
Technical specification no**. TB-316-369-001 Rev 02.** No permissible Technical Deviation has been envisaged. Bidders to quote as per Technical Specification.	
10.	**Pre-Qualification Requirement:**
As specified in Technical Specifications	
11.	**MQP (Manufacturing Quality Plan):**
MQP format is indicative only, however inspection shall be carried out as per approved Quality Plan. Supplier has to submit Quality Plan to BHEL for Customer approval.	
12.	**Inspection:**
Inspection shall be carried out as per customer as per approved Quality Plan.	
13.	**Destination / Delivery Location**:
BHEL C/O GENERAL MANAGER, NTPC North Karanpura, Post Office - Tandwa, Dist.-Chatra, Jharkhand, PIN. 825321, GSTN No.: 20AAACN0255D2ZB, Site in charge: Prasun Bhattacharjee- Sr Manager- 8790040005- prasun@bhel.in	
14.	**Bill to Address:**
Bharat Heavy Electricals Limited-TBG, 10th Floor, Plot No.C-20/1A/1, Joy Tower, Sector-62, Noida-201301, U.P. **GSTN-**09AAACB4146P2ZC	

15.	**Guarantee Clause (Defect Liability Period):**
The equipment / material supplied and services rendered (if applicable) shall be guaranteed to be free from all defects and faults in design & engineering, material, workmanship & manufacture and in full conformity with the Purchase Order / Contract, Technical Specifications & approved drawings / data sheets, if any, for 18 months from the date of last delivery or 18 months from 28.08.2022 (i.e. date of completion/installations), whichever is later. ***Note: In case ordering is delayed beyond 28.08.2022 (i.e. date of completion/installations) then, guarantee clause shall be 18 months from the date of last delivery.***	
16.	**Performance Bank Guarantee:**
Performance BG to be kept valid till the completion of guarantee period.	

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

"Bidder agrees to submit performance security required for execution of the contract within the time period mentioned. In case of delay in submission of performance security, enhanced performance security which would include interest (SBI rate + 6%) for the delayed period, shall be submitted by the bidder. Further, if performance security is not submitted till such time the first bill becomes due, the amount of performance security due shall be recovered as per terms and conditions defined in NIT / Contract, from the bills along with due interest."	
17.	Bidders to ensure that Third party / customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document / certificate issuing authority such as name & designation of Issuing Authority and its organization contact number and e-mail Id etc. In case the same found not available, Purchaser has right to reject such document from evaluation.
18.	**Acceptance of Offer:**
Bidder's offer will be technically acceptable subject to final acceptance of vendor by ultimate customer (NTPC) as approved supplier. Price Bid will be opened only for those bidders in respect of which vendor approval is received from NTPC. Necessary credentials/documents to be submitted for approval by Customer as per format.	
19.	**Deviations:**
a) Technical Deviation: No Technical Deviation is envisaged. b) Commercial Deviation: No Commercial Deviation is envisaged.	
20.	All other terms & conditions shall be as per GTC of GeM

Signature & Seal of supplier

Date

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

ACTIVITY SCHEDULE **Annexure-A**

SL. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS
1.	Submission of documents necessary for getting manufacturing clearance Drawings, data sheets (In scope of vendor)	04
2.	Review and Approval of documents and issue of manufacturing clearance (In scope of BHEL)	06
3.	Manufacturing Time (In scope of vendor)	19
4.	Inspection (In scope of BHEL)	01
5.	Issue of MICC (In scope of BHEL)	01
6.	Dispatch (In scope of vendor)	01
7.	Supervision activity considered from the date of PO/Contract (32 Weeks for supply + 08 Weeks for site readiness + 12 Weeks for services)	52 Weeks

Note – 1 - Supplier to ensure every revised submission incorporating comments within 2 weeks from the date of comments by BHEL.

1. Inspection call to be issued 2 weeks in advance.
2. Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier.
3. Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.

Signature & Seal of Supplier
Date

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

Annexure-V

Item/Package Name :	**Supply & Supervision of ETC for Isolators**
Enquiry No.:	
Project:	**NTPC North Karanpura**
Type of project	
Percentage of Local Content	***(Bidder to enter the applicable % of local content)***

Format of Self certification regarding Local Content in line with PPP-MII order, 2017 & its revision dated 04.06.2020.

Date:……

I _____S/o, D/o, W/o, _____Resident of _____ hereby solemnly affirm and declare as under:

That I will agree to abide by the terms and conditions of the Public Procurement (Preference to Make in India) Order, 2017 (*hereinafter PPP-MII order*) of Government of India issued vide Notification No: P-45021/2/2017-BE-II dated 15/06/2017, its revision dated 04/06/2020 and any subsequent modifications/Amendments**,** if any**.**

That the information furnished hereinafter is correct to the best of my knowledge and belief and I undertake to produce relevant records before the procuring entity/BHEL or any other Government authority for the purpose of assessing the local content of goods/services/works supplied by me for …… *(Enter the name of the Equipment/Item for Project)*.

That the local content for all inputs which constitute the said goods/services/works has been verified by me and I am responsible for the correctness of the claims made therein.

That the goods/services/works supplied by me for …… (Enter the name of the Equipment/Item for Project) contains…….% (mention the Local content in %age) Local Content.

That the value addition for the purpose of meeting the 'Minimum Local Content 'has been made by me at …… (*Enter the details of the location(s) at which value addition is made)*.

That in the event of the local content of the goods/services/works mentioned herein is found to be incorrect and not meeting the prescribed supplier class categorization criteria as per said order, based on the assessment of procuring agency (ies)/BHEL/Government Authorities for the purpose of assessing the local content, action shall be taken against me in line with the PPP-MII order and provisions of the Integrity pact/ Bidding Documents.

I agree to maintain the following information in the Company's record for a period of 8 years and shall make this available for verification to any statutory authority.

i. Name and details of the Local Supplier

(Registered Office, Manufacturing unit location, nature of legal entity)

ii. Date on which this certificate is issued

Annexure-V

iii. Goods/services/works for which the certificate is produced

iv. Procuring entity to whom the certificate is furnished

v. Percentage of local content claimed and whether it meets the Minimum Local Content prescribed

vi. Name and contact details of the unit of the Local Supplier (s)

vii. Sale Price of the product

viii. Ex-Factory Price of the product

ix. Freight, insurance and handling

x. Total Bill of Material

xi List and total cost value of input used to manufacture the Goods/to provide services/in construction of works

xii. List and total cost of input which are domestically sourced. Value addition certificates from suppliers, if the input is not in-house to be attached

xiii. List and cost of inputs which are imported, directly or indirectly

For and on behalf of…… (Name of firm/entity)

Authorized signatory (To be duly authorized by the Board of Directors)

<Insert Name, Designation and Contact No.>

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

SCHEDULE OF COMMERCIAL DEVIATION

The following are the deviations/ variations exception from the General Terms and Conditions:

SL. NO.	CLAUSE NO. OF TERMS AND CONDITIONS	STATEMENT OF DEVIATION
	NIL DEVIATION	NIL DEVIATION

In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the General Terms and Conditions.

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

Note : 1. Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

2. Deviation mentioned in this schedule shall only be considered.

This Format is to be submitted in original duly signed by bidder. Reproduction of the same in any sort is not acceptable.

Signature of the authorized representative of

Place: é é é é é é é

Bidder's name
:é é é é é é é é é é é é é é é
Date : é é é é é é é é .
Designation:é é é é é é é é é é é é é é é é
..
Company
Seal:é é é é é é é é é é é é é é

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations/ variations exception from the Technical Specifications:

SL. NO.	CLAUSE NO. OF TERMS AND CONDITIONS	STATEMENT OF DEVIATION
	NIL DEVIATION	NIL DEVIATION

In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is deemed to be in compliance with the Technical Specifications,

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

Note : 1. Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

2. Deviation mentioned in this schedule shall only be considered.

This Format is to be submitted in original duly signed by bidder. Reproduction of the same in any sort is not acceptable.

Signature of the authorized representative of

Place: é é é é é é é .
Date : é é é é é é é .

Bidder's name :é é é é é é é é é é é é é é é
Designation:é é é é é é é é é é é é é é é ..

