Enquiry

Bharat Heavy Electricals Limited
Transmission Business Group
Materials Management

Project : PGCIL BIHARSHARRIF JAMSHEDPUR GAZUWAKA RENGALI ROURKELA DURGAPUR GORAKHPUR

Enquiry No	Enquiry Dt	Rev No	Rev Dt	PI No	Enquiry Type	Inspection by	Due Dt	Commercial Comments	Technical Comments	Signing Authority
174E203	15-Jan-15	0		342240232	Package		11-Feb-15	As per BHEL GTC - BHEL/TBG/GTC/02-07 and annexure to GTC.	AS PER TECHNICAL SPECIFICATION DOCUMENT NO. TB-4-370-510-012, REV 00	

DOCUMENTS ENCLOSED-

1-Terms & conditions for Indigenous Enquiry
2-Annexure to GTC for Indigenous Vendor
3- Annexure to GTC for Foreign Vendor
4-Activity Schedule
5-Checklist
6-Commercial Deviation Sheet
7-Technical Deviation Sheet
8-Un-price Schedule - Indigenous Vendor
9-Un-price Schedule- Foreign Vendor
10-Technical Specification

SN	Equipment	Phy Unit	Qty	Unit Exworks	% ED	% CST	Unit F&I	Plan Dt	Comments
1	CONTROL PANELS CONTROL & RELAY PANEL	LOT	1					15-Apr-14	FOR DETAILED BOQ, PLEASE REFER CLAUSE 6 OF SECTION-1 OF TECHNICAL SPECIFICATION
2									
3									
4	For 400kV Rourkela Substation : Control & Relay Panel Augmentation of Existing Control Panel	No.	1						
5	For 400kV Gazuwaka Substation : Control & Relay Panel Control Panel for Diameter (one & half breaker scheme)	No.	1						
6	For 400kV Gazuwaka Substation : Control & Relay Panel Circuit Breaker Relay Panel With Auto-Reclose	No.	1						
7	For 400kV Gazuwaka Substation : Control & Relay Panel Circuit Breaker Relay Panel Without Auto-Reclose	No.	1						
8	For 400kV Gazuwaka Substation : Control & Relay Panel Reactor Protection Panel	No.	1						
9	For 400kV Gazuwaka Substation : Control & Relay Panel Augmentation of existing Bus Bar protection scheme (For two bay)	No.	1						
10	For 400kV Gazuwaka Substation : Control & Relay Panel Common equipments : Special Relay test kit	Set	1						
11	For 400kV Gazuwaka Substation : Control & Relay Panel Common equipments : BCU and its integration with NTAMC System	Nos.	3						
12	For 400kV Biharshariff Substation : Control & Relay Panel 400kV Reactor Protection panel	No.	1						
13	For 400kV Biharshariff Substation : Control & Relay Panel Augmentation of Existing Control Panel	No.	1						
14	For 400kV Biharshariff Substation : Control & Relay Panel Other/Common equipments : Special Relay test kit	Set	1						
15	For 400kV Rengali Substation : Control & Relay Panel Control Panel for Diameter (one & half breaker scheme)	No.	1						
16	For 400kV Rengali Substation : Control & Relay Panel Augmentation of Existing Control Panel	No.	1						
17	For 400kV Rengali Substation : Control & Relay Panel Circuit Breaker Relay Panel : With Auto-Reclose	No.	1						
18	For 400kV Rengali Substation : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	Nos.	2						
19	For 400kV Rengali Substation : Control & Relay Panel Reactor Protection Panel	Nos.	2						
20	For 400kV Rengali Substation : Control & Relay Panel Augmentation of existing Bus Bar protection scheme (For three bay)	No.	1						
21	For 400kV Rengali Substation : Control & Relay Panel Other / Common equipments : Special Relay test kit	Set	1						
22	For 400kV Rengali Substation : Control & Relay Panel Other / Common equipments : BCU and its integration with NTAMC System	Nos.	3						
23	For 400kV Jamshedpur Substation : Control & Relay Panel Reactor Protection Panel	No.	1						
24	For 400kV Jamshedpur Substation : Control & Relay Panel Augmentation of Existing Control Panel	Nos.	2						
25	For 400kV Jamshedpur Substation : Control & Relay Panel Other / Common equipments : Special Relay test kit	Set	1						

SN	Equipment	Phy Unit	Qty	Unit Exworks	% ED	% CST	Unit F&I	Plan Dt	Comments
26	For 400kV Durgapur Substation : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	No.	1						
27	For 400kV Durgapur Substation : Control & Relay Panel Augmentation of Existing Control Panel	Nos.	2						
28	For 400kV Durgapur Substation : Control & Relay Panel Reactor Protection Panel	Nos.	2						
29	For 400kV Durgapur Substation : Control & Relay Panel Other / Common equipments : Special Relay test kit	Set	1						
30	For 400kV Durgapur Substation : Control & Relay Panel Other / Common equipments : BCU and its integration with NTAMC System	No.	1						
31	For 400kV Gorakhpur Substation : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	Nos.	2						
32	For 400kV Gorakhpur Substation : Control & Relay Panel Augmentation of Existing Control Panel (as per Tech Spec)	No.	1						
33	For 400kV Gorakhpur Substation : Control & Relay Panel Augmentation of RTU and LDMS (as per Tech Spec)	No.	1						
34	Services-For Rourkela Substation: a) Augmentation of existing 400 kV control panel in all respect b) Site visits for collecting inputs for interfacing with the existing sub-station c) Relay Setting Calculation d) Scheme modification of existing Bays a	Lot	1						
35	Services-For Gazuwaka Substation: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration	Lot	1						
36	Services-For Biharsharif Substation: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary to	Lot	1						
37	Services-For Rengali Substation: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration	Lot	1						
38	Services-For Jamshedpur Substation: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary too	Lot	1						
39	Services-For Durgapur Substation: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration	Lot	1						
40	Services-For Gorakhpur Substation: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tool	Lot	1						
41	For Rourkela Substation: Services: Training Charges	Lot	1						
42	For Gazuwaka Substation: Services: Training Charges	Lot	1						
43	For Biharsharif Substation: Services: Training Charges	Lot	1						
44	For Rengali Substation: Services: Training Charges	Lot	1						
45	For Jamshedpur Substation: Services: Training Charges	Lot	1						
46	For Durgapur Substation: Services: Training Charges	Lot	1						
47	For Gorakhpur Substation: Services: Training Charges	Lot	1						
48	Mandatory spares : For Gazuwaka Substation: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1						
49	Mandatory spares : For Gazuwaka Substation: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1						
50	Mandatory spares : For Gazuwaka Substation: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1						
51	Mandatory spares : For Biharsharif Substation: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1						
52	Mandatory spares : For Biharsharif Substation: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1						
53	Mandatory spares : For Biharsharif Substation: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1						
54	Mandatory spares : For Rengali Substation: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1						
55	Mandatory spares : For Rengali Substation: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1						
56	Mandatory spares : For Rengali Substation: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1						
57	Mandatory spares : For Jamshedpur Substation: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1						
58	Mandatory spares : For Jamshedpur Substation: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1						
59	Mandatory spares : For Jamshedpur Substation: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1						

SN	Equipment	Phy Unit	Qty	Unit Exworks	% ED	% CST	Unit F&I	Plan Dt	Comments
60	Mandatory spares : For Durgapur Substation: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1						
61	Mandatory spares : For Durgapur Substation: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1						
62	Mandatory spares : For Durgapur Substation: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1						

You are requested to submit your most competitive offer so as to reach us positively by the tender opening date & time. THE TENDERS NOT RECEIVED WITHIN SCHEDULED DATE AND TIME ARE LIKELY TO BE IGNORED. BHEL shall not be responsible for any postal delay.

IN YOUR OWN INTEREST YOU ARE ADVISED TO CAREFULLY READ "THE INSTRUCTIONS TO BIDDERS". INCOMPLETE BIDS AND/OR BIDS NOT COMPLYING WITH TENDER CONDITIONS SHALL BE TREATED AS NON RESPONSIVE AND ARE LIKELY TO BE IGNORED.

In case Tender Documents are not received within 7 days of this E-mail message, intimate BHEL accordingly. If no intimation is received, it will be considered that you have received tender enquiry and delay in submission offer due to late receipt of tender documents will not be entertained.

YOU ARE REQUESTED TO SUBMIT YOUR MOST COMPETITIVE OFFER SO AS TO REACH US POSITIVELY BY 2 PM ON THE TENDER OPENING DATE AND TENDER WILL BE OPENED AT 2:30 PM WITH EFFECT FROM 15-SEP-09.

BHEL RESERVES THE RIGHT TO OPT FOR REVERSE AUCTION FOR OBTAINING BEST PRICES.

OFFERS THROUGH E-MAIL / FAX:

WHOSOEVER DESIRES TO SEND OFFERS ON THEIR OWN RISK (COMPLETE IN ALL RESPECTS) VIA E-MAIL or FAX HAVE TO SEND THE OFFERS TO THE COMMON E-MAIL ADDRESS tenderbox@bhel.in or 0120-6748581 FAX .

THE RECEIVED EMAIL OFFERS WILL BE PRINTED BY PURCHASE COORDINATOR AND PUT THEM INTO COVERS AS PER CONVENTIONAL METHOD FOR TENDER OPENING I.E., TECHNO COMMERCIAL & PRICE OFFER SHALL BE PUT INTO TWO SEPARATE COVERS AND BOTH THE COVERS ARE KEPT IN THIRD COVER DULY SUPER SCRIBING ENQY. NO. AND DUE DATE.

OFFERS SENT TO ANY OTHER E-MAIL ID or FAX NO AND INCOMPLETE OFFERS SHALL NOT BE CONSIDERED FOR EVALUATION PURPOSE.

It is suggested that the bidders are advised to send the files with 'password protection'. procedure for giving a password to a file has been given below:

For saving Excel file with password

Steps to be followed:

1. Click on the FILE option in XP system and Start sign in Vista system then go to SAVE AS option.
2. Select the location to save and Click on the TOOLS box and go to GENERAL OPTION.
3. It will ask for the password, type the password into open or modify box or both as required.
4. Then click on the OK button it will ask for reenter of the password.
5. After reentering the password click on the save box.

For saving Word file with password

Steps to be followed:

1. Click on the FILE option in XP and Start sign in Vista then go to SAVE AS option.
2. Select the location to save and Click on the TOOLS box and go to SECURITY OPTION in XP system and GENERAL OPTION in Vista system.
3. It will ask for the password, type the password into open or modify box or both as required.
4. Then click on the OK button it will ask for reenter of the password.
5. After reentering the password click on the save box.

The venders who has sent offers with password,the passwords are to be forwarded to another email id:supplierinfo@bhelindustry.com

MSME STATUS

"THOSE INDUSTRIES WHO HAVE FILED A MEMORANDUM WITH THE CONCERNED AUTHORITIES AND REGISTERED AS MICRO & SMALL ENTERPRISE UNDER MICRO, SMALL AND MEDIUM ENTERPRISES DEVELOPMENT ACT 2006, HAVE TO SUBMIT A COPY OF SUCH REGISTRATION CERTIFICATE / MEMORANDUM TO BHEL FOR NECESSARY COMPLIANCES OF THE ABOVE ACT".

Please acknowledge the receipt of tender enquiry and fax back this letter by ticking the appropriate item below.

Anna Hembrom.

for BHARAT HEAVY ELECTRICALS LTD

ऐना हेमब्रोम / ANNA HEMBROM
वरि. अभियन्ता (टी.बी.एम.एम.) / Sr. Engineer (T.B.M.M.)
पारेषण व्यापार समूह / Transmission Business Group
भारत हैवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Limited
5th Floor, Tower-A, Advant Navis IT Business Park,
Plot No. 7, Sector-142, Expressway Noida-201305 (U.P.)

We acknowledge the receipt of tender.

(a) The offer against subject enquiry shall be submitted by the scheduled date and time.

(b) We regret to quote. The item in reference is out of our manufacturing range.

(c) We regret because of our prior commitments.

(d) Any other reason.

To
R.K.Gangal
Sr.Manager
BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP
TOWER-A,5th Floor,
Advant Navis IT Business Park,
Plot No-7,Sector-142,Expressway Noida
Noida-201305
Distt. Gautam BudhNagar,U.P

Ph: 0120-6748477
Fax: 0120-6748581

Signature and Seal of Tenderer

Enquiry No : 174E203 **Enquiry Dt :** 15-Jan-15

BHARAT HEAVY ELECTRICALS LTD.
(TRANSMISSION BUSINESS GROUP)
TERMS AND CONDITIONS FOR INDIGENOUS TENDER ENQUIRY

This Format is to be submitted in original duly signed by bidder. Deviation, if any, is to be brought out clearly in Schedule of Commercial deviation giving clause wise deviation. Any condition / clarification / deviation mentioned elsewhere may not be accepted.

Sr. No	Terms & Conditions
1.	1. Sealed quotations are invited for the items mentioned in the enquiry. Quotations should be typed and free from over writing and erasures, corrections or additions must be clearly written both in words and figures and attested, otherwise offer may be rejected. 2. Bidder must ensure that their quotation is received / dropped in the tender box on or before 02.00 PM of the due date of opening in **Tender Room ,Material Management Division, BHEL-TBG** **Tower A, 5th Floor, Advant Navis It Business Park,** **Plot No-7, Sector-142, Expressway Noida,** **Noida - 201305,** **Distt- Gautam Budh Nagar (U.P.)** 3. The same shall be opened at 02.30 PM on the same day. Tenders received late may be rejected. Bidders sending tenders by courier or post, to ensure that it is delivered one day before as same day delivery may not reach above office by due time. 4. Bids are to be submitted in Two parts: i) Techno-commercial bid (Part I) – To be submitted in duplicate. A copy of price bid (Part II) (without prices) is also to be enclosed in Part I bid. ii) Price bid (Part II) – To be submitted only in one copy in a separate sealed envelope. This should not contain any Technical or Commercial Terms. The rates should be quoted both in figures and words. In case of any difference between figures and words, the quoted rate in words will prevail over figure. Both Part I and Part II bids are to be sealed in separate envelope and both envelops to be kept in another common envelope. Each envelope should be sealed and super scribed with enquiry no., item / package name, project name and due date of opening. **5. For any Technical clarification, please contact** **Rajat Kumar, Engineer (TBEM)/Vivek Kapil, Sr. Manager (TBEM)** **Tower A, 5th Floor, Advant Navis It Business Park,** **Plot No-7, Sector-142, Expressway Noida,** **Noida - 201305,Distt- Gautam Budh Nagar (U.P.)** **e-mail : rajat.kumar@bhel.in/vivekk@bhel.in** **Contact No. – 0120 – 6748524 / 8539** For any commercial clarification please contact person issuing enquiry.

Sr. No	Terms & Conditions
	6. Price bid should not contain any information / description / terms & condition other than given in Part-I of the bid except prices, otherwise bid is liable for rejection. **7. Price bid submitted along with the bid shall remain valid up to validity of offer. Unsolicited Supplementary / Revised price bid submitted during validity period of offer, unless asked by BHEL, shall not be considered. With-drawl of quotation by the bidder, at any stage after its opening, may entail blacklisting of vendor.** **8. Enquiry condition for where the scope against this tender includes Installation and Commissioning of the equipment / material** There will be separate contract awarded for Supply portion and Site execution portion. For Supply portion General Terms and Conditions mentioned here shall be applicable for Site execution portion, Terms and conditions for Installation services shall be applicable. However, any breach in either of the contract shall be deemed as the breach of other contract also.
2.	**PRICES:** **<RELEVANT OPTION TO BE SELECTED BEFORE ISSUE OF ENQUIRY>** **A.1.** Unless specifically indicated, all prices shall be **FIRM.** No enhancement of rate for whatever cause unless and until asked by BHEL will be allowed. **A.2. PVC (if indicated)** The prices to be quoted are with **PVC** with following formula. *<Formula>* The base indices in the formula shall be of first notification of ---------- of the --------- month. The date of delivery shall be PO delivery date or date of actual despatch, whichever is earlier. **B** The prices shall be quoted by the vendors considering following. **B.1.** Unless specifically indicated, the prices shall be on **Domestic basis.** **B.2. Deemed export (if indicated)** i) Prices are to be quoted considering following benefits: 1. _____ 2. _____ 3. _____ ii) For availing above benefits, BHEL shall provide following documents. 1. _____ 2. _____ iii) In case of import benefit in deemed export projects, bidder to indicate import content (CIF value) in the price bid.
	B.3. Physical export (if indicated) i) Prices are to be quoted considering following benefits 1. _____ 2. _____ ii) For availing above benefits BHEL shall provide following documents

Sr. No	Terms & Conditions
	1. _____ 2. _____ **C**. The prices are to be quoted on FOR (Destination) basis. The break-up of price shall be as under:- **a) Ex-works Price:** Ex- works price including packing & forwarding charges. **b) Excise duty:** ED as applicable is to be quoted as percentage in both un-price and price bid. **c) Sales Tax:** ST / VAT /CST (against C-form) to be quoted as percentage in un-price and price bid. In case of interstate sale-in-transit supplier have to provide E1/E2 form. **e) Entry tax / Octroi Charges:** Any Entry tax / Octroi applicable at destination / destination state shall be paid extra on proof of such payment. **f) Freight & Insurance:** Freight and Transit Insurance for door delivery up to destination/store is to be quoted. **g) Type Test charges:** If asked in the technical specification, is to be quoted separately for each Test along with taxes and duties applicable on them. **h) Erection / Commissioning supervision charges:** If asked in the technical specification, to be quoted separately along with taxes and duties applicable on them. Note : The purchase order shall be placed on Ex-works basis.
3.	**TERMS OF PAYMENT :** **<RELEVANT OPTION TO BE SELECTED BEFORE ISSUE OF ENQUIRY>** <u>For BOIs (non package items)</u> 100% payment along with taxes, duties, Freight & Insurance within 60 days from the date of receipt of invoice. The invoice must contain following documents in 3 sets (Original + 2 copies). - Receipted LR - Excise invoice (where ED re-imbursement is required) - Delivery Challan / Packing list (case wise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers, - Despatch Clearance given by BHEL, - Guarantee certificate, - All Test reports and inspection reports, - Performance Bank Guarantee copy. <u>For BOPs : Air-Conditioning & Ventilation, Fire Protection, Illumination, Oil handling system where ETC is in scope of bidder</u> a. 90% of Ex-works value alongwith 100% taxes, duties, Freight & Insurance within 60 days from the date of receipt of invoice. The invoice must contain following documents in 3

Sr. No	Terms & Conditions
	sets (Original + 2 copies) - Receipted LR / RR - Excise invoice (where ED re-imbursement is required) - Delivery Challan / Packing list (case wise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers, - Despatch Clearance given by BHEL, - Guarantee certificate, - All Test reports and inspection reports, - Performance Bank Guarantee copy. b. 5% of Ex-works value on completion of supplies as per billing breakup. c. 5% of Ex-works value on successful completion of Erection, Testing, Commissioning (To be certified by BHEL site) and final documentation (Against proof of submission to Engineering) Note: When ETC is not in scope last 5% as per (c) above shall be paid alongwith (b). <u>Terms of payment for Type test charges:</u> 100% payment with taxes and duties on acceptance of test reports by BHEL on certification by BHEL engineering within 60 days from the date of receipt of clear invoice. <u>Terms of payment for Supervision charges:</u> 100% payment against completion with taxes and duties on certification by BHEL site within 60 days from the date of receipt of clear invoice.
4.	**INTEREST LIABILITY** In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment.
5.	**GUARANTEE :** The equipment / material shall be guaranteed for 18 months from the date of delivery or 12 months from the date of commissioning, whichever is earlier. The defective material / component shall be replaced free of cost at site. **<FOLLOWING TO BE DELETED IN ALL ENQUIRY OTHER THAN ILLUMINATION PACKAGE>** However for Illumination system after commissioning Lamps, Tubes, Ballast, Starters, Capacitors, Fuses will not be covered in Guarantee.
6.	**PERFORMANCE BANK GUARANTEE :** **<PBG CLAUSE TO BE REMOVED BEFORE ISSUE OF ENQUIRY FOR ITEMS FOR WHICH PBG IS NOT REQUIRED>** Bidder shall furnish along with first invoice Performance BG / deposit as per one of following 3 options. <u>Option A</u> A single rolling Bank Guarantee of Rs 20 lakhs initially valid for one year for all the orders being executed for Transmission Business Group, BHEL.

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	Option B BG for 10% of the total Ex-works PO value, valid for 24 months from the date of first delivery. PO value at the time of first invoice for the particular order shall be considered for calculation of BG amount. Option C Retention of 10% of the total Ex-works PO value by BHEL from the first bill in lieu of Performance Bank Guarantee, to be released after expiry of 24 months from the date of first delivery. Note : For Shield wire, Earthing material, Cable gland, Cable Trench material, GI/PVC pipe, Hardwares, Al tube, MS Rod, Lable & phase colour disc, HG Fuse, Ferrule, Lug, Marker, Stationary, Office eqpt. and any petty / sundry purchase no Performance bank guarantee is required. The Bank guarantee shall be from State Bank of India / State bank of Hyderabad / State Bank of Travancore / State Bank of Mysore / Canara Bank / Bank of Baroda / Punjab National Bank / Deutsche Bank / HDFC Bank / Standard Chartered Bank / CITI Bank / ICICI Bank / IDBI Bank / HSBC / any other Nationalised Bank. The original BG should be sent by issuing Bank directly to AGM (Finance), TBG, BHEL.
7.	**FINAL ENGINEERING DOCUMENTATION:** Final documentation as called in the specification is to be submitted within 3 months from the date of despatch of material. In case of default, the Performance BG is liable to be en-cashed.
8.	**INSPECTION :** BHEL / customer / third party shall inspect equipment / material before despatch. Stage inspection during manufacturing may also be carried out. Material to be despatched only after getting Despatch Clearance from BHEL. Supplier shall send inspection call on prescribed format (web site) only, with an advance notice of 15 days.
9.	**DESPATCH DOCUMENTS :** Following despatch documents are to be immediately sent to purchaser on despatch. - Copy of LR - Copy of delivery challan / packing list - Insurance certificate - Guarantee certificate
10.	**DELIVERY PERIOD:** Bidder to specify delivery period in weeks from the date of LOI / PO. Time for conduction of type test, if required, is to be separately indicated. Note: LR date or Invoice date whichever is later shall be considered as delivery date.
11.	**DELAYED DELIVERY:** In case of delay in execution of order beyond the lot wise contractual delivery, an amount of ½ % of total Ex-Works Value per week or part there-of subject to maximum of 5% of total Ex-Works value of P.O. will be withheld.
12.	**VALIDITY :** The offer shall be valid for 120 days from the due date of opening.
13.	**ACCEPTANCE / REJECTION OF TENDER :**

Sr. No	Terms & Conditions
	BHEL reserves the right to reject in full or part, any or all tender without assigning any reason thereof. BHEL also reserves right to vary the quantities mentioned in the tender.
14.	**EVALUATION :** Comparative statement shall be prepared based on overall quantity basis unless otherwise indicated in the enquiry. Evaluation of offers shall be done on the basis of delivered cost to BHEL.
15.	**DEVIATION :** The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may load the prices for evaluation of offer with prior intimation to bidder.
16.	**ARBITRATION :** All cases of disputes emanating from and relating to this contract, the matter shall be referred to the sole arbitration of Unit Head / GM, BHEL or any other person (including an employee of BHEL, even though he had to deal with the matter relating to this contract in any manner) nominated by him to act as sole arbitrator. The arbitration shall be under 'The arbitration and contract act 1996' and the rules there under as amended from time to time. The arbitrator may from time to time with the consent of the parties enlarge the time for making and publishing the award. The venue of arbitration shall be any Indian city as decided by BHEL.
17.	**LEGAL SETTLEMENT :** All suits/claims in respect of this contract shall be in the courts having jurisdiction at New Delhi
18.	**SUBCONTRACTING :** In case further subcontracting of BHEL order or part thereof is envisaged by supplier, the same can be done after written permission is obtained from BHEL. However it shall not absolve the supplier of the responsibility of fulfilling BHEL purchase order requirements.
19.	**RISK PURCHASE :** In case the successful bidder fails to supply or fails to comply with the terms & conditions of the purchase order, BHEL reserves the right to source such material/ component / equipment/ system from any other agency at the risk and cost of the successful bidder.
20.	**ADJUSTMENT OF RECOVERY:** Any amount payable by the supplier under any of the condition of this contract shall be liable to be adjusted against any amount payable to the supplier under any other works / contract awarded to him by any BHEL unit. This is without prejudice to any other action as may be deemed fit by BHEL.
21.	**FORCE MAJEURE CONDITION:** If by reason of war, civil commotion, act of god, Government restrictions, strike, lockout which are not in control of supplier the deliveries are delayed, supplier shall not be held responsible.

Signature of Bidder
Seal

Mentioned clauses of General Terms and Conditions are to be read as follows:

Clause 1:

2. Bid submission time: up to 02:00 PM of the due date of opening

3. Bid opening time: 02:00 PM on the same day.

Clause 2: PRICES

A.1 Applicable

A.2. Not applicable

B.1 Applicable

B.2. Not applicable

B.3. Not applicable

Clause 3: TERMS OF PAYMENT

Terms for BOP is not applicable.

Terms for BOI is applicable.

Note: - Dispatch Clearance given by BHEL means BHEL MICC.

Clause 6: PERFORMANCE BANK GUARANTEE

Option A – Same as per GTC

Note :- IF TOTAL Ex-works EXCEEDS Rs. 2,00,00,000/- ,THEN OPTION – A IS NOT APPLICABLE

Option B

BG for 10% of the total Ex-works PO value, valid for 18 months from the date of last delivery against PO. The claim period of 3 months shall also be required from the date of expiry of PBG, ie. over and above the guarantee period of 18 months. Total validity of PBG shall be for 21 months from the date of last delivery, i.e. inclusive of claim period. PO value at the time of first invoice for the particular order shall be considered for calculation of BG amount.

Option C

Retention of 10% of the total Ex-works PO value by BHEL from the first bill in lieu of Performance Bank Guarantee, to be released after expiry of 21 months from the date of last delivery.

Clause 11: DELAYED DELIVERY

In case of delay in execution of order beyond the lot wise contractual delivery. LD shall be levied as follows:

a) LD shall be 0.5% of the total order value per week of delay or part thereof subject to a maximum of 10% of the total order value.
b) In case of staggered delivery schedule, LD shall be 0.5% of the undelivered portion per week of delay or part thereof subject to a maximum of 10% of the total order value.

Clause 15: DEVIATION

The bids having deviation(s) w.r.t tender are liable for rejection. However, BHEL, at its discretion, may load the prices for evaluation of offer with prior intimation to bidder.

Deviations must be mentioned in deviation schedule(s) and deviation mentioned, if any, elsewhere shall not be considered.

Clause 16: ARBITRATION

The arbitration shall be under '**The Arbitration and Conciliation act 1996**'.**All remaining terms which are not mentioned here shall remain unchanged.**

Note: -

1. **DELIVERY** –
   15.04.15. Vendor has to quote their best possible delivery plan.

2. **BG-**
   Supplier has to specifically indicate / tick mark their preference for PBG out of the three options mentioned in clause no. 6 of General Terms and Conditions (BHEL/TBG/GTC/02-07) i.e. Performance Bank Guarantee.

3. **REVERSE AUCTION-**
   BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation.
   All bidders to give their acceptance for participation in RA.
   Non-*acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.*

   In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction.
   Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit "online sealed bid" in the Reverse Auction. Non-submission of "online sealed bid" by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.

   Information and General Terms and Conditions governing RA as per Annexure-I.

4. **In case if VAT is applicable, supplier has to provide VAT Invoice irrespective of availability of VAT benefit to BHEL. VAT charged, if any shall be included in arriving at total cost to BHEL.**

5. **PERMISSIBLE DEVIATIONS & LOADING CRITERIA:**
   PERMISSIBLE COMMERCIAL DEVIATIONS
   TERMS OF PAYMENT:
   If a bidder asks for payment within specified no. of days from the date of receipt of invoice with complete documents as per "Terms of Payment" at Clause. No. 3 of Terms & Conditions for Indigenous Tender Enquiry, loading to be done as follows:
   a) Base rate of SBI (as applicable on the date of techno commercial bid opening) + 6 % shall be considered for loading for the period of relaxation sought by the bidder. Loading shall be done on total cost to BHEL.
   b) 60 days - No loading

   DELAYED DELIVERY: Any loading on LD clause shall be to the extent to which it is not agreed by bidder (at offered value).