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

UNPRICED BID

Item No.	Item Description	Item Quantity	Unit of Measure	Unit Price (Inclusive of F&I & GST)	GST % Applicable
1	SUPPLY- CIRCUIT BREAKER : 420KV, 50KA FOR 1S, 3150A THREE PHASE SF6 CIRCUIT BREAKER WITHOUT CSD, WITHOUT CLOSING RESISTOR, WITH CORONA SHIELDING, OPERATING MECHANISM, INSULATORS , BASE FRAME, HV TERMINAL PLATES, CONTROL CABINET, SUPPORT STRUCTURE, CABLE GLANDS, LADDER (IF APPLICABLE), MARSHALLING BOX (IF APPLICABLE) AND OTHER ACCESSORIES, COMPLETE IN ALL RESPECTS	02	NO	Mention as "Quoted"	Mention GST %
2	SUPPLY- CIRCUIT BREAKER : 245KV, 40KA FOR 1S, 1600A THREE PHASE SF6 CIRCUIT BREAKER WITH OPERATING MECHANISM, INSULATORS , BASE FRAME, HV TERMINAL PLATES, CONTROL CABINET, SUPPORT STRUCTURE, CABLE GLANDS, LADDER (IF APPLICABLE), MARSHALLING BOX (IF APPLICABLE) AND OTHER ACCESSORIES, COMPLETE IN ALL RESPECTS	01	NO	Mention as "Quoted"	Mention GST %
3	SUPPLY- CIRCUIT BREAKER: 420KV, FOUNDATION BOLTS FOR CIRCUIT BREAKER, PLATFORM AND LADDER (IF APPLICABLE) AND MARSHALLING BOX (IF APPLICABLE)	02	LOT	Mention as "Quoted"	Mention GST %
4	SUPPLY- CIRCUIT BREAKER: 245KV, FOUNDATION BOLTS FOR CIRCUIT BREAKER, PLATFORM AND LADDER (IF APPLICABLE) AND MARSHALLING BOX (IF APPLICABLE)	01	LOT	Mention as "Quoted"	Mention GST %
5	SUPPLY- CIRCUIT BREAKER: 20% SF6 GAS.	01	LOT	Mention as "Quoted"	Mention GST %

PROJECT:	**NTPC North Karanpura**
ITEM:	**Supply & Services of 400kV Circuit Breakers**
SUBJECT:	**BID SPECIFIC ATC**

Supervision of ETC					
Item Number	**Item Description**	**Item Quantity**	**Unit of Measure**	**Unit Price (Inclusive of GST)**	**GST % Applicable**
6	SERVICES- CIRCUIT BREAKER : SUPERVISION OF ERECTION, TESTING & COMMISSIONING OF SUPPLIED 420KV, 3-PHASE CIRCUIT BREAKERS AT SITE.TESTING & COMMISSIONING INSTRUMENTS (TIME INTERVAL METER (TIMING KIT), SF6 GAS LEAKAGE DETECTOR & ANY OTHER SPECIAL TOOLS LIKE GAS FILLING ADAPTER ETC) SHALL BE BROUGHT BY SUPPLIER AND SHALL BE TAKEN BACK AFTER SUCCESSFUL COMPLETION OF TESTING AND COMMISSIONING.	6	Man-days	Mention as "Quoted"	Mention GST %
7	SERVICES- CIRCUIT BREAKER : SUPERVISION OF ERECTION, TESTING & COMMISSIONING OF SUPPLIED 245KV, 3-PHASE CIRCUIT BREAKERS AT SITE.TESTING & COMMISSIONING INSTRUMENTS (TIME INTERVAL METER (TIMING KIT), SF6 GAS LEAKAGE DETECTOR & ANY OTHER SPECIAL TOOLS LIKE GAS FILLING ADAPTER ETC) SHALL BE BROUGHT BY SUPPLIER AND SHALL BE TAKEN BACK AFTER SUCCESSFUL COMPLETION OF TESTING AND COMMISSIONING	2	Man-days	Mention as “Quoted”	Mention GST %
8	SERVICES- CIRCUIT BREAKER : TO & FRO CHARGES APPLICABLE FOR RAIL/ ROAD/ AIR	1	Visit	Mention as “Quoted”	Mention GST %

Signature & Seal of Supplier
Date:

Annexure-QR

TECHNICAL QUALIFYING REQUIREMENT

400kV Circuit Breakers being offered should be from manufacturer who has manufactured and supplied minimum five (5) nos. of three phase circuit breakers suitable for Air Insulated Substation/ Switchyard of 400 kV or above class which must have been in successful operation for a minimum period of two(2) years prior to 24.04.2021.

Documents to be submitted for Technical Requirements:

a. Purchase Order copy defining the scope & value/ Material Receipt Certificate at site.
b. Proof of successful operation/ performance certificate issued by end user.

Prepared By	Reviewed By	Approved By
Akhilesh Kumar	Vivek Kapil	Aruna Gulati
Dy. Manager/TBEM	SDGM/TBEM	AGM/TBEM

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

BHEL Document No. TB-316-369-001	Rev. 02		Prepared by	Checked by	Approved by
		Name	AK	MS/ DKM	RS
Type of Document: Technical Specification		Sign	-sd-	-sd-	-sd-
Title: **420 kV & 220kV CIRCUIT BREAKERS**		Date	30.05.14	30.05.14	30.05.14
		Group	TBEM		
		W.O. No	83011		

CUSTOMER: **NTPC LTD.**

CONSULTANT: **-**

PROJECT: **North Karanpura Super TPP (3x660MW)**
1. 400/220kV Switchyard at NKSTPP
2. 220kV Sub-station at Chatti Bariatu & Kerandari-A Mine

CONTENTS

NOTE:-

Offers submitted without checklist (section-6) shall not be evaluated.

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
02	19.08.21	AK	VK	AG	Revised specification for 400kV & 220kV CB required for associated bays of ICT-2 circuit.

Distribution	To					
	Copies					

SECTION 1

TECHNICAL SPECIFICATION OF 400kV & 220kV CIRCUIT BREAKER

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 400/220 kV SF6 Circuit Breaker along with steel structure, Inter pole cables, Operating Mechanism, Central Control Cabinet etc. to site.

Refer Section 3 for Project Details.

The Equipment is required for the following projects

Name of Customer : **NTPC LTD.**

Name of Projects : **400/220kV Switchyard for North Karanpura Super Thermal Power Project (3x660MW)**

1.2 SPECIFIC TECHNICAL REQUIREMENTS

As per Section 2 (Chapter B-14).

1.3 QUANTITIES

As per Annexure-C

1.4 Supervision charges for Erection, Testing and commissioning

Bidder shall quote lump-sum price for supervision of **Erection, Testing and commissioning** of the offered circuit breakers.

An indicative list of tests to be performed at site is given below. Supplier shall perform any additional test based on specialties of CB as per Field QP/ instruction of the equipment manufacturer or Purchaser without extra cost to purchaser. The supplier shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish list of instruments to BHEL/NTPC for approval.

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.

1.5 Spares

All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacement. The spares shall be treated and packed for long term storage in the climatic conditions prevailing at the site. Small items shall be packed in sealed transparent plastic covers with desiccant bags as necessary.

Each spare part shall be clearly marked and labeled on the outside of the packing together with the description when more than one spare part is packed in single case. A general description of the contents shall be shown on outside of the case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

1.6 Sub-Suppliers

Bidder should consider NTPC approved make of components and fitments. In case the offered make is not approved by BHEL/ NTPC, bidder has to provide alternate make components without any commercial/ time of delivery implication to BHEL.
Few of the approved make of equipments shall be as follows:

Item Description	Proposed sub-supplier	Place	Sub-supplier approval status code/category
Cable Lugs	DOWELS	MUMBAI	A
	3D	UMBERGAON	A
	CHETNA	NASIK	A
Cable Glands	COMET	MUMBAI	A
	SUNIL & CO	KOLKATA	A
	STANDARD METAL INDUSTRIES	MUMBAI	A
	ARUP ENGG	KOLKATA	A
	QUALIT PERCISION	KOLKATA	A
	BRACO	MUMBAI	A
SF6 Gas Filling & Evacuation Plant, Gas recycling & purifying plant, Gas Leakage detector (if applicable)	ENERVAC	CANADA	A
	DILO	GERMAN	A
	VACCUM PLANT INDUSTRIES	PUNE	A
	AL QUALITEK	USA	A
Operational Analyser with DCRM kit (if applicable)	SCOPE T & M	PUNE	A
	MEGGER	UK	DR
	HATHAWA	USA	DR
	GE	SWEDEN	A
	VIC	USA	A
	TECH. IMP S STEMS	ITAL	DR

A – For this item proposed sub-vendor is acceptable to NTPC.
DR – For these items Details required for NTPC review.
Above vendor list is final and no additional vendor approval will be given.

1.7 Qualifying requirements

400kV Circuit Breakers being offered should be from manufacturer who has manufactured and supplied minimum five (5) nos. of three phase circuit breakers suitable for Air Insulated Substation/ Switchyard of 400 kV or above class which must have been in successful operation for a minimum period of two(2) years prior to 28.04.2021.

220 kV Circuit Breakers being offered should be from manufacturer who has manufactured and supplied minimum five (5) nos. of three phase circuit breakers suitable for Air Insulated Substation/ Switchyard of 220 kV or above class which must have been in successful operation for a minimum period of two (2) years prior to 28.04.2021.