   PERMISSIBLE TECHNICAL DEVIATIONS: No permissible Technical Deviation has been envisaged.

6. **PRE QUALIFYING CRITERIA-**
   - ***The manufacturer whose Control, Relay & Protection System (Control & protection Intelligent Electronic Devices (IEDs)), and Sub-station Automation System (If applicable) are offered should have designed, manufactured, tested, installed and commissioned Control, Relay & Protection system along with Sub-station Automation System which must be in satisfactory operation on (i) 400 kV system [for 765kV substation] & (ii) specified voltage***

level or above [for 400kV & below substation] for at least 2 (two) years on the originally scheduled date of bid opening.

AND

The Manufacturer or their joint venture or subsidiary company must have established repair, testing and integration (for at least 4 bays) facilities for Control, Relay & Protection System and Sub-station Automation System in India.

- ***The manufacturers must have valid MQP approved from M/s PGCIL.***

7. OFFER EVALUATION-

- **Evaluation to be done SITE WISE.**

1- Separate Site wise Price bids to be submitted in separate sealed envelopes.(7 Price Bids for Envelopes for *Bihartshariff,Jamshedpur,Gazuwaka,Rengali,Rourkela,Durgapur,Gorakhpur****)***

2-Techno-commercial bid to be sealed in separate envelope(1 Techno Commercial Envelope)

3-All envelopes (7 Price Bid Envelopes & 1 Techno Commercial Envelope) to be kept in another common envelope. Each envelope should be sealed and super scribed with PRICE BID, enquiry no., item / package name, project name and due date of opening.

- For evaluation, exchange rate (TT selling rate of SBI) as on scheduled date of tender opening (part-I in case of two part bid) shall be considered.

a- Evaluation (for Indian vendors) – Evaluation on landed cost to BHEL.

b- Evaluation (for foreign vendors) – Evaluation shall be on CIF(discharge port) basis and PO shall be on FOB basis.

c- Evaluation (in case offers for Indian and foreign vendors) – Evaluation shall be on landed cost to BHEL.

8. INTENDED BENEFITS FOR MSME SUPPLIERS:-

MSE suppliers can avail the intended benefits only if they submit along with offer, attested copies of either EM II certificate having deemed validity (Two years from the date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM II certificate along with CA certificate (Format enclosed as per ***Annexure II***) applicable for the year, certifying quantum of investment in plant & machinery within the permissible limit as per the act for relevant status (Micro or Small) where the deemed validity of EM II is over. Date to be reckoned for determining the deemed validity will be the last date of technical bid submission. Non submission of such documents will lead to consideration of their bids at par with other bidders and MSE status of such suppliers shall be shifted to Non MSE supplier till the supplier submits these documents.

Terms & Conditions of Reverse Auction

Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

2. Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder for any of the eligible items for which techno-commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.

3. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.

4. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.

5. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.

6. Bidders have to fax the Compliance form (annexure IV) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.

7. In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.

8. Reverse auction will be conducted on scheduled date & time.

9. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.

10. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure VII) as provided on case-to-case basis to Service provider within two working days of Auction without fail.

11. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL's standard practice.

12. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the 'Business Rules of Reverse Auction', which will be communicated before the Reverse Auction.

13. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines*, shall be initiated by BHEL and the results of the RA scrapped/ aborted.

14. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.

15. In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

Certificate by Chartered Accountant on letter head

This is to Certify that M/S ....., (hereinafter referred to as 'company') having its registered office at ..... is registered under MSMED Act 2006, (Entrepreneur Memorandum No (Part–II) ..... dtd:....., Category: ..... (Micro/Small)). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as on date..... as per MSMED Act 2006 is as follows:

1. **For Manufacturing Enterprises:** Investment in plant and machinery (i.e. original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No.S.O.1722(E) dated October 5, 2006 :
   Rs.....Lacs
2. **For Service Enterprises:** Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:
   Rs.....Lacs

The above investment of Rs.....Lacs is within permissible limit of Rs.....Lacs for .....Micro / Small **(Strike off which is not applicable)** Category under MSMED Act 2006.

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant

Mentioned clauses of General Terms and Conditions are to be read as follows:

Clause 1:

2. Bid submission time: up to 02:00 PM of the due date of opening

3. Bid opening time: 02:00 PM on the same day.

Clause 2: PRICES

A.1 Applicable

A.2. Not applicable

B.1 Applicable

B.2. Not applicable

B.3. Not applicable

Clause 3: TERMS OF PAYMENT

LR to be read as Bill of Lading/AWB.

Terms for BOP is not applicable.

Terms for BOI is applicable.

Note: - Dispatch Clearance given by BHEL means BHEL MICC.

Clause 6: PERFORMANCE BANK GUARANTEE

Option A – Same as per GTC

Note :- IF TOTAL Ex-works EXCEEDS Rs. 2,00,00,000/- ,THEN OPTION – A IS NOT APPLICABLE

Option B

BG for 10% of the total Ex-works PO value, valid for 18 months from the date of last delivery against PO. The claim period of 3 months shall also be required from the date of expiry of PBG, ie. over and above the guarantee period of 18 months. Total validity of PBG shall be for 21 months from the date of last delivery, i.e. inclusive of claim period. PO value at the time of first invoice for the particular order shall be considered for calculation of BG amount.

Option C

Retention of 10% of the total Ex-works PO value by BHEL from the first bill in lieu of Performance Bank Guarantee, to be released after expiry of 21 months from the date of last delivery.

Clause 11: DELAYED DELIVERY

In case of delay in execution of order beyond the lot wise contractual delivery. LD shall be levied as follows:

a) LD shall be 0.5% of the total order value per week of delay or part thereof subject to a maximum of 10% of the total order value.
b) In case of staggered delivery schedule, LD shall be 0.5% of the undelivered portion per week of delay or part thereof subject to a maximum of 10% of the total order value.

Clause 15: DEVIATION

The bids having deviation(s) w.r.t tender are liable for rejection. However, BHEL, at its discretion, may load the prices for evaluation of offer with prior intimation to bidder.

Deviations must be mentioned in deviation schedule(s) and deviation mentioned, if any, elsewhere shall not be considered.

Clause 16: ARBITRATION

The arbitration shall be under '**The Arbitration and Conciliation act 1996'**.**All remaining terms which are not mentioned here shall remain unchanged.**

Note: -

1. **DELIVERY** –
   15.04.15. Vendor has to quote their best possible delivery plan.

2. **BG-**
   Supplier has to specifically indicate / tick mark their preference for PBG out of the three options mentioned in clause no. 6 of General Terms and Conditions (BHEL/TBG/GTC/02-07) i.e. Performance Bank Guarantee.

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   Non-*acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.*

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   Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit "online sealed bid" in the Reverse Auction. Non-submission of "online sealed bid" by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.

   Information and General Terms and Conditions governing RA as per Annexure-I.

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level or above [for 400kV & below substation] for at least 2 (two) years on the originally scheduled date of bid opening.

AND

The Manufacturer or their joint venture or subsidiary company must have established repair, testing and integration (for at least 4 bays) facilities for Control, Relay & Protection System and Sub-station Automation System in India.

- ***The manufacturers must have valid MQP approved from M/s PGCIL.***

7. **OFFER EVALUATION-**

- **Evaluation to be done SITE WISE.**

1- Separate Site wise Price bids to be submitted in separate sealed envelopes.(7 Price Bids for Envelopes for *Biharshariff,Jamshedpur,Gazuwaka,Rengali,Rourkela,Durgapur,Gorakhpur****)***

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b- Evaluation (for foreign vendors) – Evaluation shall be on CIF(discharge port) basis and PO shall be on FOB basis.

c- Evaluation (in case offers for Indian and foreign vendors) – Evaluation shall be on landed cost to BHEL.

8. **PRICE BREAKUP-**

Price breakup should consist of the following breakup:-

a. FOB port of Loading.

b. Marine Freight from load port to discharge port i.e. any Indian discharge port preferably Mumbai.

c. Marine Insurance from load port to discharge port i.e. any Indian discharge port preferably Mumbai.

9. **MARINE FREIGHT AND INSURANCE-**

Marine freight and insurance to be quoted separately.

BHEL may arrange Marine Shipment or exercise option for shipment by vendor at quoted F&I rates.

Freight & Insurance from discharge port to site – BHEL's scope. Rates will be based on BHEL's applicable rate contract for arriving at landed cost to BHEL. However vendor may also quote for the same. (i**.e. from Discharge port to site i.e.** *Biharshariff- BIHAR ,Jamshedpur-JHARKHAND , Gazuwaka- ANDHRA PRADESH, Rengali, Rourkela - ODISHA, Durgapur-WEST BENGAL, & Gorakhpur-UTTAR PRADESH,INDIA***)**

Freight and Insurance to be quoted separately.

10. Following details regarding shipment shall also be mentioned to arrange logistics for the same-

a) No. of package.

b) Size and Weight (Net & Gross) of each package.

c) No. of containers required with type of container & size of container.

d) Type of cargo (Break Bulk/LCL/FCL).

e) Custom Tariff No.

Terms & Conditions of Reverse Auction

Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

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3. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.

4. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.

5. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.

6. Bidders have to fax the Compliance form (annexure IV) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.

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8. Reverse auction will be conducted on scheduled date & time.

9. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.

10. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure VII) as provided on case-to-case basis to Service provider within two working days of Auction without fail.

11. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL's standard practice.

12. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the 'Business Rules of Reverse Auction', which will be communicated before the Reverse Auction.

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14. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.

15. In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

ACTIVITY SCHEDULE

(To be filled – up by the supplier)

NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.

SL. NO.	ACTIVITY		ACTIVITY TIME IN WEEKS	CUMULATIVE TIME IN WEEKS FROM LOI/PO DATE	REMARKS IF ANY
1.	Receipt of P.O				
2.	Submission of P.O Acceptance	Max 1 week (7 days)			
3.	Submission of documents necessary for getting manufacturing clearance like Drawings, date sheet etc.				
4.	Review and Approval of documents and issue of manufacturing clearance	**"BY BHEL/CUSTOMER"**			
5.	Manufacturing Time	(A)			
6.	Inspection	**"BY BHEL/CUSTOMER"**			
7.	Issue of other documents like MICC ,Road Permits etc.	**"BY BHEL/CUSTOMER"**			
8.	Dispatch				
9.	Transit time upto Site.				

Note :

1) For item at Sl. No. 4) Vendor to reply to all queries within 3 days.

2) For Sl. No. 5) Inspection call for entire lot to be issued 2 weeks in advance. Date given in call for inspection should be within the period indicated in "A" for completion of activity at Sl. No. 6.

3) 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.

4) Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.

5) Qty to be offered for inspection should be in accordance within Delivery-schedule – lot. BHEL reserves the right not to entertain multiple inspection calls for a Delivery – lot and delay on this account shall be the responsibility of Supplier.

Signature & Seal of Supplier

Date:

Enquiry No. 174E203 dtd. 15.01.15

CHECKLIST

SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.

Put a tick mark on "YES" if the information is enclosed with the offer or put a tick mark on "NO" if the information is not enclosed or write "NOT APPLICABLE" if the information is not applicable.

1.	Technical offer with detailed schedule of equipment / material and spares enclosed.	YES / NO
2.	Guaranteed Technical Particulars as per Section – 4 enclosed.	YES / NO
3.	Schedule of deviation, if any, clause wise with respect to Technical Specification enclosed.	YES / NO
4.	Standard Manufacturing Quality Plan enclosed.	YES / NO
5.	GA Drawings with dimensions and weights & foundation / fixing details enclosed.	YES / NO
6.	Drawing and Data submission schedule enclosed.	YES / NO
7.	Type Test Reports enclosed.	YES / NO
8.	Bar Chart showing the schedule indicating time required for design, manufacture, test and inspection, transport, erection, site testing and commissioning enclosed.	YES / NO
9.	Makes of all components as per technical Specification enclosed.	YES / NO

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal ……..

Date ……..

SCHEDULE OF COMMERCIAL DEVIATION

Enquiry No. 174E203 dtd. 15.01.15

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

Sl. No	CLAUSE NO. OF GENERAL TERMS AND CONDITIONS	STATEMENT OF 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: Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

All deviations must be mentioned in this format only. Deviation(s) to terms mentioned elsewhere will not 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 Bidder

Bidder's name: _____

Place: _____

Designation: _____

Date: _____

Company Seal: _____

SCHEDULE OF TECHNICAL DEVIATION

Enquiry No. 174E203 dtd. 15.01.15

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

Sl. No	CLAUSE NO. OF GENERAL TERMS AND CONDITIONS	STATEMENT OF 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: Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

All deviations must be mentioned in this format only. Deviation(s) to spec/std. mentioned elsewhere will not 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 Bidder

Bidder's name: _____

Place: _____

Designation: _____

Date: _____

Company Seal: _____

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Rourkela Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
1	**For 400kV Rourkela Substation** : Control & Relay Panel Augmentation of Existing Control Panel	No.	1								
31	Services-**For Rourkela Substation**: a) Augmentation of existing 400 kV control panel in all respect b) Site visits for collecting inputs for interfacing with the existing sub-station c) Relay Setting Calculation d) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
38	**For Rourkela Substation:** Services: Training Charges	Lot	1								
	TOTAL PRICE										

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Gazuwaka Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
2	**For 400kV Gazuwaka Substation** : Control & Relay Panel Control Panel for Diameter (one & half breaker scheme)	No.	1								
3	**For 400kV Gazuwaka Substation** : Control & Relay Panel Circuit Breaker Relay Panel With Auto-Reclose	No.	1								
4	**For 400kV Gazuwaka Substation** : Control & Relay Panel Circuit Breaker Relay Panel Without Auto-Reclose	No.	1								
5	**For 400kV Gazuwaka Substation** : Control & Relay Panel Reactor Protection Panel	No.	1								
6	**For 400kV Gazuwaka Substation** : Control & Relay Panel Augmentation of existing Bus Bar protection scheme (For two bay)	No.	1								
7	**For 400kV Gazuwaka Substation** : Control & Relay Panel Common equipments : Special Relay test kit	Set	1								
8	**For 400kV Gazuwaka Substation** : Control & Relay Panel Common equipments : BCU and its integration with NTAMC System	Nos.	3								
32	Services-**For Gazuwaka Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
39	**For Gazuwaka Substation:** Services: Training Charges	Lot	1								
45	Mandatory spares : **For Gazuwaka Substation**: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1								
46	Mandatory spares : **For Gazuwaka Substation**: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1								
47	Mandatory spares : **For Gazuwaka Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1								
	TOTAL PRICE										

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Biharshariff Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
9	**For 400kV Biharshariff Substation** : Control & Relay Panel 400kV Reactor Protection panel	No.	1								
10	**For 400kV Biharshariff Substation** : Control & Relay Panel Augmentation of Existing Control Panel	No.	1								
11	**For 400kV Biharshariff Substation** : Control & Relay Panel Other/Common equipments : Special Relay test kit	Set	1								
33	Services-**For Biharsharif Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
40	**For Biharsharif Substation:**Services: Training Charges	Lot	1								
48	Mandatory spares : **For Biharsharif Substation**: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1								
49	Mandatory spares : **For Biharsharif Substation**: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1								
50	Mandatory spares : **For Biharsharif Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1								
	TOTAL PRICE										

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Rengali Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
12	**For 400kV Rengali Substation** : Control & Relay Panel Control Panel for Diameter (one & half breaker scheme)	No.	1								
13	**For 400kV Rengali Substation** : Control & Relay Panel Augmentation of Existing Control Panel	No.	1								
14	**For 400kV Rengali Substation** : Control & Relay Panel Circuit Breaker Relay Panel : With Auto-Reclose	No.	1								
15	**For 400kV Rengali Substation** : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	Nos.	2								
16	**For 400kV Rengali Substation** : Control & Relay Panel Reactor Protection Panel	Nos.	2								
17	**For 400kV Rengali Substation** : Control & Relay Panel Augmentation of existing Bus Bar protection scheme (For three bay)	No.	1								
18	**For 400kV Rengali Substation** : Control & Relay Panel Other / Common equipments : Special Relay test kit	Set	1								
19	**For 400kV Rengali Substation** : Control & Relay Panel Other / Common equipments : BCU and its integration with NTAMC System	Nos.	3								
34	Services-**For Rengali Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection and Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
41	**For Rengali Substation:** Services: Training Charges	Lot	1								

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
51	Mandatory spares : **For Rengali Substation**: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1								
52	Mandatory spares : **For Rengali Substation**: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1								
53	Mandatory spares : **For Rengali Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1								
	TOTAL PRICE										

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Jamshedpur Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
20	**For 400kV Jamshedpur Substation** : Control & Relay Panel Reactor Protection Panel	No.	1								
21	**For 400kV Jamshedpur Substation** : Control & Relay Panel Augmentation of Existing Control Panel	Nos.	2								
22	**For 400kV Jamshedpur Substation** : Control & Relay Panel Other / Common equipments : Special Relay test kit	Set	1								
35	Services-**For Jamshedpur Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
42	**For Jamshedpur Substation:** Services: Training Charges	Lot	1								
54	Mandatory spares : **For Jamshedpur Substation**: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1								
55	Mandatory spares : **For Jamshedpur Substation**: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1								
56	Mandatory spares : **For Jamshedpur Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1								
	TOTAL PRICE										

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Durgapur Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
23	**For 400kV Durgapur Substation** : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	No.	1								
24	**For 400kV Durgapur Substation** : Control & Relay Panel Augmentation of Existing Control Panel	Nos.	2								
25	**For 400kV Durgapur Substation** : Control & Relay Panel Reactor Protection Panel	Nos.	2								
26	**For 400kV Durgapur Substation** : Control & Relay Panel Other / Common equipments : Special Relay test kit	Set	1								
27	**For 400kV Durgapur Substation** : Control & Relay Panel Other / Common equipments : BCU and its integration with NTAMC System	No.	1								
36	Services-**For Durgapur Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection and Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
43	**For Durgapur Substation:** Services: Training Charges	Lot	1								
57	Mandatory spares : **For Durgapur Substation**: Reactor Protection Panel : Reactor Differential Protection Relay	Set	1								
58	Mandatory spares : **For Durgapur Substation**: Reactor Protection Panel : Reactor Back up impedance Relay	Set	1								

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
59	Mandatory spares : **For Durgapur Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1								
	TOTAL PRICE										

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.14

Gorakhpur Substation

S.No.	Description of Item	Unit	Qty.	Unit Price Ex-works	Total Ex-Works	Unit F & I	Total F & I	(**)ED @____ % of Col6	CST @ ___% against C-Form/ VAT @ _____	Service Tax @ ____%	TOTAL (FOR Destination) PRICE (Rs.)
1	2	3	4	5	6	7	8	9	10	11	12
28	**For 400kV Gorakhpur Substation** : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	Nos.	2								
29	**For 400kV Gorakhpur Substation** : Control & Relay Panel Augmentation of Existing Control Panel (as per Tech Spec)	No.	1								
30	**For 400kV Gorakhpur Substation** : Control & Relay Panel Augmentation of RTU and LDMS (as per Tech Spec)	No.	1								
37	Services-**For Gorakhpur Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1								
44	**For Gorakhpur Substation:** Services: Training Charges	Lot	1								
	TOTAL PRICE										

Note:

1.Vendor to indicate applicable local tax/VAT without as any concessional forms for transaction within the state.local tax/VAT_____

2. Please note that unpriced copy of price bid (i.e. with all price blanked) shall be furnished alongwith techo-commercial bid.

3. Required required copies of format be made & details may be annexed.

4. The prices must be quoted in the prescribed unit only.

5. In case of CST rate against c form shall be quoted.(for detail please refer to terms & conditions).

6. (**) .(For detail please refer to terms & conditions).

TENDERER

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Rourkela Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
1	**For 400kV Rourkela Substation** : Control & Relay Panel Augmentation of Existing Control Panel		1 No.												
31	Services-For Rourkela Substation: a) Augmentation of existing 400 kV control panel in all respect b) Site visits for collecting inputs for interfacing with the existing sub-station c) Relay Setting Calculation d) Scheme modification of existing Bays and documentation as per technical specification.		1 Lot												
38	**For Rourkela Substation:** Services: Training Charges		1 Lot												
	Total														

NOTE-
Discharge Port:- any Indian discharge port preferably Mumbai
CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"
Load port to be mentioned by bidder .
No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.
Vendor has to mention tarrif no against each item for custom duty purpose.
Bidder has to mention quoted (in each cell) in unpriced price bid

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Gazuwaka Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
2	**For 400kV Gazuwaka Substation** : Control & Relay Panel Control Panel for Diameter (one & half breaker scheme)		1 No.												
3	**For 400kV Gazuwaka Substation** : Control & Relay Panel Circuit Breaker Relay Panel With Auto-Reclose		1 No.												
4	**For 400kV Gazuwaka Substation** : Control & Relay Panel Circuit Breaker Relay Panel Without Auto-Reclose		1 No.												
5	**For 400kV Gazuwaka Substation** : Control & Relay Panel Reactor Protection Panel		1 No.												
6	**For 400kV Gazuwaka Substation** : Control & Relay Panel Augmentation of existing Bus Bar protection scheme (For two bay)		1 No.												
7	**For 400kV Gazuwaka Substation** : Control & Relay Panel Common equipments : Special Relay test kit		1 Set												
8	Common equipments : BCU and its integration with NTAMC System		3 Nos.												
32	Services-**For Gazuwaka Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection in all respect e) Site visits for collecting inputs for interfacing with the		1 Lot												
39	**For Gazuwaka Substation:** Services: Training Charges		1 Lot												

						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
45	Mandatory spares : **For Gazuwaka Substation**: Reactor Protection Panel : Reactor Differential Protection Relay		1 Set												
46	Mandatory spares : **For Gazuwaka Substation**: Reactor Protection Panel : Reactor Back up impedance Relay		1 Set												
47	Mandatory spares : **For Gazuwaka Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor		1 Set												
	Total														

NOTE-
Discharge Port:- any Indian discharge port preferably Mumbai
CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"
Load port to be mentioned by bidder .
No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.
Vendor has to mention tarrif no against each item for custom duty purpose.
Bidder has to mention quoted (in each cell) in unpriced price bid

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Biharshariff Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
9	**For 400kV Biharshariff Substation** : Control & Relay Panel 400kV Reactor Protection panel		1 No.												
10	**For 400kV Biharshariff Substation** : Control & Relay Panel Augmentation of Existing Control Panel		1 No.												
11	**For 400kV Biharshariff Substation** : Control & Relay Panel Other/Common equipments : Special Relay test kit		1 Set												
33	Services-**For Biharsharif Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		1 Lot												
40	**For Biharsharif Substation:**Services: Training Charges		1 Lot												
48	Mandatory spares : **For Biharsharif Substation**: Reactor Protection Panel : Reactor Differential Protection Relay		1 Lot												
49	Mandatory spares : **For Biharsharif Substation**: Reactor Protection Panel : Reactor Back up impedance Relay		1 Set												
50	Mandatory spares : **For Biharsharif Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor		1 Set												
	Total														

NOTE-

Discharge Port:- any Indian discharge port preferably Mumbai

						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
	CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"														
	Load port to be mentioned by bidder .														
	No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.														
	Vendor has to mention tarrif no against each item for custom duty purpose.														
	Bidder has to mention quoted (in each cell) in unpriced price bid														

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Rengali Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
12	**For 400kV Rengali Substation** : Control & Relay Panel Control Panel for Diameter (one & half breaker scheme)		1 No.												
13	**For 400kV Rengali Substation** : Control & Relay Panel Augmentation of Existing Control Panel		1 No.												
14	**For 400kV Rengali Substation** : Control & Relay Panel Circuit Breaker Relay Panel : With Auto-Reclose		1 No.												
15	**For 400kV Rengali Substation** : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose		2 Nos.												
16	**For 400kV Rengali Substation** : Control & Relay Panel Reactor Protection Panel		2 Nos.												
17	**For 400kV Rengali Substation** : Control & Relay Panel Augmentation of existing Bus Bar protection scheme (For three bay)		1 No.												
18	**For 400kV Rengali Substation** : Control & Relay Panel Other / Common equipments : Special Relay test kit		1 Set												
19	**For 400kV Rengali Substation** : Control & Relay Panel Other / Common equipments : BCU and its integration with NTAMC System		3 Nos.												
34	Services-**For Rengali Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be i BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection and Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		1 Lot												
41	**For Rengali Substation:** Services: Training Charges		1 Lot												

						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
51	Mandatory spares : **For Rengali Substation**: Reactor Protection Panel : Reactor Differential Protection		1 Set												
52	Mandatory spares : **For Rengali Substation**: Reactor Protection Panel : Reactor Back up impedance Relay		1 Set												
53	Mandatory spares : **For Rengali Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor		1 Set												
	Total														

NOTE-
Discharge Port:- any Indian discharge port preferably Mumbai
CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"
Load port to be mentioned by bidder .
No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.
Vendor has to mention tarrif no against each item for custom duty purpose.
Bidder has to mention quoted (in each cell) in unpriced price bid

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Jamshedpur Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
20	**For 400kV Jamshedpur Substation** : Control & Relay Panel Reactor Protection Panel		1 No.												
21	**For 400kV Jamshedpur Substation** : Control & Relay Panel Augmentation of Existing Control Panel		2 Nos.												
22	**For 400kV Jamshedpur Substation** : Control & Relay Panel Other / Common equipments : Special Relay test kit		1 Set												
35	Services-**For Jamshedpur Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		1 Lot												
42	**For Jamshedpur Substation:** Services: Training Charges		1 Lot												
54	Mandatory spares : **For Jamshedpur Substation**: Reactor Protection Panel : Reactor Differential Protection Relay		1 Lot												
55	Mandatory spares : **For Jamshedpur Substation**: Reactor Protection Panel : Reactor Back up impedance Relay		1 Set												
56	Mandatory spares : **For Jamshedpur Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor		1 Set												
	Total														

NOTE-

Discharge Port:- any Indian discharge port preferably Mumbai

						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
	CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"														
	Load port to be mentioned by bidder .														
	No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.														
	Vendor has to mention tarrif no against each item for custom duty purpose.														
	Bidder has to mention quoted (in each cell) in unpriced price bid														

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Durgapur Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
23	**For 400kV Durgapur Substation** : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose	1 No.													
24	**For 400kV Durgapur Substation** : Control & Relay Panel Augmentation of Existing Control Panel	2 Nos.													
25	**For 400kV Durgapur Substation** : Control & Relay Panel Reactor Protection Panel	2 Nos.													
26	**For 400kV Durgapur Substation** : Control & Relay Panel Other / Common equipments : Special Relay test kit	1 Set													
27	**For 400kV Durgapur Substation** : Control & Relay Panel Other / Common equipments : BCU and its integration with NTAMC System	1 No.													
36	Services-**For Durgapur Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection and Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	1 Lot													
43	**For Durgapur Substation:** Services: Training Charges	1 Lot													
57	Mandatory spares : **For Durgapur Substation**: Reactor Protection Panel : Reactor Differential Protection Relay	1 Set													
58	Mandatory spares : **For Durgapur Substation**: Reactor Protection Panel : Reactor Back up impedance Relay	1 Set													

						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
59	Mandatory spares : **For Durgapur Substation**: Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	1 Set													
	Total														

NOTE-
Discharge Port:- any Indian discharge port preferably Mumbai
CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"
Load port to be mentioned by bidder .
No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.
Vendor has to mention tarrif no against each item for custom duty purpose.
Bidder has to mention quoted (in each cell) in unpriced price bid

SCHEDULE OF PRICE (for Foreign vendors only) (Part II)

(BIDDER TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

Enq. No. 174E203 dtd. 15.01.15

Gorakhpur Substation

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
						Break up of CIF(Indian "Mumbai" Sea port)						Breakup of Inland Transportation			
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Unit -FOB (Load port).	Total - FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)
28	**For 400kV Gorakhpur Substation** : Control & Relay Panel Circuit Breaker Relay Panel : Without Auto-Reclose		2 Nos.												
29	**For 400kV Gorakhpur Substation** : Control & Relay Panel Augmentation of Existing Control Panel (as per Tech Spec)		1 No.												
30	**For 400kV Gorakhpur Substation** : Control & Relay Panel Augmentation of RTU and LDMS (as per Tech Spec)		1 No.												
37	Services-**For Gorakhpur Substation**: Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		1 Lot												
44	**For Gorakhpur Substation:** Services: Training Charges		1 Lot												
	Total														

NOTE-

Discharge Port:- any Indian discharge port preferably Mumbai

CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"

Load port to be mentioned by bidder .