1.8 Type tests

Equipment offered shall be of type tested design. During detailed engineering, the Bidder shall submit for Owner's approval the reports of all type tests as per the relevant IEC/IS & carried out within last **ten years** from the date 28.04.2021. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test (s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However, if bidder is not able to submit any test report conducted within last ten years from the date 28.04.2021 or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct the same test(s) under this contract at no additional cost to the owner either at third party lab or in presence of clients/ owners representative and submit the reports for approval.

i) All acceptance and routine tests shall be carried out. Charges for these shall be deemed to be included in the equipment price.

S.N.	Description	Unit	Qty
SUPPLY			
1	Main item- 420 kV, 3150 A, 50 kA for 1 Sec, Three phase SF6 Circuit Breaker without CSD without closing resistor with corona shielding, operating mechanism, Insulators , base frame, HV terminal Plates, control cabinet, support structure, cable glands, ladder (if applicable), marshalling box (if applicable) and other accessories, complete in all respects	Nos.	2
2	Main item- 245 kV, 1600 A, 40 kA for 1 Sec, Three phase SF6 Circuit Breaker with operating mechanism, Insulators , base frame, HV terminal Plates, control cabinet, support structure, cable glands, ladder (if applicable), marshalling box (if applicable) and other accessories, complete in all respects	Nos.	1
3	Main item-Foundation/fixing bolts for 420kV, 3-Phase SF6 Circuit Breaker structure, platform, ladder (if applicable) and marshalling box (if applicable) at sl no. 1. 1Lot = Qty. required for 1 no. 3-Phase 400kV Circuit Breaker.	Lot	2
4	Main item-Foundation/fixing bolts for 245kV, 3-Phase SF6 Circuit Breaker structure, platform, ladder (if applicable) and marshalling box (if applicable) at sl no. 2. 1Lot = Qty. required for 1 no. 3-Phase 245kV Circuit Breaker.	Lot	1
5	20% spare SF6 gas for 400 & 220kV Circuit Breakers (3-ph)	Lot	1
SERVICES			
6	Supervision of Erection, Testing & Commissioning of supplied 420kV, 3-Phase Circuit breakers at site.Testing & commissioning instruments (Time interval meter (timing kit), SF6 gas leakage detector & any other special tools like gas filling adapter etc) shall be brought by supplier and shall be taken back after successful completion of testing and commissioning	Man days	6
7	Supervision of Erection, testing and commissioning of 245 kV Circuit Breaker (item no. 2) (1 lot =1 complete 3-ph CB)	Man days	2
8	Services- To and fro charges for Supervision of Erection, Testing & Commissioning of supplied Circuit Breakers at site	Visits	1

Notes:

1 Spare Gas shall be 20% of total quantity of gas required for all 420kV & 245kV Circuit Breakers (3-ph)

2 Inter pole cabling between Circuit breaker and common marshalling box shall be Non Plug in type. Inter pole cable schedule shall be provided by bidder during detailed engineering stage

3 Supply of terminal connectors for circuit breakers is in BHEL scope.

6 a) For item at Sl. no. 6 & 7 of BOQ, no. of mandays consumed in Supervision of erection, testing and commissioning of Circuit Breakers shall be duly certified by BHEL Site-incharge.

b) Visit charges are covered separately under item at Sl. no. 8 of BOQ. No other charges shall be paid by BHEL.

c) The following instruments/kits shall be brought by Bidder and shall be taken back after successful completion of testing and commissioning:
i. Time Interval meter (Timing kit)
ii. SF6 Gas leak Detector
iii. Any other special tools like gas filling adapter etc

d) The following instruments/kits shall be provided by BHEL at site:
i. DCRM
ii. 5kV Insulation tester
iii. 1kV Insulation tester
iv. Single phase variac
v. Dew Point meter
vi. Capacitance and Tan Delta Kit
vii. Contact Resistance measurement kit
viii. Multimeter

e) Circuit Breaker Analyzer - Adaptor/Transducer for analyzer (if required) suitable for breaker shall be scope of bidder.

SECTION 2

EQUIPMENT SPECIFICATION

- NTPC specification for Circuit Breaker – Chapter B14 along with Annexure -I, II & III (11 pages)
  - Specification of Circuit Breaker (07 pages)
  - Annexure-I: List of valid type tests reports to be submitted by bidder (1 page)
- Refer Section-3 for specification of CABINETS, HOLLOW INSULATORS, MOTORS, etc.

2.00.00 CIRCUIT BREAKER

2.01.00 **GENERAL**

Circuit Breakers shall be outdoor type, comprising three identical single pole units, complete in all respects with all fittings and wiring. The circuit breakers and accessories shall conform to IEC- 62271-100 or equivalent Indian Standard.

The requirement of control switching is at Annexure-II of this chapter.

2.02.00 **DUTY REQUIREMENTS**

2.02.01 Circuit breaker shall be C2/M1class 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 400/220 kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily.

2.02.03 The circuit breaker shall be capable for breaking the steady & transient magnetizing current corresponding to 400/220 kV transformers up to 630 MVA rating. It shall also be capable of breaking line charging currents as per IEC- 62271-100 with a voltage factor of 1.4.

2.02.04 The rated transient recovery voltage for terminal fault and short line faults shall be as per IEC:62271-100.

2.02.05 The circuit breakers shall be reasonably quiet in operation. Noise level in excess of 140 dB measured at base of the breaker would be unacceptable. Bidder shall indicate the noise level of breaker at distance of 50 to 150 m from base of the breaker.

2.02.06 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.

2.02.07 While furnishing particulars regarding the D.C. component of the circuit breaker, the Bidder shall note that IEC-62271-100 requires that this value should correspond to the guaranteed minimum opening time under any condition of operation.

2.02.08 The critical current which gives the longest arc duration at lock out pressure of extinguishing medium and the duration shall be indicated.

2.02.09 All the duty requirements specified above shall be provided with the support of adequate test reports to be furnished along with the bid.

2.03.00 **CONSTRUCTIONAL FEATURES**

2.03.01 All making and breaking contacts shall be sealed and free from atmospheric effect. In the event of leakage of extinguishing medium to a value, which cannot withstand the dielectric stresses specified in the open position, the contacts shall preferably self close. Main contacts shall be easily accessible for inspection and replacement. If there are no separately mounted arcing contacts, then the main contacts shall be easily accessible for inspection and replacement. Main contacts shall have ample area and contact pressure for carrying the rated current under all conditions. The interrupter sectional drawing showing the following conditions shall be furnished for information with the bid:

a) Close position
b) Arc initiation position
c) Full arcing position
d) Arc extinction position
e) Open position.

2.03.02 All the three poles of the breaker shall be linked together either electrically/pneumatically or electro hydraulically in case of single phase reclosing.

2.03.03 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.

2.04.00 **SULPHUR HEXAFLOURIDE (SF6) GAS CIRCUIT BREAKER**

2.04.01 Circuit breakers shall be single pressure type.

2.04.02 Design and construction of the circuit breaker shall be such that there is minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on insulated surfaces of the circuit breaker.

2.04.03 In the interrupter assembly, there shall be absorbing product box to eliminate SF6 decomposition products and moisture. The details and operating experience with such filters shall be brought out in additional information schedule.

2.04.04 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.

2.04.05 Material used in the construction of circuit breakers shall be such as fully compatible with SF6.

2.04.06 The SF6 gas density monitor shall be adequately temperature compensated to model the density changes due to variations in ambient temperature within the body of circuit breaker as a whole. It shall be possible to dismantle the monitor without removal of gas. Temperature compensated SF6 pressure gauge shall be provided which will be visible from ground level.

2.04.07 Sufficient SF6 gas shall be supplied to fill all the circuit breakers installed plus an additional 20% of the quantity as spare.

2.05.00 **OPERATING MECHANISM**

2.05.01 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.

2.05.02 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.

2.05.03 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.
2.05.04	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.
2.06.00	**FITTINGS AND ACCESSORIES**
2.06.01	The insulators and terminal connectors shall conform to requirements stipulated elsewhere. All routine tests shall be conducted on the insulators as per relevant IEC.
2.07.00	**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).

2.08.00 **TESTS**

2.08.01 In accordance with the requirements stipulated under Part-A, the circuit breakers alongwith its operating mechanism shall be type tested for all the type tests as per annexure-I to this chapter.

2.09.00 **ROUTINE TESTS**

Routine tests as per IEC-62271-100 on the complete breaker/ pole alongwith its own operating mechanism and pole column shall be performed on all circuit breakers.