No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required - To be mentioned by bidder.

Vendor has to mention tarrif no against each item for custom duty purpose.

Bidder has to mention quoted (in each cell) in unpriced price bid

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-4-370-510-012	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	RK	VK	RS
TITLE	CONTROL & RELAY PANEL			SIGN			
				DATE			
				GROUP	TBEM	W.O. No	84001
CUSTOMER	Power Grid Corporation of India Ltd.						
PROJECTS	POWERGRID's Substation Package for Extension of I) 400kV Biharshariff S/s, II) 400kV Jamshedpur S/s, III) 400 kV Gazuwaka S/s, IV) 400 kV Rengali S/s, V) 400 kV Rourkela S/s, VI) 400 kV Durgapur S/s & VII) 400 kV Gorakhpur S/s Extension package under ERSS-IX						

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
				Distribution	TBMM	TBQM	TBCM	TBTS
				Copies	-	-	-	-

SECTION I
SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture and assembly , testing at manufacturer's works, packing and dispatch of Control & Relay panel for Substation Extension Package for 400kV Biharshariff S/s, 400kV Jamshedpur S/s, 400 kV Gazuwaka S/s, 400 kV Rengali S/s, 400 kV Rourkela S/s, 400 kV Durgapur S/s & 400 kV Gorakhpur S/s under Eastern Region Strengthening Scheme-IX (ERSS-IX) complete with accessories as listed below. Testing and Commissioning of all equipments including Protective relays shall be done by the OEM Engineer along with on site, local training to PGCIL engineers as specified in respective sections.
The fitments offered shall be of PGCIL approved make or its subsequent approval from PGCIL shall be bidder's responsibility, with no commercial implications to BHEL. If any of the make offered by the bidder is not acceptable to M/s PGCIL, the bidder has to supply alternate PGCIL approved make, meeting the specification, with no commercial implications to BHEL.
All auxiliary relays, timers, counters, aux CTs, switches etc required for completeness of the scheme & good engineering are deemed to be included in the offer and no claim whatsoever shall be entertained at contract stage.

In case of any conflict between the technical details mentioned in this section and the remaining sections of this document, then Section-1 shall prevail and is to be considered as binding requirement.

1.1 The equipment is required for the following Project.

Name of customer	:	**Power Grid Corporation of India Limited**
Name of the project	:	**Extension of 400kV Rourkela S/S, 400kV Gazuwaka S/S, 400kV Biharshariff S/s, 400kV Rengali S/s, 400kV Jamshedpur S/s, 400kV Durgapur S/s & 400/220kv Gorakhpur S/s under Eastern region strengthening scheme-IX (ERSS-IX)**

Refer Section - 3 for Project Details and General Specifications.

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

2.0 SPECIFIC TECHNICAL PARTICULARS

Extension of 400kV Rourkela Substation:

Relay and protection system for 400kV bays under present scope. Existing control and relay panel of 50MVAR Bus Reactor (3-Phase) shall be utilized for 125MVAR Bus Reactor under present scope.

- Under augmentation of Control Panel replacement of meter and transducer, Remote WTI etc. and necessary wiring modification is also included in scope.

- Existing protection relay for 50MVAR reactor shall be utilized for 125MVAR Bus Reactor under subject scope. Existing protection relay for 50MVAR reactor are as follows
  -Differential- Alstom make MICOM P643
  -B/U Imp-ABB make RAKZB
  -REF-ABB make RADHD
  -Teed-I-ABB make RADHA
  -Teed-II-ABB make RADSB

Extension of 400kV Gazuwaka Substation:

Complete relay and protection system for 400kV bays under present scope as per Section-II.

- The existing 400kV bus bar protection scheme at Gazuwaka S/S is ABB make MAC Software (duplicate bus-bar protection scheme for each bus). This Busbar protection is of type MACH-2, low impedance & centralised. Additional current module and trip relays & Auxiliary relays including wiring/cabling & integration for augmentation of 400kV Busbar protection related to bays under present scope is included in contract.
- Bay Control Units (BCU) for NTAMC SCADA requirement & integration of these BCUs with NTAMC in line with technical specification for NTAMC SCADA system enclosed at ANEXURE-II is under present scope of work. Auxiliary contact of CB & Isolator and associated potential free contact of multiplier relay/auxiliary relay and secondary winding of CT, as applicable is to hardwired upto the BCU which shall be integrated with NTAMC SCADA under present scope.
- NTAMC SCADA at Gazuwaka end is ALSTOM make.

Extension of 400kV Biharshariff Substation:

Complete relay and protection system for 400kV bays under present scope as per Section-II.

- Augmentation of existing control panel (such as mounting of Isolator control switch, indication lamp, Remote winding temperature indicator, Mvar meter etc.) for diameter associated with 50MVAR bus reactor. TEED protection wiring to be extended to the 125MVAR Bus Reactor. Teed 1 and 2 both are low impedance type and are ABB make RADSB model.
- All analog & digital inputs as per Annexure-II shall be hardwired upto NTAMC SCADA system. NTAMC SCADA at Biharshariff substation is ALSTOM make. However, integration with NTAMC SCADA is not under present scope of work. Further extending DR from Reactor protection panel (B/U impedance relay) up to station data concentrator of NTAMC SCADA system over 61850 protocol is included under present scope. Auxiliary contact of CB & Isolator and associated potential free contact of multiplier relay/auxiliary relay and secondary winding of CT, as applicable is to hardwired upto the BCU which shall be integrated with NTAMC SCADA under present scope.
- 6 nos. annunciation windows shall be provided in existing Control Panel under present scope.
- Spare port in existing BCU for control/monitoring of Isolator & Analog input (associated with paralleling of Reactor) being provided under present scope shall be made available by POWERGRID
- Space for mounting 400kV isolator Local/ Remote (L/R) switch is available in existing control panel.

Extension of 400kV Rengali Sub-station:

Complete relay and protection system for 400kV bays under present scope as per Section- II.

- Augmentation of existing control panel for the 400kV diameter associated with Bus Reactor#1 as per single line diagram is under present scope.
- The existing 400kV bus bar protection scheme at Rengali substation is English Electric make PBDCB (single bus-bar protection scheme for each bus). Augmentation of existing Busbar protection including necessary trip relays & auxiliary relays under present scope of work.
- Bay Control Units (BCU) for NTAMC SCADA **(Alstom make)** requirement & integration of these BCUs with NTAMC in line with technical specification for NTAMC SCADA system enclosed at Annexure-II. Auxiliary contact of CB & Isolator and associated potential free contact of multiplier relay/auxiliary relay and secondary winding of CT, as applicable is to hardwired upto the BCU which shall be integrated with NTAMC SCADA under present scope.
- Spare CRM module of Bus bar protection scheme (PBDCB) shall be made available by POWERGRID, however its mounting in existing relay panel and additional trip relay, auxiliary relay are included in scope of work.
- 2 no. BCU will be used for **125MVAR reactor #Tie#Future diameter** and 1 no. BCU will be used for **Indrāvati line #Tie#125MVAR reactor** diameter.
- For BCU related to bay with existing control panel, the space available in CB relay panel under present scope may be used.
- The existing local gateway/RTU is capable to configure present bay signals (hard/Soft) without adding any extra hardware/software

Extension of 400kV Jamshedpur Sub-station:

Complete relay and protection system for 400kV bays under present scope as per Section- II.

- Augmentation of existing two nos. Control Panels (such as mounting of Isolator control switch, indication lamp, Remote winding temperature indicator, Mvar meter etc.) for the 400kV diameters associated with Bus Reactors#1&2 as per single line diagram is under present scope.
- All analog & digital inputs as per Annexure-II shall be hardwired upto NTAMC SCADA system (ALSTOM make). However, integration with NTAMC SCADA is not under present scope of work.
- Further extending DR from Reactor protection panel (B/U impedance relay) upto station data concentrator of NTAMC SCADA system over 61850 protocol is included under present scope. Auxiliary contact of CB & Isolator and associated potential free contact of multiplier relay/auxiliary relay and secondary winding of CT, as applicable is to hardwired upto the BCU which shall be integrated with NTAMC SCADA under present scope.
- 6 nos. annunciation windows shall be provided in existing Control Panel is under present scope.
- Sufficient space is already available in existing control panel (for ICT-2#Tie#Bus reactor-1,3 dia) for augmentation due to additional 125MVAR(reactor#3) reactor
- Space is available in existing relay panel for mounting Control switching device required for Main and Tie circuit breaker associated with 125MVAR bus reactor.

- Spare port in existing BCU for control/monitoring of Isolator & Analog input (associated with paralleling/replacement of Reactor) being provided under present scope shall be made available by POWERGRID.
- Space for mounting 400kV isolator L/R switch is available in existing control panel.
- Existing Relay panels for 50MVAR Bus reactor (3-Phase) to be replaced shall be utilized for 125MVAr Bus reactor#2 under present scope.

  -B/U Imp-Alstom make MICOM P442
  - Differential- ABB make RADHA
  -REF-ABB make RADHD
  -Teed-I-ABB make RADSB
  -Teed-II-ABB make RADSB

Extension of 400kV Durgapur Sub-station:

Complete relay and protection system for 400kV bays under present scope as per Section-II.

- Augmentation of existing one no. control panel (such as mounting of Isolator control switch, indication lamp, Remote winding temperature indicator, Mvar meter etc.) for the 400kV diameter associated with Bus Reactors#1 as per single line diagram is under present scope.
- The existing 400kV bus bar protection scheme at 400kV Durgapur substation is RADHA (Single busbar protection scheme for each bus with check zone. Differential relay of high Impedance type) of M/s ABB make.
- For 125MVAR Bus Reactor#3 bay necessary hardwiring of analog and digital input up to BCU being supplied under present scope and integration of these BCU's with NTAMC SCADA system as per Annexure-II is included in the subject scope.
- Further for 125MVAR Bus Reactor#2 bay necessary hardwiring of analog and digital input up to existing BCU as per Annexure-II is also in present scope. However, integration of existing BCU's with NTAMC SCADA system is not under present scope.
- 6 nos. annunciation windows shall be provided in existing Control Panel is under present scope.
- Space is available in existing relay panels for mounting Control switching device required for Main and Tie circuit breaker associated with 125MVAR bus reactors**(line #Tie#125MVAR reactor-2 dia& Line(F) #Tie#Bus reactor-1,2 dia)**
- Sufficient space is already available in existing control panel **(In Line(F)#Tie#Bus reactor-1,2 dia)** for augmentation due to additional 125MVAR(reactor#3) reactor

Extension of 400/220kV Gorakhpur Sub-station:

Complete relay and protection system for 400kV Circuit breakers under present scope as per Section- II. The present scope includes:

- Circuit Breaker relay panels along with necessary wiring modification to augment it with existing line and reactor protection. The circuit breaker relay panels shall be placed in existing switchyard panel room.
- Augmentation of existing control panel located in Control Room for the 400kV diameter associated with 400kV Barh D/C lines with reactors as per single line diagram.
- Existing control panels associated with Barh-1&2 line reactor breakers are required to be augmented and sufficient space is already available in the existing control panel.

- Augmentations of existing RTU & LDMS for bays under present scope. The existing RTU is of ABB make, model RTU-232 and SCADA software being used is of Siemens, type SICAM PAS. The hardware for bays under present scope along with necessary modification in software displays database etc is also in scope of work. The control function using DO card is needed at Gorakhpur substation to control the circuit breakers under present scope. However, interfacing, cabling and updation of software to integrate the bays under scope with NRLDC & LDMS shall also be in scope.

2.1 In addition, following points to be noted by the bidder:

i) The scope for relay setting shall be as follows:

a) Conducting the relay setting calculations and determination of the recommended relay settings shall be in bidder's scope. The relay settings shall be submitted in the OEM's format along with supporting calculations for approval of POWERGRID during contract stage.
b) Providing all the inputs pertaining to protection relay settings shall be in POWERGRID scope.

ii) Necessary site visits for collecting inputs for interfacing with the existing sub-station are included in the bidder's scope for this tender.

iii) Dimension and color of C&R panels at all the substations shall match with existing panels.

iv) Wherever bidder offers any spare in lieu of the same being "Built-in feature" of any relay/ fitment or the same being "Not applicable" is subject to approval by POWERGRID. No price implication will be entertained by BHEL at contract stage if any separate item is insisted by POWERGRID to meet the contract requirement.

v) Bidder to note that the GTP, Make & type of fitments, Bill of material of the offered Control & Relay Panels and their mandatory spares are subject to POWERGRID approval at the contract stage. No price implications will be entertained by BHEL at contract stage.

vi) Augmentation of existing Busbar protection will also require change in relay settings of existing Busbar Protection relay which is in the scope of bidder.

vii) Mounting of control Switching device (CSD) in the existing / new relay panel is being dealt separately. However, associated scheme modification is included in the present scope. However, make and type of CSD to be informed to successful bidder. Following is the station wise distribution of CSD.

S.No.	Station	No. of CSD Installed
1.	400kV Rourkela S/s	2
2.	400kV Gazuwaka S/s	2
3.	400kV Biharsharif S/s	2
4.	400kV Rengali S/s	4
5.	400kV Jamshedpur S/s	4

6.	400kV Durgapur S/s	4
7.	400/220kV Gorakhpur S/s	2

3.0 TECHNICAL REQUIREMENTS:

(i) The manufacturer whose Control, Relay & Protection System (Control & protection Intelligent Electronic Devices (IEDs)) are offered should have designed, manufactured, tested, installed and commissioned Control, Relay & Protection system which must be in satisfactory operation on (i) 400 kV system [for 765kV substation] & (ii) specified voltage level or above [for 400kV & below substation] for at least 2 (two) years on the date of LOA i.e. 23.06.14.

AND

(ii) The Manufacturer or their joint venture or subsidiary company must have established repair, testing and integration (for at least 4 bays) facilities for Control, relay & protection System in India.

(iii)The Vendor/Manufacturer should have valid MQP number approved by PGCIL.

4.0 TRAINING :

The supplier shall impart necessary training to Employer's personnel (Two persons) on design, operation, maintenance and commissioning aspect of Control & Protection at manufacturer's/supplier's works for 5 (five) days.