2.10.00 **SITE TESTS**

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

2.11.00 **PARAMETERS**

2.11.01 **General**

a)	Type of circuit breaker	Outdoor SF6, single pressure, Live tank type
b)	Rated frequency	50 Hz
c)	Number of poles	Three (3)
d)	Rated operating duty cycle	O - 0.3 sec. - CO - 3min. – CO
e)	Rated line charging breaking Current (voltage factor of 1.4)	As per IEC
f)	Reclosing	Single and three phase high speed auto reclosing (as required)
g)	Total closing time	Not more than 150 ms.
h)	Maximum difference in the instants of closing/opening of contacts	As per standard
i)	Trip and closing coil voltage	220V DC
j)	Auxiliary contacts	As required plus 10 NO and 10 NC contacts per pole as spare. The contacts shall have continuous rating of 10A

		and breaking capacity of 2A with circuit time constant of minimum 20 millisecond at 220V DC.
k)	Noise level	Maximum 140dB at 50m distance from base of circuit breaker
l)	Rated terminal load	Adequate to withstand 100kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capacity.
m)	Temperature rise over Ambient	As per IEC: 62271-100
n)	Type of operating mechanism	Pneumatic/spring/hydraulic/or a combination of these
o)	Minimum creepage distance	As indicated in elsewhere in specification.
p)	Rated ambient temperature	50 degree Centigrade
q)	System neutral earthing	Effectively earthed
r)	Seismic acceleration	0.3 g horizontal
s)	Support structure height	Adequate so that lowest part of support insulator of equipment is minimum 2550 mm from ground/ plinth level.
2.11.02	**400kV Class Circuit Breakers**	
a)	Rated voltage	420 kV rms
b)	Rated continuous current	Minimum 3150/2000 A at rated ambient temperature current capacity
c)	Rated short circuit breaking current at rated voltage	50kA with percentage of DC component as per IEC corresponding to minimum opening time under operating conditions specified.
d)	Symmetrical interrupting Capability	50 kA rms
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)	600A at 90□ C leading power factor with maximum permissible switching overvoltage of 2.3 pu.
i)	Rated small inductive current	Corresponding to interrupting steady and transient

	Breaking capacity		magnetising current of 50 to 630 MVA transformers with overvoltage less than 2.3 pu
j)	First pole to clear factor		1.3
k)	Rated break time		
	i) 40 ms under test duties 2, 3 & 4 at rated values ii) 45 ms under test duties 1 to 5 and short line fault test duties and combined variation of trip coil voltage, operating pressure and quenching media pressure, etc.		
l)	Rated one minute power frequency withstand voltage	i) ii)	520 kV rms between live terminals and earth. 610 kV rms across isolating distance.
m)	Rated lightning impulse withstand voltage	i) ii)	±1425 kVp between live terminals and earth. ± 1425 kVp impulse on one terminal and 240 kVp power freq. voltage of opposite polarity on other terminal (across isolating distance).
n)	Rated switching impulse withstand voltage	i) ii)	± 1050 kVp between live terminals and earth ± 900 kVp impulse on one terminal and 345 kVp power freq. voltage of opposite polarity on other terminal (across isolating distance).
o)	Max. Radio interference voltage		1000 micro volts for freq. between 0.5 MHz and 2.0 MHz at voltage 266 kV rms.
p)	Phase to phase spacing		7000 mm (Other type tested spacing is also acceptable)
q)	Corona extinction voltage		Not less than 320 kV rms

2.11.03 **220 kV Class Circuit Breakers:**

a)	Rated voltage	245 kV, rms.
b)	Rated continuous current at an ambient temperature of 50^0 C	1600/2500 A
c)	Symmetrical interrupting Capability	40 kA, rms.
d)	Rated short circuit making current	100 kAp
e)	Short time current carrying Capability for one second	40 kA, rms.
f)	Out of phase breaking current Capacity	10 kA, rms.
g)	Rated line charging breaking current At 90^0 leading power factor angle (A, rms.)	As per IEC

(The breaker shall be able to interrupt the rated line charging current with a test voltage immediately before opening equal to the product of U/□ 3 and 1.4 as per IEC-60271-100).

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	60 ms
l)	Total breaktime	65 ms
m)	Rated Insulation levels :	

I) Full wave impulse withstand voltage (1.2/50 micro sec.)

between line terminals and ground	± 1050 kV peak
between terminals with circuit breaker open	± 1200 kV impulse on one terminal and other terminal earthed

II) One minute power frequency dry and wet withstand voltage

between line terminals and ground	460 kV rms
between terminals with circuit breaker open	530 kV rms

n)	Max. radio interference voltage for Frequency between 0.5 MHz and 2MHz at 156 kV rms (Micro volts) both in open and closed position	1000
o	Phase to phase spacing	4500 mm

Annexure-I

List of type tests to be included by Bidder

a) Dielectric tests

b) Radio interference voltage test

c) Temperature Rise test

d) Short time withstand current and peak withstand test

e) Mechanical endurance

f) Short circuit test duties

g) Short line fault test

h) Out of phase making & breaking test

i) Line charging current breaking test

j) Corona test for 400kV Only

k) IP:55 test on each type of box

l) Seismic withstand test with structure for 400kV only

m) Test for reactor switching duty for 400kV CB only (For Bus reactor)

Breakers to be offered shall be of type tested design with valid type test reports (10 yrs from date of bid opening). If valid reports are not available, bidder has to conduct the type tests without cost & delivery implication to BHEL/ NTPC.

Annexure -II

Requirement of Controlled Switching Device for 400KV Circuit Breaker

NOT APPLICABLE

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 meet the requirements of IEC-60255-4 Appendix 'E' class III regarding HF disturbance test, and fast transient test shall be as per IEC-61000 – 4 level III and insulation test as per 60255 – 5.

5. The device shall have functions for switching ON & OFF the circuit breakers.

6. The device 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.

7. 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.

8. The device should have display facility at the front for the settings and measured values.

9. The device shall have self monitoring facility.

10. 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.

11. The device should be PC compatible for the setting of various parameters. During the switching operations, current and voltage waveforms and other parameters shall be recorded and saved together with calculated values. Recorded waveform shall be downloaded on to PC for evaluation purpose. It shall also enable downloading of data captured from the switching events. Window based software for this purpose shall be supplied by the contractor to be used on owner's PC.

12. 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.

13. 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.

14. The device shall have time setting resolution of 0.1 ms or better.

15. 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.

16. 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.

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

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

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

3.1 PROJECT DETAILS

	Particular	**Details**
a)	Customer	NTPC Ltd.
b)	Engineer/Consultant/ Inspector	NTPC Ltd.
c)	Project Title	North Karanpura Super Thermal Power Project (3x660 MW) : 400/220kV Switchyard at NKSTPP end & 220kV Sub-station at Mine end
d)	Project Location	Place: Near Tandwa town District: Hazaribagh & Chatra State: Jharkhand
e)	Latitude & Longitude	**400/220kV S/s at NKSTPP:** North: 23°50' to 23°52' and East: 84°59' to 85°2' **220kV S/s at Chatti Bariatu & Kerandari-A mine:** North: 23°52'35" and East: 85°05'25"
f)	Nearest Railway Station	Khalari Railway Station Ranchi-Garhwa section of Eastern Railways
g)	Distance of project location from the Railway station	40 Km (approx.)
h)	Nearest Major Town	Hazaribagh city
i)	Distance of the town from the project site	50 Km.
j)	Nearest commercial airport	Ranchi
k)	Distance of airport from the project site	150 Km
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000 meters
d)	Pollution Severity	Heavily polluted (With Coal dust & Fly ash) and Highly Corrosive environment.
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3) 1987
f)	Basic Wind speed "Vb" at ten meters	39 m/ sec

	above the mean ground level.	
g)	Category of terrain	Cat –2
h)	Risk Coefficient "K1"	1.06

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV	220 kV
1	Highest system voltage	420 kV rms	245 kVrms
2	Lightning Impulse voltage	±1425kVp	± 1050kVp
3	Switching impulse voltage	±1050kVp	-
4	Power frequency withstand for 1 min (rms)	630 kV(rms)	460 kV(rms)
5	Max. fault level (1 sec.)	50 kA	40kA
6	Minimum creepage distance	10500 mm	6125mm

3.1.2 **AUXILIARY POWER:**

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

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

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

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

Voltage	Equipment /1st Level	2nd Level	3rd Level	Peak
220kV	6000mm	12000mm	17000mm	8500mm
400kV	8000mm	16000mm	23000mm	8500mm

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

The minimum height of intermediate gantry tower for 400kV wherever required shall be 25 m and the peak (s) shall be of 8.5 m.

3.1.4 The minimum clearances for 400kV & 220 kV switchyards shall be as given below:

	400kV	**220kV**
Phase to earth clearance	3500 mm	2100mm
Phase to phase clearance	4000 mm	2100mm
Section clearance	6500 mm	5000mm

3.2 INSTRUCTION TO BIDDERS:

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

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

It is recognized that the bidders may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar

equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section-Lighting System.

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

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

3.3 CODES AND STANDARDS

The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), and other local rules and regulations.