Charges for Tutorials & other training materials at each substation shall also be included in the price quoted by the bidder.
However, the travel lodging, & boarding expenses of employers personnel, if any shall be done by Employer.

5.0 PRECOMMISSIONING, COMMISSIONING & COMPLETION

a. PRECOMMISSIONING: As per requirements specified in Section III.

b. COMMISSIONING :
Charging of the facilities at rated voltage. Further, wherever appearing in this specification, the words –'commissioning checks', 'installation checks', 'site tests', 'Performance guarantee tests for fire protection system', are to be considered as 'pre commissioning checks'.

c. COMPLETION :
Upon successful completion of commissioning.

d. The respective dates of commencement of erection, pre-commissioning and commissioning activities by BHEL will be intimated to the equipment manufacturer from time to time, so that arrangements for supervising the activity can be made accordingly by the manufacturer.

6.0 BILL OF QUANTITY:

S. No.	Description	Unit	Total Quantity
1.0	**For Rourkela Substation:** **400kV Control & Relay Panel (Simplex type Panel)**		
1.1	Augmentation of Existing Control Panel	No.	1
2.0	**For Gazuwaka Substation:** **400kV Control & Relay Panel (Simplex type Panel)**		
2.1	Control Panel for Diameter (one & half breaker scheme)	No.	1
2.2	Circuit Breaker Relay Panel		
2.2.1	With Auto-Reclose	No.	1
2.2.2	Without Auto-Reclose	No.	1
2.3	Reactor Protection Panel	No.	1
2.4	Augmentation of existing Bus Bar protection scheme (For two bay)	Set	1
2.5	Common equipments		
2.5.1	Special Relay test kit	Set	1
2.5.2	BCU and its integration with NTAMC System	Nos.	3
3.0	**For Biharshariff Substation:** **400kV Control & Relay Panel (Simplex type Panel)**		
3.1	400kV Reactor Protection panel	No.	1
3.2	Augmentation of Existing Control Panel	No.	1
3.3	Other/Common equipments		
3.3.1	Special Relay test kit	Set	1
4.0	**For Rengali Substation:** **400kV Control & Relay Panel (Simplex type Panel)**		

4.1	Control Panel for Diameter (one & half breaker scheme)	No.	1
4.2	Augmentation of Existing Control Panel	No.	1
4.3	Circuit Breaker Relay Panel		
4.3.1	With Auto-Reclose	No.	1
4.3.2	Without Auto-Reclose	No.	2
4.4	Reactor Protection Panel	No.	2
4.5	Augmentation of existing Bus Bar protection scheme (For three bay)	Set	1
4.6	Other / Common equipments		
4.6.1	Special Relay test kit	Set	1
4.6.2	BCU and its integration with NTAMC System	Nos.	3
5.0	**For Jamshedpur Substation:** **400kV Control & Relay Panel (Simplex type Panel)**		
5.1	Reactor Protection Panel	No.	1
5.2	Augmentation of Existing Control Panel	Nos.	2
5.3	Other / Common equipments		
5.3.1	Special Relay test kit	Set	1
6.0	**For Durgapur Substation:** **400kV Control & Relay Panel (Simplex type Panel)**		
6.1	Circuit Breaker Relay Panel		
6.1.1	Without Auto-Reclose	No.	1
6.2	Augmentation of Existing Control Panel	No.	2
6.3	Reactor Protection Panel	No.	2
6.4	Other / Common equipments		
6.4.1	Special Relay test kit	Set	1

6.1.2	BCU and its integration with NTAMC System	No.	1
7.0	**For Gorakhpur Substation:** **400kV Control & Relay Panel (Without automation)**		
7.1	Circuit Breaker Relay Panel		
7.1.1	Without Auto-Reclose	Nos.	2
7.2	Augmentation of Existing Control Panel (as per Tech Spec)	No.	1
7.3	Augmentation of RTU and LDMS (as per Tech Spec)	No.	1
8.0	**Services-**		
8.1.1	**For Rourkela Substation:** Services : a) Augmentation of existing 400 kV control panel in all respect b) Site visits for collecting inputs for interfacing with the existing sub-station c) Relay Setting Calculation d) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1
8.1.2	**For Gazuwaka Substation:** Services : Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection in	Lot	1

	all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		
8.1.3	**For Biharsharif Substation:** Services : Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1
8.1.4	**For Rengali Substation:** Services : Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility.	Lot	1

	c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection and Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		
8.1.5	**For Jamshedpur Substation:** Services : Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder’s responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.	Lot	1
8.1.6	**For Durgapur Substation:** Services : Testing and Commissioning of protection relays at site.	Lot	1

	Scope shall be as follows : a) Testing & commissioning of main protection relays and Busbar protection including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Interfacing with existing 400 kV Busbar Protection and Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		
8.1.7	**For Gorakhpur Substation:** Services : Testing and Commissioning of protection relays at site. Scope shall be as follows : a) Testing & commissioning of main protection relays including Relay parameterization and configuration b) Arranging all necessary tools & tackles and equipment for testing of relays and communication infrastructure including automatic 3-phase relay test kit shall be bidder's responsibility. c) For network/optical cables which are in the bidder's scope, the laying of cables shall be in BHEL scope. However, Optical cable will be laid under bidder's supervision. Splicing and Termination shall be in bidder's scope. d) Augmentation of existing 400 kV control panel in all respect e) Site visits for collecting inputs for interfacing with the existing sub-station	Lot	1

	f) Relay Setting Calculation g) Scheme modification of existing Bays and documentation as per technical specification.		
8.2.1	**For Rourkela Substation:** Services: Training Charges	Lot	1
8.2.2	**For Gazuwaka Substation:** Services: Training Charges	Lot	1
8.2.3	**For Biharsharif Substation:** Services: Training Charges	Lot	1
8.2.4	**For Rengali Substation:** Services: Training Charges	Lot	1
8.2.5	**For Jamshedpur Substation:** Services: Training Charges	Lot	1
8.2.6	**For Durgapur Substation:** Services: Training Charges	Lot	1
8.2.7	**For Gorakhpur Substation:** Services: Training Charges	Lot	1
9.0	**Mandatory spares**		
9.1	**For Gazuwaka Substation:** Reactor Protection Panel : Reactor Differential Protection Relay	Set	1
9.2	**For Gazuwaka Substation:** Reactor Protection Panel : Reactor Back up impedance Relay	Set	1
9.3	**For Gazuwaka Substation:** Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1
9.4	**For Biharsharif Substation:** Reactor Protection Panel : Reactor Differential Protection Relay	Set	1
9.5	**For Biharsharif Substation:** Reactor Protection Panel : Reactor Back up impedance Relay	Set	1
9.6	**For Biharsharif Substation:** Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1
9.7	**For Rengali Substation:** Reactor Protection Panel : Reactor Differential Protection Relay	Set	1
9.8	**For Rengali Substation:** Reactor Protection Panel : Reactor Back up impedance Relay	Set	1

9.9	**For Rengali Substation:** Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1
9.10	**For Jamshedpur Substation:** Reactor Protection Panel : Reactor Differential Protection Relay	Set	1
9.11	**For Jamshedpur Substation:** Reactor Protection Panel : Reactor Back up impedance Relay	Set	1
9.12	**For Jamshedpur Substation:** Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1
9.13	**For Durgapur Substation:** Reactor Protection Panel : Reactor Differential Protection Relay	Set	1
9.14	**For Durgapur Substation:** Reactor Protection Panel : Reactor Back up impedance Relay	Set	1
9.15	**For Durgapur Substation:** Reactor Protection Panel : Restricted earth fault protection relay with non-linear resistor	Set	1

Note: a) If any additional item as per the specification is required to be supplied for completion of the system over and above the item indicated above, the same shall be indicated clearly in the offer. Otherwise, the same shall be deemed to be included in the offer.
b) Bus Bar Protection wherever offered is inclusive of network cabling, FO cables, patch cords, connectors, TEE's etc. as applicable. It is the Bidders responsibility to assess the quantity for the same and include in the offer.
c) Collection and coordination of scheme drawings from site / PGCIL corporate office is in the scope of the bidder. BHEL will extend all its possible support.
d) Testing & Commissioning services for interface between Bus-bar protection and all relevant existing bays is deemed to be included in offered price of services.
e) Common equipment shall be panel mounted.
f) Wherever, existing Reactor protection and Bus bar protection panels are used, modification and reconfiguration of existing relay settings to be carried out by the successful bidder at contract stage.

7.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All equipment being supplied shall conform to type tests including additional type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections. The reports for all type tests and additional type tests as per technical specification shall be furnished by the bidder alongwith equipment/material drawings. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID or representative authorized by POWERGRID or Utility or representative of accredited test lab or reputed consultant.
The test reports submitted shall be of the tests conducted within last 10 (ten) years prior to the date of LOA i.e. 23.06.14 . In case the test reports are of the test conducted earlier than 10 (ten) years prior to the date of LOA, the contractor shall repeat these test(s) at no extra cost to the purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

8.0 DEVIATIONS :

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

9.0 MANUFACTURING QUALITY PLAN:

Bidder has to follow Power Grid approved Manufacturing Quality Plan, SAT /FAT procedure at contract stage.

10.0 DRAWINGS and SCHEME

The documentation requirements detailed under clause 5.0 of Section-II shall be submitted to BHEL at various stages of contract. Softcopy of the drawings and schemes are to be submitted at contract stage. Preparation of AS- BUILT drawings is also in the scope of the bidder.

11.0 DOCUMENTS REQUIRED WITH OFFER

a) Clause-wise confirmation/ comments.
b) Bill of Material.
c) Un-priced schedule as per BOQ at clause 6.0
d) Filled up Guaranteed Technical Particulars
e) Catalogue and Technical Leaflets for the offered Equipments

SECTION-II

SECTION: CONTROL, RELAY & PROTECTION PANELS

1. TYPE OF PANELS

1.1 Simplex Panel

Simplex panel shall consist of a vertical front panel with equipment mounted thereon and having wiring access from rear for control panels & front for relay/**protection** panels. In case of panel having width more than 800mm, double leaf-doors shall be provided. Doors shall have handles with either built-in locking facility or will be provided with pad-lock.

1.2 Duplex Panel

Duplex panel shall be walk-in tunnel type comprising two vertical front and rear panel sections connected back-on-back by formed sheet steel roof tie members and a central corridor in between. The corridor shall facilitate access to internal wiring and external cable connections. In case of number of duplex panels located in a row side by side, the central corridor shall be aligned to form a continuous passage. Both ends of the corridor shall be provided with double leaf doors with lift off hinges. Doors shall have handles either with built-in locking facility or shall be provided with pad-locks. Separate cable entries shall be provided for the front and rear panels. However, inter-connections between front and back panels shall be by means of inter panel wiring at the top of the panel.

2. CONSTRUCTIONAL FEATURES

2.1. Control and Relay Board shall be of panels of simplex or duplex type design as indicated in bill of quantity. It is the responsibility of the Contractor to ensure that the equipment specified and such unspecified complementary equipment required for completeness of the protective/control schemes be properly accommodated in the panels without congestion and if necessary, **either more number of panels or** provide panels with larger dimensions. No price increase at a later date on this account shall be allowed. However, the width of panels that are being offered to be placed in existing switchyard control rooms, should be in conformity with the space availability in the control room.

2.2. Panels shall be completely metal enclosed and shall be dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP-31 in accordance with IS: 2147.

2.3. Panels shall be free standing, floor mounting type and shall comprise structural frames completely enclosed with specially selected smooth finished, cold rolled sheet steel of thickness not less than 3 mm for weight bearing members of the panels such as base frame, front sheet and door frames, and 2.0mm for sides, door, top and bottom portions. There shall be sufficient reinforcement to provide level transportation and installation.

2.4. All doors, removable covers **of** panels shall be gasketed all around with synthetic gaskets Neoprene/EPDM generally conforming with provision of IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh

2.5. Design, materials selection and workmanship shall be such as to result in neat appearance, inside and outside with no welds, rivets or bolt head apparent from outside, with all exterior surfaces tune and smooth.

2.6. Panels shall have base frame with smooth bearing surface, which shall be fixed on the embedded foundation channels/insert plates. Anti vibration strips made of shock absorbing materials that shall be supplied by the contractor, **which** shall be placed between panel & base frame.

2.7. Cable entries to the panels shall be from the bottom. Cable gland plate fitted on the bottom of the panel shall be connected to earthing of the panel/station through a flexible braided copper conductor rigidly.

2.8. Relay/protection panels of modern modular construction would also be acceptable.

3. MOUNTING

3.1. All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for external connections. The equipment on front of panel shall be mounted flush.

3.2. Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices and are readily accessible without use of special tools. Terminal marking on the equipment shall be clearly visible.

3.3. The Contractor shall carry out cut out, mounting and wiring of the free issue items supplied by others which are to be mounted in his panel in accordance with the corresponding equipment manufacturer's drawings. Cut outs if any, provided for future mounting of equipment shall be properly blanked off with blanking plate.

3.4. The centre lines of switches, push buttons and indicating lamps shall be not less than 750mm from the bottom of the panel. The centre lines of relays, meters and recorders shall be not less than 450mm from the bottom of the panel.

3.5. The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Like wise the top lines of all meters, relays and recorders etc. shall be matched.

3.6. No equipment shall be mounted on the doors.

3.7. At existing station, panels shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment (centre lines of switches, push buttons and other equipment) on the front of the panel.

4. PANEL INTERNAL WIRING

4.1. Panels shall be supplied complete with interconnecting wiring provided between all electrical devices mounted and wired in the panels and between the devices and terminal blocks for the devices to be connected to equipment outside the panels. When panels are arranged to be located adjacent to each other all inter panel wiring and connections between the panels shall be carried out internally

4.2. All wiring shall be carried out with 650V grade, single core, stranded copper conductor wires with PVC insulation. The minimum size of the multi-stranded copper conductor used for internal wiring shall be as follows:

- All circuits except current transformer circuits and voltage transfer circuits meant for energy metering - one 1.5mm sq. per lead.
- All current transformer circuits - one 2.5 sq.mm per lead.
- Voltage transformer circuit (for energy meters): Two 2.5 mm sq. per lead.

4.3. All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters & troughs shall be used for this purpose.

4.4. Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panels running throughout the entire length of the panels.

4.5. Wire termination shall be made with solderless crimping type and tinned copper lugs, which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit breaker or device shall be distinguished by the addition of red coloured unlettered ferrule.

4.6. Longitudinal troughs extending throughout the full length of the panel shall be preferred for inter panel wiring. Inter-connections to adjacent panel shall be brought out to a separate set of terminal blocks located near the slots of holes meant for taking the inter-connecting wires.

4.7. Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipments.

5. TERMINAL BLOCKS

5.1. All internal wiring to be connected to external equipment shall terminate on terminal blocks. Terminal blocks shall be 650 V grade and have 10 Amps. continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Markings on the terminal blocks shall correspond to wire number and terminal numbers on the wiring diagrams. All terminal blocks shall have shrouding with transparent unbreakable material.

5.2. Disconnecting type terminal blocks for current transformer and voltage transformer secondary leads shall be provided. Also current transformer secondary leads shall be provided with short circuiting and earthing facilities.

5.3. At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

5.4. Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side

- All CT & PT circuits: minimum of two of 2.5mm Sq. copper.
- AC/DC Power Supply Circuits: One of 6mm Sq. Aluminium.
- All other circuits: minimum of one of 2.5mm Sq. Copper.

5.5. There shall be a minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate or panel side wall. Also the clearance between two rows of terminal blocks edges shall be minimum of 150mm.

5.6. Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal blocks is run in parallel and close proximity along each side of the wiring-duct to provide for convenient attachment of internal panel wiring. The side of the terminal block opposite the wiring duct shall be reserved for the external cable connections. All adjacent terminal blocks shall also share this field wiring corridor. All wiring shall be provided with adequate support inside the panels to hold them firmly and to enable free and flexible termination without causing strain on terminals.

5.7. The number and sizes of the Owner's multi core incoming external cables will be furnished to the Contractor after placement of the order. All necessary cable terminating accessories such as gland plates, supporting clamps & brackets, wiring troughs and gutters etc. (except glands & lugs) for external cables shall be included in the scope of supply.

6. PAINTING

The painting shall be carried out as detailed in Section–GTR.

7. MIMIC DIAGRAM

7.1. Coloured mimic diagram and symbols showing the exact representation of the system shall be provided in the front of control panels.

7.2. Mimic diagram shall be made preferably of anodised aluminium or plastic of approved fast colour material, which shall be screwed on to the panel and can be easily cleaned. The mimic bus shall be 2mm thick. The width of the mimic bus shall be 10mm for bus bars and 7mm for other connections. Painted overlaid mimic is also acceptable.

7.3. Mimic bus colour will be decided **during detailed Engineering** by the POWERGRID.

7.4. When semaphore indicators are used for equipment position, they shall be so mounted in the mimic that the equipment in close position shall complete the continuity of mimic.

7.5. Indicating lamp, one for each phase, for each bus shall be provided on the mimic to indicate bus charged condition

8. NAME PLATES AND MARKINGS

8.1. All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. Also on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/feeder designation.

8.2. All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.

8.3. Each instrument and meter shall be prominently marked with the quantity measured e.g. KV, A, MW, etc. All relays and other devices shall be clearly marked with manufacturer's name, manufacturer's type, serial number and electrical rating data.

8.4. Name Plates shall be made of non-rusting metal or 3 ply lamicoid. Name plates shall be black with white engraving lettering.

8.5. Each switch shall bear clear inscription identifying its function e.g. 'BREAKER' '52A', "SYNCHRONISING" etc. Similar inscription shall also be provided on each device whose function is not other-wise identified. If any switch device does not bear this inscription separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. "Trip- Neutral-Close", "ON-OFF", "R-Y-B-OFF" etc

8.6. All the panels shall be provided with name plate mounted inside the panel bearing LOA No & Date, Name of the Substation & feeder and reference drawing number.

9. MISCELLANEOUS ACCESSORIES

9.1. **Plug Point**: 240V, Single phase 50Hz, AC socket with switch suitable to accept 5 Amps and 15 Amps pin round standard Indian plug, shall be provided in the interior of each cubicle with ON-OFF switch.

9.2. **Interior Lighting**: Each panel shall be provided with a fluorescent lighting fixture rated for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel controlled by the respective panel door switch. Adequate lighting shall also be provided for the corridor in Duplex panels.

9.3. **Switches and Fuses**: Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with Fuses. Selection of the main and sub-circuit Fuses rating shall be such as to ensure selective clearance of sub-circuit faults. Voltage transformer circuits for relaying and metering shall be protected by fuses. All fuses shall be HRC cartridge type conforming to IS: 13703 mounted on plug-in type fuse bases. The short time fuse rating of Fuses shall be not less than 9 KA. Fuse carrier base shall have imprints of the fuse 'rating' and

'voltage'.

9.4. **Space Heater**: Each panel shall be provided with a thermostatically connected space heater rated for 240V, single phase, 50 Hz AC supply for the internal heating of the panel to prevent condensation of moisture. The fittings shall be complete with switch unit.

10. EARTHING

10.1. All panels shall be equipped with an earth bus securely fixed. Location of earth bus shall ensure no radiation interference from earth systems under various switching conditions of isolators and breakers. The material and the sizes of the bus bar shall be at least 25 X 6 sq.mm copper with threaded holes at a gap of 50 mm with provision of bolts and nuts for connection with cable armours and mounted equipment etc for effective earthing. When several panels are mounted adjoining each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply of Contractor. Provision shall be made for extending the earth bus bars to future adjoining panels on either side.

10.2. Provision shall be made on each bus bar of the end panels for connecting Substation earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply of Contractor.

10.3. All metallic cases of relays, instruments and other panel mounted equipment including gland plate, shall be connected to the earth bus by copper wires of size not less than 2.5 sq. mm. The colour code of earthing wires shall be green.

10.4. Looping of earth connections which would result in loss of earth connection to other devices when the loop is broken, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be provided.

10.5. VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system for other groups.

10.6. An electrostatic discharge **arrangement** shall be provided in each panel **so as to discharge human body before he handles the equipments inside the panels**.

11. INDICATING INSTRUMENTS & TRANSDUCERS FOR CONTROL PANEL:

All instruments, meters and transducers shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. All megawatt , megavar, Bus voltage and frequency indicating instruments shall be provided with individual transducers and these shall be calibrated along with transducers to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have means of calibration check and adjustment at site. The supplier shall submit calibration certificates at the time of delivery.

However no separate transducers are envisaged for digital bus voltmeters and digital frequency meters and the indicating meters provided in the synchronising equipment.

11.1. Indicating Instruments

11.1.1. Unless otherwise specified, all electrical indicating instruments shall be of digital type suitable for flush mounting.

11.1.2. Instruments shall have 4-digit display; display height being not less than 25 mm

11.1.3. Instrument shall confirm to relevant IS and shall have an accuracy class of 1.5 or better. Watt and Var meters shall have an indication of (+) and (-) to indicate EXPORT and IMPORT respectively.

11.1.4. Digital voltage and frequency meters shall be of class: 0.5 and shall have digital display of 5 and 4 digits respectively, with display size, not less than 25mm (height).

11.2. Transducers

11.2.1. Transducers (for use with Indicating Instruments and Telemetry/Data Communication application) shall in general conform to IEC:688-1

11.2.2. The transducers shall be suitable for measurement of active power, reactive power, voltage, current and frequency in three phase four wire unbalanced system.

11.2.3. The input to the transducers will be from sub-station current & potential transformers. The output shall be in milli ampere D.C. proportional to the input & it shall be possible to feed the output current directly to the telemetry terminal or indicating instruments.

11.2.4. The transducer characteristic shall be linear throughout the measuring range.

11.2.5. The transducer output shall be load independent.

11.2.6. The input & output of the transducer shall be galvanically isolated.

11.2.7. Each transducer shall be housed in a separate compact case and have suitable terminals for inputs & outputs.

11.2.8. The transducers shall be suitably protected against transient high peaks of voltage & current.

11.2.9. The transducer shall withstand indefinitely without damage and work satisfactorily at 120% of the rated voltage and 120% of the rated input current as applicable.

11.2.10. All the transducers shall have an output of 4-20 mA.

11.2.11. The response time of the transducers shall be less than 1 second.

11.2.12. The accuracy class of transducers shall be 1.0 or better for voltage/current transducer, 0.5 or better for watt/VAR transducer and 0.2 or better for frequency transducer.

11.2.13. The transducers shall have a low AC ripple on output less than 1%.

11.2.14. The transducer shall have dual output.

12. ANNUNCIATION SYSTEM for Control Panel

12.1. Alarm annunciation system shall be provided in the control board by means of visual and audible alarm in order to draw the attention of the operator to the abnormal operating conditions or the operation of some protective devices. The annunciation equipment shall be suitable for operation on the voltages specified in this specification.

12.2. The visual annunciation shall be provided by annunciation facia, mounted flush on the top of the control panels.

12.3. The annunciation facia shall be provided with translucent plastic window for alarm point with approximate size of 35mm x 50mm. The facia plates shall be engraved in black lettering with respective inscriptions. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall not be less than 5 mm.

12.4. Each annunciation window shall be provided with two white lamps in parallel to provide safety against lamp failure. Long life lamps shall be used. The transparency of cover plates and wattage of the lamps provided in the facia windows shall be adequate to ensure clear visibility of the inscriptions in the control room having high illumination intensity (350 Lux), from the location of the operator's desk.

12.5. All Trip facia shall have red colour and all Non-trip facia shall have white colour.

12.6. The audible alarm shall be provided by Buzzer/ Hooter /Bell having different sounds and shall be used as follows.

Hooter	Alarm Annunciation
Bell	Annunciation DC failure
Buzzer	AC supply failure

12.7. Sequence of operation of the annunciator shall be as follows :

Sl. NO.	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
1.	Normal	Open	OFF	OFF
2.	Abnormal	Close	Flashing	ON
3.	Accept Push Button Pressed	Close	Steady On	OFF
		Open	Steady On	OFF
4.	Reset Push Button Pressed	Close	On	OFF
		Open	Off	OFF
5.	Lamp Test Push Button Pressed	Open	Steady On	OFF

12.8. Audible annunciation for the failure of DC supply to the annunciation system shall be provided and this annunciation shall operate on 240 Volts AC supply. On failure of the DC to the annunciation system for more than 2 or 3 seconds (adjustable setting), a bell shall sound. A

separate push button shall be provided for the cancellation of this audible alarm alone but the facia window shall remain steadily lighted till the supply to annunciation system is restored.

12.9. A separate voltage check relay shall be provided to monitor the failure of supply (240V AC) to the scheme mentioned in Clause above. If the failure of supply exists for more than 2 to 3 seconds, this relay shall initiate visual and audible annunciation. Visual and audible annunciation for the failure of AC supply to the annunciation system shall be provided and this annunciation shall operate on Annunciation DC and buzzer shall sound.

12.10. The annunciation system described above shall meet the following additional requirements :

a) The annunciation system shall be capable of catering to at least 20 simultaneous signals at a time.

b) One set of the following push buttons shall be provided on each control panel:

- Reset push button for annunciation system
- Accept push button for annunciation system
- Lamp test push button for testing the facia windows

c) One set of the following items shall be provided common for all the control panel (not applicable for extension of substation) :

- Flasher relay for annunciation system
- Push button for Flasher test
- Three Push buttons for test of all audible alarm systems

d) These testing circuits shall be so connected that while testing is being done, it shall not prevent the registering of any new annunciation that may land during the test.

e) The annunciation shall be repetitive type and shall be capable of registering the fleeting signal. Minimum duration of the fleeting signal registered by the system shall be 15 milli seconds.

f) In case of static annunciator scheme, special precaution shall be taken to ensure that spurious alarm condition does not appear due to influence of external electromagnetic/ electrostatic interference on the annunciator wiring and switching disturbances from the neighbouring circuits within the panels and the static annunciator shall meet the high voltage susceptibility test , impulse voltage with stand test , high frequency disturbance test– class III and fast transient disturbance test –level III as per IEC 60255.

12.11. The annunciation system to be supplied for existing sub-stations shall be engineered as an extension to the existing scheme.

13. SWITCHES

13.1. Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show operating position and circuit

designation plates and suitable for flush mounting with only switch front plate and operating handle projecting out.

13.2. The selection of operating handles for the different types of switches shall be as follows :

Breaker, Isolator control switches	:	Pistol grip, black
Synchronising switches	:	Oval, Black, Keyed handle (one common removable handle for a group of switches or locking facility having common key)
synchronising Selector switches	:	Oval or knob, black
Instrument switches	:	Round, knurled, black
Protection Transfer switch	:	Pistol grip, lockable and black.

13.3. The control switch of breaker and isolator shall be of spring return to neutral type. The switch shall have spring return from close and trip positions to "after close" and "after trip" positions respectively.

13.4. Instrument selection switches shall be of maintained contact (stay put) type. Ammeter selection switches shall have make-before-break type contacts so as to prevent open circuiting of CT secondary when changing the position of the switch. Voltmeter transfer switches for AC shall be suitable for reading all line- to-line and line-to-neutral voltages for non-effectively earthed systems and for reading all line to line voltages for effectively earthed systems.

13.5. Synchronising switches shall be of maintained contact (stay put) type having a common removable handle for a group of switches. The handle shall be removable only in the OFF position and it shall be co-ordinated to fit in to all the synchronising switches. These switches shall be arranged to connect the synchronising equipment when turned to the 'ON' position. One contact of each switch shall be connected in the closing circuit of the respective breaker so that the breaker cannot be closed until the switch is turned to the 'ON' position.

13.6. Lockable type of switches which can be locked in particular positions shall be provided when specified. The key locks shall be fitted on the operating handles.

13.7. The contacts of all switches shall preferably open and close with snap action to minimise arcing. Contacts of switches shall be spring assisted and contact faces shall be with rivets of pure silver or silver alloy. Springs shall not be used as current carrying parts

13.8. The contact combination and their operation shall be such as to give completeness to the interlock and function of the scheme.