The equipment to be furnished under this specification shall conform to latest issue with all amendments of standards and/ or codes specified under respective section heads. The standards mentioned in the specification are not mutually exclusive or complete in them, but intended to complement each other. The supplier shall also note that list of standards presented in this specification is not complete. Whenever necessary the list standards shall be considered in conjunction with specific IS/IEC. When the specified requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards which ensure equivalent or better performance that specified in the standards referred under section shall also be acceptable.

In case governing standards for the equivalent for the equipment is different from IS/ IEC, the salient points of difference shall be clearly brought out in additional information schedule along with English language version of standard of relevant extract of the same. The equipment conforming to standards other than IS/ IEC shall be subject to Purchaser’s approval.

The full names of the codes and standards mentioned in abbreviations under various equipment heads are as follows:

BS	British Standards
IEC/ CISPR	International Electro-technical Commission

IS	Bureau of Indian Standards
ISO	International Organization for Standards
NEMA	National Electric Manufacturers Association

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions. All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (not applicable for this project) short circuit etc for the equipment .

The equipment shall also comply with the following:

a) All equipments shall be suitable for hot line washing.
b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.
d) All equipment shall be supplied with necessary inter-pole cabling, and its cost shall be included in the cost of equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

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

Each drawing submitted by the 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, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

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

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

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

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

3.5.2 Approval Procedure

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

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. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.

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 subvendor along with his purchase order for subvendor's compliance.

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

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

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

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

g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases 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.

h. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay

arising out of submission and modification of drawings shall not alter the contract completion schedule.

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

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

3.5.3 Erection Drawings.

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

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

3.5.4 Instruction Manual

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

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

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

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

e. The manuals shall include the following

a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.

b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

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

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

3.5.5 Final Submission of drawings and documents:

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

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

3.5.6 TEST REPORTS

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

3.6 MATERIAL /WORKMANSHIP

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

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

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

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

The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.7 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

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

SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On –off switch and fuse shall be provided.

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

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

FUNGI STATIC VARNISH

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

Ventilation opening

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

Degree of Protection

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

a. Installed outdoor: IP- 55
b. Installed indoor in air conditioned area: IP-31
c. Installed in covered area: IP-52
d. Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e. For LT Switchgear (AC & DC distribution Boards) : IP-52

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

PRESERVATIVE SHOP COATING

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

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

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

3.8 RATING PLATES, NAME PLATES AND LABELS

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

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

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

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

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

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

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

3.9 GALVANISING:

3.9.1 The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.

3.9.2 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor's cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness of zinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS:2633.

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

3.10 PAINTING

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

3.11 QUALITY ASSURANCE PROGRAMME

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

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

i. His organisation structure for the management and implementation of the proposed quality assurance programme
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.

xv. System for maintenance of records, and

xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed as Annexure-I.

3.12 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.12.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the 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 programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.

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

3.12.3 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.

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

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

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

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

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

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

3.12.10 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.

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

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

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

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

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

3.12.16 All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 50mm shall be ultrasonically tested.

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

3.12.17 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 subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control

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

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

3.12.19 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractors 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/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

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

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

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

3.12.23 Environmental Stress Screening

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

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

Or

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

<u>Elevated Temperature Test Cycle</u>

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

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

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

Burn In Test Cycle

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

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

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

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

The 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.

3.13 QUALITY ASSURANCE DOCUMENTS

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

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

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

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

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

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

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

3.13.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

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

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

3.14 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer after the delivery date for the corresponding equipment. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.
For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 1 month after the date of the last delivery similarly as stated above.

3.15 INSPECTION, TESTING & INSPECTION CERTIFICATE

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

3.15.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect

and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

3.15.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days 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, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the 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.

3.15.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the 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.

3.15.5 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. 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.

3.15.6 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 authorised 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 authorised representative to accomplish testing.

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

3.15.8 To facilitate advance planning of inspection in addition to giving inspection notice, the 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 beginning of each calendar month.

3.15.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The 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 equipments in the presence of Project Manager / Inspector.

3.16 PACKAGING & TRANSPORTATION

Items shall be packed & dispatched separately to respective sites i.e. to 400/220kV S/s at NKSTPP end & to 220kV S/s at Chatti Bariatu & Kerandari-A mine end.

3.16.1 Packing, Marking and shipping

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

a) The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage.

b) The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.

c) The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.

d) The Contractor shall be liable for any damage or loss resulting due to careless, improper, poor or insufficient packing and handling.

e) Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked “Spare Parts Only”. They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.

f) The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

3.16.2 Transportation

a) The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.

b) All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer’s recommendations. Employer shall have the right to decide the items that should be air freighted and Employer’s decision shall be binding on Contractor.

3.16.3 Insurance

a) The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.

b) Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise

shall not constitute groups for claims for extension in time or for extra payment.

3.17 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

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

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

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

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

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

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

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

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

3.18.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS: / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.18.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

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

3.18.4 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

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

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

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

3.18.8 Insulator shall also meet requirement of IEC - 815 as applicable, having alternate long & short sheds.

3.19 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT.

3.19.1 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:439 as applicable.

3.19.2 **Mechanism Box/ Control Cabinet/ Kiosks:** A sheet steel (atleast 2.5 mm thick), dust and vermin proof M.Box/CCC/CMB shall be provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber.

Painting of boxes shall be as follows,

- External surface : Chemical resistant epoxy zinc phosphate primer, MIO (Micaceious iron oxide) as intermediate paint followed by polyurethane finish paint **(RAL 5012 Blue)**
- Internal surface : Chemical resistant epoxy zinc phosphate primer followed by chemical & heat resistant **epoxy enamel white paint**.

3.19.3 **Junction Boxes:** The junction boxes shall be made of minimum 2 mm thick sheet steel. Gland plates shall be removable type and made of 3 mm thick sheet steel. The boxes shall be provided with detachable cover or hinged door with captive screws. Top of the box shall be arranged to slope towards the rear of the box. The box shall be **hot dip galvanised** and shall be provided with suitable neoprene gaskets to achieve requisite degree of protection. Adequate spacing shall be provided to terminate the external cables. The boxes shall be suitable for mounting on various types of steel structures. The terminal blocks provided shall be of 650 V grade, rated for 10 A for control cables. Suitable numbering for terminal blocks shall be done. In case of junction box for power cable, the box shall be rated for maximum current carrying capacity. Terminal blocks shall be of one piece, Klippon RSF-1 or ELMEX CSLT-1 type with insulating barriers.

3.19.4 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

3.19.5 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.

3.19.6 The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.

3.19.7 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.19.8 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.19.9 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.20 TERMINAL BLOCKS

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

3.20.2 The terminal blocks shall be of 650 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.20.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

3.20.4 The terminals shall be provided with marking tags for wiring identification.

3.20.5 Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:
All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. Aluminium conductor
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor.

3.20.6 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.

3.21 Wiring

3.21.1 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).

3.21.2 All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

3.21.3 Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires

shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

3.21.4 All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

3.21.5 All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.

3.22 CABLE GLANDS AND LUGS

3.22.1 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 packing glands to close unused openings in gland plates shall also be provided.

3.22.2 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.

3.22.3 Cables lugs for power cables shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipmentsThe cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.4 CONDUITS, PIPES AND ACCESSORIES

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

3.4.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. 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.

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

3.5 MOTOR CONTROL CENTRE

3.5.1 The 415 Volt motor control centres (if provided separately) shall conform to the requirements for boxes/cabinets/kiosks. They shall be fixed type, shall be fully sectionalised and shall be equipped with load break switches. Motor feeders shall be provided with isolating switch fuse unit and Contractor with thermal overload relay and single phase protection. The motor Contractor shall have one normally open auxiliary contact for alarm purposes. The motor control circuit shall be independent from all other control circuits.

3.5.2 Isolating Switches

The incoming power supply isolating switch operation handle shall be interlocked with the control cabinet door as to prevent opening of door when main switch is closed. Device for by passing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions.

3.5.3 Fuses

All fuses shall be of the HRC cartridge type, conforming to IS: 2208 and suitable to mount on plug-in type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live conductor. Insulated fuse pulling handle shall be supplied with each control cabinet.

3.6 MOTORS

3.6.1 Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards.

3.6.2 Enclosures

a) For motors to be installed outdoor, the motor enclosure shall have degree of protection IP: 55. For motors to be installed indoor, i.e. inside a box, the motor enclosure shall be dust proof equivalent to IP: 54.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting condensation or other causes from all pockets in the motor casing.

3.6.3 Operational Features :

a) Continuous motor ratings (name plate rating) shall be at least suitable for the driven equipment at design duty operating point of driven equipment that will arise in service.
b) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the given system.

3.6.4 Starting Requirements

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops.
b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
c) The locked rotor current shall not exceed six(6) times the rated full load current for all motors subject to tolerance given in IS:325.
d) Motors when started with driven equipment imposing full staring torque and supply voltage conditions specified shall be capable of withstanding at least two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by a least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Contractor shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower

than 20% and open for speeds above 20% of the rated. The speed switch shall be capable of withstanding 120% of the rated speed in either directions of rotation.

3.6.5 The maximum permissible temperature rise over the ambient temperature shall be within the limits specified in IS: 325 (for 3 phase induction motors) after adjustment due to increased ambient temperature specified.

3.6.6 The double amplitude of motor vibration shall be within the limits specified in IS:729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

3.6.7 All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes.

3.7 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

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

3.8 LAMPS AND SOCKETS

3.8.1 Lamps:

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

3.8.2 Sockets

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

3.8.3 Hand Lamp:

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

3.9 SWITCHES & FUSES:

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

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

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

3.10 TYPE, ROUTINE & ACCEPTANCE TESTS:

All equipments to be supplied shall be of type tested design. During contract stage, bidder shall submit for Owner's approval the reports of all the type tests listed in this specification and carried out within last ten years from the date **28.11.2013**. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have be witnessed by a client.

However if contractor is not able to submit report of the type tests conducted within ten years from the date **28.11.2013** or in the case of type test reports are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

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

3.11 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

a) The corona (for 400kV only) and RIV tests shall confirm to the requirements as per Annexure A.
b) The seismic withstand test for 400kV shall conform to requirements as per Annexure B.

3.12 Enclosures:

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

Annexure – A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1.0 **General**

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

2.0 **Test Levels**

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

3.0 **Test Methods for RIV:**

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 420 KV 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**

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

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

The bidder shall arrange to transport the structure from his contractor's premises / owner's sites for purpose of seismic withstand test only.

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.

ANNE URE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	**MANUFACTURING QUALITY PLAN**		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV.NO.:	CONTRACT NO. :
		SUB-SYSTEM:	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.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

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"

FOR NTPC USE

DOC. NO.:		REV…… CAT…..
REVIEWED BY	APPROVED BY	APPROVAL SEAL

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

S ITCHYARD S E 2

Attributes / Characteristics / Items/Components Sub Systems	Make, model, Type & Rating, Test Certificate	Routine & Acceptance Test as per IS / IEC	Functional requirements as per NTPC Specification
Circuit Breaker (IEC:62271-100)	Y	Y	Y
Interruptor & hollow insulator (IEC:233/ IS:5284)	Y	Y	Y
Isolator (IEC:62271-102)	Y	Y	Y
Current Transformer (IEC:60044/BS:3938/IS2705)	Y	Y	Y
Capacitor Voltage Tramsformer (IEC:186A / 358/IS3156/IEC60044)	Y	Y	Y
Bus Post Insualtor (IEC:168 / 815 / IS:2544)	Y	Y	Y
Disc,Pin & String Insualtor (IEC:383 / IS:731)	Y	Y	Y
Long Rod Insualtor (IEC:433)	Y	Y	Y
Surge Arrestor (IEC:99-4/IS:3070)	Y	Y	Y
Hardware fittings for Insulator (IS:2486 / BS:3288)	Y	Y	Y
Spacer Clamps & Connector (IS:10162 / 5561)	Y	Y	Y
Aluminium Tube (IS:5082 / 2673 / 2678)	Y	Y	Y
Wave Trap (IEC:353 / IS:8792 / 8793)	Y	Y	Y
Conductor (IS:398-P-II)(V)	Y	Y	Y
Galvanised Steel Structures (IS:2062/2629/4759/6745)	Y	Y	Y
Vibration Damper (IS:9708)	Y	Y	Y
Sag Compensating Spring DIN:2089/2096 IS:3195 / 7906	Y	Y	Y
Control & Relay Panel	Y	Y	Y
SF6 Gas filling & evacuating plant	Y	Y	Y
SF6 Gas Leak Detector	Y	Y	Y
Leakage Current Analyser	Y	Y	Y
Nitrogen Gas Filling Device	Y	Y	Y
Protection Relays	Y	Y	Y
Event Logger	Y	Y	Y
Operation Analyser	Y	Y	Y
Disturbance Recorder	Y	Y	Y
Tariff Metering System	Y	Y	Y
Synchronising Trolly	Y	Y	Y

Attributes / Characteristics / Items/Components Sub Systems	Make, Type Rating,and Model, Test Certificates	Routine & Acceptance Test as per relevant IS/IEC	Functional requirements as per NTPC Specification
Relay Test Kit	Y	Y	Y
LT Switchgear /LT Panels (IEC:947 / IS:13947)	Y	Y	Y
Battery IS:1652	Y	Y	Y
Lighting Panels	Y	Y	Y
Surge Monitor	Y	Y	Y

Notes : 1) This is an indicative list of test/checks. The manufacture is to furnish a detailed
Quality Plan indicating the practice and procedure along with relevant supporting
documents during QP finalisation for all items.
2) All major Bought Out Items will be subject to NTPC approval.

SECTION - 4

GUARANTEED TECHNICAL PARTICULARS FOR CIRCUIT BREAKERS

(To be furnished during detailed engineering)

- NTPC datasheet for Circuit Breaker (5 pages)
- NTPC datasheet for Bushing/Hollow Insulators (1 page)

D :12A

EHV CIRCUIT REA ERS

(Bidder to fill up separately for each type of breaker)

1.	General		
	a)	Name & country of the Manufacturer	.....
	b)	Type of Circuit breaker	.....
	c)	Manufacturer's type designation	.....
	d)	Standards Applicable	.....
	e)	Rated Voltage (KV)	.....
	f)	Rated Current	.....
		i) Under normal condition (Amps)	.....
		ii) Under site conditions (Amps)	.....
	g)	Rated frequency (Hz)	.....
	h)	Number of poles	.....
	i)	Whether 3 poles or single pole unit	.....
	j)	Whether dead tank or live tank design	.....
	k)	No. of breaks per pole	.....
2.	Guaranteed Ratings		.....
	a)	Rated short circuit breaking current	.....
		i) Symmetrical component at highest system voltage (kA)	.....
		ii) DC Component (%)	.....
		iii) Asymmetrical breaking current at highest system voltage (kA)	.....

b)	Rated Making capacity		.....
	i)	at higher rated voltage (kA peak)	.....
	ii)	at lower rated voltage (kA peak)	.....
c)	Maximum break time for any current upto rated breaking current (ms)		.....
	i)	For Test duties 2,3 & 4 at rated values	.....
	ii)	For other duties at limiting conditions of voltage and pressure	.....
d)	Closing times (ms)		.....
e)	Minimum opening time under any condition with limiting voltage and pressure (ms)		.....
f)	Maximum opening time under any condition with limiting voltage and pressure (ms)		.....
g)	First pole to clear factor		.....
h)	Short time current rating (kA)		.....
	i)	1 Second	.....
	ii)	3 Second	.....
i)	Rated operating duty		.....
j)	Maximum line charging breaking current with temporaty over voltage up to 1.4 p.u. (kA)		.....
k)	Maximum arc duration and corresponding current under lockout pressure.		.....

l)	Pre-insertion resistor (if applicable)	.....
	i) Value / pole (Ohms)/with tolerance	.....
	ii) Minimum and maximum duration of insertion per pole (ms)	.....
	iii) Thermal rating for the C-1m-0-CO-2m-C-1m-O-CO for terminal fault considering maximum resistance and time setting	.....
	iv) Thermal rating for the same duty as (iii) above for reclosing against trapped charges	.....
3.	Dielectric with-stand of Complete Breaker	.....
a)	One minute dry & wet power frequency withstand voltage	.....
	i) Between live terminal and ground (kV rms)	.....
	ii) Between terminals with breaker contacts open (kV rms)	.....
b)	1.2/50 micro second impulse withstand test voltage	.....
	i) Between live terminal and ground (kV peak)	.....
	ii) Between terminals with breaker contacts open (kV peak)	.....
c)	250/2500 micro second impulse switching surge withstand test voltage	.....
	i) Between live terminal and ground (kV peak)	.....
	ii) Between terminals with breaker contacts open (kV peak)	.....

	d) Total creepage distance	.....
	i) To ground (mm)	.....
	ii) Between terminals (mm)	.....
4.	Operating Mechanism	.....
	a) Type of operating mechanism for	.....
	i) Closing	.....
	ii) Opening	.....
5.	Quenching Media	
	a) Quantity of SF6 per pole at rated pressure (Kg)	.....
	b) Guaranteed maximum leakage rate per year	.....
	c) Rated pressure of SF6 in operating chamber (Kg/cm^2)	.....
	d) Limit of pressure at which breaker operates correctly (Kg/cm^2)	.....
6.	Constructional Details	.
	a) Type and capacity of device used to obtain uniform voltage distribution between breaks	.....
	b) Number of auxiliary contacts per pole provided	.....
	i) NO	.....
	ii) NC	.....
	iii) Adjustable	.....

7.	Detailed Literature	.....
	(Whether the following are enclosed)	
	a) Type test reports	Yes/No
	b) OGA drawing of breaker	Yes/No

CLAUSE NO.	idder s Name ..	

D :12H

EHV INSULATORS FOR CHA TER E1 TO 12

A. USHING / HOLLO INSULATORS

(Bidder shall furnish these data for each equipment separately i.e
. for circuit Breakers, Instrument Transformer, Surge Arrestors, etc.)

1.	Manufacturer's Name		.....
2.	Country of Manufacturer		.....
3.	Type		.....
4.	Applicable Standards		.....
5.	i)	Height	.....
	ii)	Diameter (Top)	.....
	iii)	Diameter (Bottom)	.....
6.	Creepage distance		.....
	a)	Total (mm)	.....
7.	Rated Voltage		.....
8.	Power frequency withstand voltage for 1 min. (kv rms)		.....
	i)	Dry	.....
	ii)	Wet	.....
9.	1.2/50 micro sec. impulse withstand voltage (kVp)		.....
10.	250/2500 Micro sec. switching impulse withstand voltage (kVp)		.....
	i)	Dry	.....
	ii)	Wet	.....
11.	Weight (Kg)		.....
12.	Cantilever Strength (Kg)		.....
13.	OGA drawing enclosed		Yes/No

SECTION - 5

QUALITY PLAN

Supplier shall follow valid approved Quality Plan of NTPC.

-x-

SECTION - 6

CHECK LIST FOR 400 kV & 220 kV CIRCUIT BREAKERS

Put a tick mark (√) on 'YES' if the specified requirement is met, or put a tick mark on 'NO', if the specified requirement is not met and give comments in the "Remarks" column.

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
1	Type/class of Circuit Breaker	Outdoor SF6, Single Pressure/ C2M1	YES/NO	Outdoor SF6, Single Pressure/ C2M1	YES/NO	
2	Manufacturer's type designation					
3	Standard Applicable	IEC 62271 - 100	YES/NO	IEC 62271 - 100	YES/NO	
4	Rated Voltage (kV rms)	420	YES/NO	245	YES/NO	
5	Rated Current					
	Under normal condition (A)	3150/ 2000 A	YES/NO	2500/ 1600 A	YES/NO	
6	Max fault level (1 s)	50 kA	YES/NO	40 kA	YES/NO	
7	Phase to phase spacing	7000 mm		4500 mm		
8	Rated frequency (Hz)	50	YES/NO	50	YES/NO	
9	Number of poles	3	YES/NO	3	YES/NO	
10	Whether All The 3 poles ganged electrically or mechanically	Electrically	YES/NO	Electrically	YES/NO	
11	Whether dead tank or live tank design	Live	YES/NO	Live	YES/NO	
12	No. of break per pole	2	YES/NO	1	YES/NO	
13	Rated short circuit breaking current					
	i. Symmetrical component at highest system voltage (kA)	50	YES/NO	40	YES/NO	
	ii. DC Component (%)	(a) 49 %	YES/NO	(a) 49 %	YES/NO	
		(b) 36 %	YES/NO	(b) 36 %	YES/NO	

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
14	Rated short circuit Making Current (kAp)	125	YES/NO	100	YES/NO	
15	Rated break time (ms)	i) 40 ms under test duties 2,3 & 4 at rated voltages		60	YES/NO	
		ii) 45 ms under test duties 1 to 5 and short line fault test duties and combined variation of trip coil voltage, operating pressure and quenching media pressure, etc.		-		
	Rated small inductive current Breaking capacity	Corresponding to interrupting steady and transient magnetizing current of 50 to 630 MVA transformers with overvoltage less than 2.3 pu		0.5 to 10 A Switching capability with overvoltage less than 2.3 p.u.		
16	Total break time	-		65	YES/NO	
17	Closing time (ms)	150 (max.)	YES/NO	150 (max.)	YES/NO	
18	Maximum difference in the instants of closing/ opening of contacts	As per standard	YES/NO	As per standard		
19	First pole to clear factor	1.3	YES/NO	1.3	YES/NO	
20	Short time current rating (kA) for 1s	50	YES/NO	40	YES/NO	
21	Rated operating duty	O-0.3 Sec –CO - 3 min –CO	YES/NO	O-0.3 Sec –CO - 3 min –CO	YES/NO	
22	Out of phase breaking current	12.5 kA	YES/NO	10 kA	YES/NO	

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
23	Rated line charging breaking current	600A at 90^{o} leading power factor with max permissible switching overvoltage of 2.3pu. (voltage factor of 1.4)	YES/NO	As per IEC (at 90^{o} leading power factor angle)	YES/NO	
24	Maximum over voltage (p.u.) under any switching conditions	2.3	YES/NO	2.3	YES/NO	
25	Small fault current breaking capacity (kAp)	As per IEC	YES/NO	As per IEC	YES/NO	
26	Temperature rise over ambient temperature of 50^{o}C	As per IEC: 62271-100	YES/NO	As per IEC: 62271-100	YES/NO	
27	Rated voltage & pick up range for trip coil (V)	220 V DC, Range – 70 % to 110 %	YES/NO	220 V DC, Range – 70 % to 110 %	YES/NO	
28	Rated voltage & pick up range for closing coil (V)	220 V DC, Range 85 % to 110 %	YES/NO	220 V DC, Range 85 % to 110 %	YES/NO	
29	Reclosing	Single and three phase high speed auto reclosing (as required)	YES/NO	Single and three phase high speed auto reclosing (as required)	YES/NO	
30	Auxiliary contacts	As required plus 10 NO and 10 NC contacts per pole as spare. The contacts shall have continuous rating of 10A and breaking capacity of 2A with circuit time constant of minimum 20ms at 220V DC.	YES/NO	As required plus 10 NO and 10 NC contacts per pole as spare. The contacts shall have continuous rating of 10A and breaking capacity of 2A with circuit time constant of minimum 20ms at 220V DC.	YES/NO	

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
31	Noise Level	Maximum 140dB at 50m distance from base of CB	YES/NO	Maximum 140dB at 50m distance from base of CB	YES/NO	
32	Rated terminal load	Adequate to withstand 100 kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capability	YES/NO	Adequate to withstand 100 kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capability	YES/NO	
33	**Dielectric withstand of complete Breaker**					
a)	One minute dry & wet power frequency withstand voltage					
	i. Between live terminal and ground (kV rms)	520	YES/NO	460	YES/NO	
	ii. Between terminals with breaker contacts open (kV rms)	610	YES/NO	530	YES/NO	
b)	1.2/50- micro second impulse withstand test voltage					
	i. Between live terminals and ground (kVp)	±1425	YES/NO	1050	YES/NO	
	ii. Between terminals with breaker contacts open (kVp)	±1425(+240)	YES/NO	1200	YES/NO	
c)	250/2500 micro second switching surge withstand test voltage					
	i. Between live terminals and ground (kVp)	±1050	YES/NO			
	ii. Between terminals with breaker contacts open (kVp)	1) 900(+345)	YES/NO			
d)	Corona extinction	320 min.	YES/NO	N.A.		

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
	voltage (kV rms)					
e)	Maximum radio interference voltage for Frequency between 0.5 MHz and 2 MHz	1000 (max) at voltage 266 kV rms.	YES/NO	1000 (max) at 156 kV rms (Micro volts)	YES/NO	
f)	Total creepage distance					
	i) To ground (mm)	1) 10500	YES/NO	1) 6125	YES/NO	
	ii) Between terminals (mm)	1)10500	YES/NO	2) 6125	YES/NO	
34	**Pre-insertion resistor requirement**					
	Rating (ohms)					
	Minimum pre-insertion time (ms)					
	opening of PIR contacts					
35	**Operating Mechanism**					
	a) Type of operating mechanism for					
	i. Closing	1) Spring	YES/NO	1) Spring	YES/NO	
		2) Pneumatic	YES/NO	2) Pneumatic	YES/NO	
		3) Hydraulic	YES/NO	3) Hydraulic	YES/NO	
	ii. Opening	1) Spring	YES/NO	1) Spring	YES/NO	
		2) Pneumatic	YES/NO	2) Pneumatic	YES/NO	
		3) Hydraulic	YES/NO	3) Hydraulic	YES/NO	
36	**General**					
a)	Whether OGA drawing enclosed		YES/NO		YES/NO	
b)	Filled in GTP furnished		YES/NO		YES/NO	
c)	Interpole cabling included in Scope alongwith required Glands, Lugs etc. Termination chart shall be submitted along with the drawings. (cable shall be supplied in one		YES		YES	

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
	length & suitable lugs shall be supplied as loose items)					
d)	TBs for auxiliary supply	Stud type TBs provided for terminating 4Cx16 sq mm aux power cable			YES	
e)	L/R switch	Spare way of "Local/remote switch provided, wired till spare TBs for its use.			YES	
f)	**Type tests:-**					
i.	All valid Type test reports(as per section-1) not older than 10 year are available				YES, available	
ii.	If valid Type test reports (as per section-1) are not available, bidder shall conduct the tests without any price & delivery implication.				YES, confirm	
iii.	Reports of Corona & Radio Interference Voltage (RIV) Test conducted as per the procedure mentioned in Annexure-A (Section-3) are available.				YES, available	
iv.	Reports of Seismic Withstand Test conducted as per the procedure mentioned in Annexure-B (Section-3) are available.				YES, available	
g)	**Whether GI support structure included in Supply**		YES		YES	
h)	**Whether foundation bolts for breakers and cabinets included in scope of supply**		YES		YES	
i)	Whether documentation schedule as per attached enclosure agreed by bidder.		YES		YES	
j)	Min clearance in Air (mm) as per section-3					
	(i) Between Live Parts		YES/NO		YES/NO	
	(ii) Live Part to Earth		YES/NO		YES/NO	

Sl. No.	Parameters	400 kV	YES/NO	220 kV	YES/NO	Remarks
	(iii) Live Part to ground with Support Structure / Stool		YES/NO		YES/NO	
k)	Control Cabinet –					
	Degree of Protection	IP 55 (Min.)	YES/NO	IP 55 (Min.)	YES/NO	
a)	**Supervision of Erection, testing and commissioning included in scope**		YES/NO		YES/NO	
b)	**Bidder to comply customer requirements as per Technical Specification**		YES/NO		YES/NO	
c)	**Bidder will be responsible of getting approval from customer**		YES/NO		YES/NO	

Report ID: GEM/GARPTS/18092021/PY6LNX348WDE
Report Name: 400kV & 220kV Circuit Breaker
Generated By: Akhilesh Kumar , Department of Heavy Industry , Ministry of Heavy Industries and Public Enterprises

Generated On: 18/09/2021
Valid till: 18/10/2021

GeM Availability Report and Past Transaction Summary

GeM Availability Report and past transaction summary report is generated based on the specifications searched by the Buyer. The specification may be modified appropriately for searching relevant categories on GeM. Buyer may navigate to GeM category page by clicking on the category link to view category specifications and products/services available in the category.

Order Count and Order Value displayed is on a cumulative basis since GeM inception.

1. Search String: 400kV circuit breaker

Search type: Product

1. There are categories available on GeM matching your requirements (as listed here). You can create a bid on GeM with a product closest matching your required specifications and add additional parameters in specifications through Corrigendum using RMS functionality.
2. If you feel that category TP needs updating you can submit category updating request also through RMS.
3. If you do not want to use any of the above option and want to proceed for procurement outside GeM, please suggest the specifications of the required product for creation of new category on GeM for future procurement.

Search Result: Category available/suggested on GeM but marked as "not matching requirements" by the buyer with undertaking as under:

It is certified that I have thoroughly checked all probable categories suggested by GeM and I am satisfied that the product required is not covered / does not fall in any of the suggested categories and can not be procured under any of these categories even after inclusion of List of Values(LOV) wherever possible in category specifications of suggested categories. It is also certified that the technical specification requirement are such that these can not be covered even by adding specification parameters using ATC in any of the GeM suggested categories. This is a one-time requirement hence new category creation is not proposed / or requirement is recurring but request for new category creation will be submitted separately post generation of GeMARPTS.

Category Name	Catalog Count	Order Count			Order Value (in Lakhs)		
		Direct Purchase	Reverse Auction	Bid	Direct Purchase	Reverse Auction	Bid
Air Circuit Breaker	24	6	1	4	23	1	17
Chairs-Office- IS 3499	68,362	43,495	217	4,142	28,862	914	8,592
Circuit Breaker Analyzer	6	0	0	0	0	0	0
Sf6 Circuit Breaker (800kv, 420 Kv)-IS/IEC:60529:2001, IS:62271-100:2008	12	0	0	0	0	0	0
SF6 Circuit Breaker, 245 kV	5	0	0	0	0	0	0
Miniature Circuit Breakers-IS 60898-1:2002	8,612	30,609	129	3,133	4,976	64	909
SF6 Circuit Breaker, 72.5 kV	0	0	0	0	0	0	0
SF6 Circuit Breaker, 145 kV	6	0	1	1	0	22	49
Compatible Cartridge	31,15,190	2,37,762	251	2,056	39,974	71	531
Oil Circuit Breaker-IS:8544	1	0	0	0	0	0	0

2. Search String: 220kV Circuit Breaker

Search type: Product

1. There are categories available on GeM matching your requirements (as listed here). You can create a bid on GeM with a product closest matching your required specifications and add additional parameters in specifications through Corrigendum using RMS functionality.
2. If you feel that category TP needs updating you can submit category updating request also through RMS.
3. If you do not want to use any of the above option and want to proceed for procurement outside GeM, please suggest the specifications of the required product for creation of new category on GeM for future procurement.

Search Result: Category available/suggested on GeM but marked as "not matching requirements" by the buyer with undertaking as under:

It is certified that I have thoroughly checked all probable categories suggested by GeM and I am

satisfied that the product required is not covered / does not fall in any of the suggested categories and can not be procured under any of these categories even after inclusion of List of Values(LOV) wherever possible in category specifications of suggested categories. It is also certified that the technical specification requirement are such that these can not be covered even by adding specification parameters using ATC in any of the GeM suggested categories. This is a one-time requirement hence new category creation is not proposed / or requirement is recurring but request for new category creation will be submitted separately post generation of GeMARPTS.

Category Name	Catalog Count	Order Count			Order Value (in Lakhs)		
		Direct Purchase	Reverse Auction	Bid	Direct Purchase	Reverse Auction	Bid
Air Circuit Breaker	24	6	1	4	23	1	17
Miniature Circuit Breakers-IS 60898-1:2002	8,612	30,609	129	3,133	4,976	64	909
Circuit Breaker Analyzer	6	0	0	0	0	0	0
Sf6 Circuit Breaker (800kv, 420 Kv)-IS/IEC:60529:2001, IS:62271-100:2008	12	0	0	0	0	0	0
SF6 Circuit Breaker, 245 kV	5	0	0	0	0	0	0
Molded Case Circuit Breakers (Mccb)-IS/IEC:60947	3,751	10,482	66	1,095	5,751	87	780
SF6 Circuit Breaker, 72.5 kV	0	0	0	0	0	0	0
SF6 Circuit Breaker, 145 kV	6	0	1	1	0	22	49
Rccb-Residual Current Operated Circuit - Breakers-IS 12640	1,684	747	11	268	386	17	307
Oil Circuit Breaker-IS:8544	1	0	0	0	0	0	0

3. Search String: SF6 gas

Search type: Product

1. There are categories available on GeM matching your requirements (as listed here). You can create a bid on GeM with a product closest matching your required specifications and add additional parameters in specifications through Corrigendum using RMS functionality.
2. If you feel that category TP needs updating you can submit category updating request also

through RMS.

3. If you do not want to use any of the above option and want to proceed for procurement outside GeM, please suggest the specifications of the required product for creation of new category on GeM for future procurement.

Search Result: Category available/suggested on GeM but marked as "not matching requirements" by the buyer with undertaking as under:

It is certified that I have thoroughly checked all probable categories suggested by GeM and I am satisfied that the product required is not covered / does not fall in any of the suggested categories and can not be procured under any of these categories even after inclusion of List of Values(LOV) wherever possible in category specifications of suggested categories. It is also certified that the technical specification requirement are such that these can not be covered even by adding specification parameters using ATC in any of the GeM suggested categories. This is a one-time requirement hence new category creation is not proposed / or requirement is recurring but request for new category creation will be submitted separately post generation of GeMARPTS.

Category Name	Catalog Count	Order Count			Order Value (in Lakhs)		
		Direct Purchase	Reverse Auction	Bid	Direct Purchase	Reverse Auction	Bid
SF6 Gas Leakage Detector	0	0	0	0	0	0	0
Compatible Cartridge	31,15,190	2,37,762	251	2,056	39,974	71	531
SF6 Gas Quality Analyzer	0	0	0	0	0	0	0
SF6 Gas Handling Plant	4	0	0	0	0	0	0
electrical box extension	5,359	18,813	17	238	1,389	5	46
SF6 Gas Circuit Breaker, 33 KV	0	0	0	0	0	0	0
SF6 Circuit Breaker, 145 kV	6	0	1	1	0	22	49
SF6 Circuit Breaker, 245 kV	5	0	0	0	0	0	0
Cat 6 Patch cord	2,436	3,299	75	284	416	37	122
SF6 Circuit Breaker, 72.5 kV	0	0	0	0	0	0	0