13.9. The contact rating of the switches shall be as follows :

Description	**Contact Rating in Amps**

	220V DC	50V DC	240V AC
Make and carry Continuously	10	10	10
Make and carry for 0.5 sec.	30	30	30
Break for Resistive load	3	20	7
Break for Inductive load with L/R = 40m sec.	0.2	-	-

14. INDICATING LAMPS

14.1. Indicating lamps shall be of cluster LED type suitable for panel mounting with rear terminal connections. Lamps shall be provided with series connected resistors preferably built in the lamp assembly. Lamps shall have translucent lamp covers to diffuse lights coloured red, green, amber, clear white or blue as specified. The lamp cover shall be preferably of screwed type, unbreakable and moulded from heat resisting material.

14.2. The lamps shall be provided with suitable resistors.

14.3. Lamps and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools, if required for replacing the bulbs and lenses shall also be included in the scope of the supply.

14.4. The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis.

15. POSITION INDICATORS (if Applicable)

15.1. Position indicators of "SEMAPHORE" type shall be provided when specified as part of the mimic diagrams on panels for indicating the position of circuit breakers, isolating/earthing switches etc. The indicator shall be suitable for semi-flush mounting with only the front disc projecting out and with terminal connection from the rear. Their strips shall be of the same colour as the associated mimic.

15.2. Position indicator shall be suitable for DC Voltage as specified. When the supervised object is in the closed position, the pointer of the indicator shall take up a position in line with the mimic bus bars, and at right angles to them when the object is in the open position. When the supply failure to the indicator occurs, the pointer shall take up an intermediate position to indicate the supply failure.

15.3. The rating of the indicator shall not exceed 2.5 W.

15.4. The position indicators shall withstand 120% of rated voltage on a continuous basis.

16. SYNCHRONISING EQUIPMENT

16.1. For sub-station equipped with sub-station Automation system, the requirement of synchronisation is specified in section Sub-station Automation System and the same shall prevail. For other sub-station which is not equipped with Sub-sub-station automation system following shall be applicable as per requirement.

16.1. The synchronising instruments shall be mounted either on a synchronising trolley or on a synchronising panel. The panel/ trolley shall be equipped with double analog voltmeters and double analog frequency meters, synchroscope and lamps fully wired. The size of voltmeters and frequency meters provided in the synchronising panel shall not be less than 144 X 144 sq.mm. Suitable auxiliary voltage transformers wherever necessary shall also be provided for synchronising condition. In case the synchroscope is not continuously rated, a synchroscope cut-off switch shall be provided and an indicating lamp to indicate that the synchroscope is energised, shall also be provided

16.1. Synchronising check relay with necessary ancillary equipment's shall be provided which shall permit breakers to close after checking the requirements of synchronising of incoming and running supply. The phase angle setting shall not exceed 35 degree and have voltage difference setting not exceeding 10%. This relay shall have a response time of less than 200 milliseconds when the two system conditions are met within present limits and with the timer disconnected. The relay shall have a frequency difference setting not exceeding 0.45% at rated value and at the minimum time setting. The relay shall have an adjustable time setting range of 0.5-20 seconds. A guard relay shall be provided to prevent the closing attempt by means of synchronising check relay when control switch is kept in closed position long before the two systems are in synchronism

16.1. The synchronising panel shall be draw out and swing type which can be swivelled in left and right direction. The synchronising panel shall be placed along with control panels and the number of synchronising panel shall be as indicated in BPS. The incoming and running bus wires of VT secondary shall be connected and run as bus wires in the control panels and will be extended to synchronising panel for synchronisation of circuit breakers. The selector switch provided for each circuit breaker in respective control panels shall be lockable type with a common key so that only one selector switch is kept in synchronising mode at a time.

16.1. Alternatively, the trolley shall be of mobile type with four rubber-padding wheels capable of rotating in 360 degree around the vertical axis. Suitable bumpers with rubber padding shall be provided all around the trolley to prevent any accidental damage to any panel in the control room while the trolley is in movement. The trolley shall have two meter long flexible cord fully wired to the instruments and terminated in a plug in order to facilitate connecting the trolley to any of the panels. The

receptacle to accept the plug shall be provided on the panel.

16.1. At existing sub-stations, the synchronising scheme shall be engineered to be compatible with the existing synchronising scheme and synchronising socket/switch on the panel. In substations, where synchronising panels are available, the bidder shall carry out the shifting of the above panels, if required, to facilitate the extension of control panel placement.

17. RELAYS

17.1. All relays shall conform to the requirements of IS: 3231/IEC-60255/IEC 61000 or other applicable standards. Relays shall be suitable for flush or semi-flush mounting on the front with connections from the rear.

17.2. All protective relays shall be of numerical type and communication protocol shall be as per IEC 61850. Further, the test levels of EMI as indicated in IEC 61850 shall be applicable to these relays.

17.3. All protective relays shall be in draw out or plug-in type/modular cases with proper testing facilities. Necessary test plugs/test handles shall be supplied loose and shall be included in contractor's scope of supply.

17.4. All AC operated relays shall be suitable for operation at 50 Hz. AC Voltage operated relays shall be suitable for 110 Volts VT secondary and current operated relays for 1 amp CT secondary. All DC operated relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.

17.5. The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification. Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts suiting contact duties of protective relays and monitoring of control supplies and circuits, lockout relay monitoring circuits etc. also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme; contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relay coils and contacts, including spare contacts.

17.6. Timers shall be of solid state type. Time delay in terms of milliseconds obtained by the external capacitor resistor combination is not preferred and shall be avoided.

17.7. No control relay, which shall trip the power circuit breaker when the relay is de-energised, shall be employed in the circuits.

17.8. Provision shall be made for easy isolation of trip circuits of each relay for the purpose of testing and maintenance.

17.9. Auxiliary seal-in-units provided on the protective relays shall preferably be of shunt reinforcement type. If series relays are used the following shall be strictly ensured:

(a) The operating time of the series seal-in-unit shall be sufficiently shorter than that of the trip coil or trip relay in series with which it operates to ensure definite operation of the flag indicator of the relay.

(b) Seal-in-unit shall obtain adequate current for operation when one or more relays operate simultaneously.

(c) Impedance of the seal-in-unit shall be small enough to permit satisfactory operation of the trip coil on trip relays when the D.C. Supply Voltage is minimum.

(d) Trip-circuit seal-in is required for all trip outputs, irrespective of the magnitude of the interrupted current. The trip-circuit seal-in logic shall not only seal-in the trip output(s),but also the relevant initiation signals to other scheme functions, (e.g. initiate signals to the circuit-breaker failure function, reclosing function etc.), and the alarm output signals.

(e) Two methods of seal-in are required, one based on the measurement of AC current, catering for those circumstances for which the interrupted current is above a set threshold, and one based on a fixed time duration, catering for those circumstances for which the interrupted current is small (below the set threshold).

(f) For the current seal-in method, the seal-in shall be maintained until the circuit-breaker opens, at which time the seal-in shall reset and the seal-in method shall not now revert to the fixed time duration method. For this seal-in method, the seal-in shall be maintained for the set time duration. For the line protection schemes, this time duration shall be independently settable for single- and three-pole tripping.

(g) Seal-in by way of current or by way of the fixed duration timer shall occur irrespective of whether the trip command originates from within the main protection device itself (from any of the internal protection functions), or from an external device with its trip output routed through the main protection device for tripping. Trip-circuit seal-in shall not take place under sub-harmonic conditions (e.g. reactor ring down).

17.10. The setting ranges of the relays offered, if different from the ones specified shall also be acceptable if they meet the functional requirements.

17.11. Any alternative/additional protections or relays considered necessary for providing complete effective and reliable protection shall also be offered separately. The acceptance of this alternative/ additional equipment shall lie with the POWERGRID.

17.12. All relays and their drawings shall have phase indications as R-Red, Y-yellow, B-blue

17.13. For numerical relays, the scope shall include the following:

a) Necessary software and hardware to up/down load the data to/from the relay from/to the personal computer installed in the substation. However, the supply of PC is not covered under this clause.

b) The relay shall have suitable communication facility for future connectivity to SCADA. The relay shall be capable of supporting IEC

61850 protocol.

c) In case of line protection and transformer/reactor protection, the features like fault recorder and event logging function as available including available as optional feature in these relays shall be supplied and activated at no extra cost to the owner. Also necessary software/ hardware for automatic uploading to station HMI/DR work station (as applicable) shall be supplied. It is to be clearly understood that these shall be in addition to Fault recorder function as specified at clause no. 28.

18. TRANSMISSION LINE PROTECTION

18.1. All relays shall be suitable for series compensated line.

18.2. The line protection relays are required to protect the line and clear the faults on line within shortest possible time with reliability, selectivity and full sensitivity to all type of faults on lines. The general concept is to have two main protections having equal performance requirement specially in respect of time as called Main-I and Main-II for 765kV, 400KV and 220KV transmission lines and Main and back up protection for 132 KV transmission lines.

18.3. The Transmission system for which the line protection equipment are required is **indicated in Section – Project**

18.4. The maximum fault current could be as high as 63kA but the minimum fault current could be as low as 20% of rated current of CT secondary. The starting & measuring relays characteristics should be satisfactory under these extremely varying conditions.

18.5. The protective relays shall be suitable for use with capacitor voltage transformers having non-electronic damping and transient response as per IEC.

18.6. Fault Recorder, Distance to fault Locator and Over voltage relay (stage - 1/2) functions if offered as an integral part of line protection relays, shall be acceptable provided these meet the technical requirements as specified in the respective clauses.

18.7. Auto reclose relay function if offered as an integral part of line distance protection relay, shall be acceptable **for 132 KV lines only** provided the auto reclose relay feature meets the technical requirements as specified in the respective clause.

18.8. The following protections shall be provided for each of the Transmission lines:

For 765 KV, 400 KV & 220KV

Main-I: Numerical distance protection scheme

Main-II: Numerical distance protection scheme of a make different from that of Main –I

Further, If specified in the “Section- Project “, back up Over current and Earth fault protection shall be provided instead of Main -II protection scheme for 220KV lines to match with requirements at the remote ends.

For 132KV

Main: Numerical distance protection scheme

Back up: Directional Over Current and Earth fault Protection

The detailed description of line protections is given here under.

18.9. **Main-I and Main-II Distance Protection scheme**:

(a) shall have continuous self monitoring and diagnostic feature

(b) shall be non-switched type with separate measurements for all phase to phase and phase to ground faults

(c) shall have stepped time-distance characteristics and three independent zones (zone 1, zone-2 and zone-3)

(d) shall have mho or quadrilateral or other suitably shaped characteristics for zone-1 , zone-2 and zone- 3

(e) shall have following maximum operating time (including trip relay time, if any) under given set of conditions and with CVT being used on line (with all filters included)

(i) for 765 KV, 400 KV & 220 KV lines:

For Source to Impedance ratio:	**4**	**15**
Relay setting (Ohms)	(10 or 20) and 2	2
Fault Locations	50	50
(as % of relay setting)		
Fault resistance (Ohms)	0	0
Maximum operating time (Milliseconds)	40 for all faults	45 for 3 ph. Faults & 60 for all other faults

(ii) for 132 KV lines:

A relaxation of 5 ms in above timings is allowed for 132 KV lines.

(f) The relay shall have an adjustable characteristics angle setting range of 30 -85 degree or shall have independent resistance(R) and reactance (X) setting.

(g) shall have two independent continuously variable time setting range of 0-3 seconds for zone-2 and 0-5 seconds for zone-3

(h) shall have resetting time of less than 55 milli-seconds (including the resetting time of trip relays)

(i) shall have facilities for offset features with adjustable 10-20% of Zone-3 setting

(j) shall have variable residual compensation

(k) shall have memory circuits with defined characteristics in all three phases to ensure correct operation during close-up 3 phase faults and other adverse conditions and shall operate instantaneously when circuit breaker is closed to zero-volt 3 phase fault

(l) shall have weak end in-feed feature

(m) shall be suitable for single & three phase tripping

(n) shall have a continuous current rating of two times of rated current. The voltage circuit shall be capable of operation at 1.2 times rated voltage. The relay shall also be capable of carrying a high short time current of 70 times rated current without damage for a period of 1 sec.

(o) shall be provided with necessary self reset type trip duty contacts for completion of the scheme (Minimum number of these trip duty contacts shall be four per phase) either through built in or through separate high speed trip relays. Making capacity of these trip contacts shall be 30 amp for 0.2 seconds with an inductive load of L/R > 10 mill seconds. If separate high speed trip relays are used , the operating time of the same shall not be more than 10 milliseconds

(p) shall be suitable for use in permissive under reach/ over reach/ blocking communication mode

(q) shall have suitable number of potential free contacts for Carrier aided Tripping, Auto reclosing, CB failure, Disturbance recorder & Data acquisition system

(r) include power swing blocking protection which shall

- have suitable setting range to encircle the distance protection described above
- block tripping during power swing conditions
- release blocking in the event of actual fault

(s) include fuse failure protection which shall monitor all the three fuses of C.V.T. and associated cable against open circuit

- inhibit trip circuits on operation and initiate annunciation
- have an operating time less than 7 milliseconds
- remain inoperative for system earth faults

(t) include a directional back up Inverse Definite Minimum Time (IDMT) earth fault relay with normal inverse characteristics as per IEC 60255-3 as a built in feature or as a separate unit for 765kV, 400 KV and 220KV transmission lines

(u) Must have a current reversal guard feature.

18.10. **Back-up Directional Over Current and Earth fault protection scheme**

(a) shall have three over current and one earth fault element(s) which shall be either independent or composite unit(s)

(b) shall include necessary VT fuse failure relays for alarm purposes

(c) **over current elements** shall

- have IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting
- have a variable setting range of 50-200% of rated current

- have a characteristic angle of 30/45 degree lead
- include hand reset flag indicators or LEDs

(d) **earth fault element** shall

- have IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting
- have a variable setting range of 20-80% of rated current
- have a characteristic angle of 45/60 degree lag
- include hand reset flag indicators or LEDs
- include necessary separate interposing voltage transformers or have internal feature in the relay for open delta voltage to the relay

18.11. **LINE OVER VOLTAGE PROTECTION RELAY** shall

(a) monitor all three phases

(b) have two independent stages

(c) stage- I & II as built-in with line distance relays Main I & II respectively are acceptable

(d) have an adjustable setting range of 100-170% of rated voltage with an adjustable time delay range of 1 to 60 seconds for the first stage

(e) have an adjustable setting range of 100-170% of rated voltage with a time delay of 100-200 mill seconds for the second stage

(f) be tuned to power frequency

(g) provided with separate operation indicators (flag target) for each stage relays

(h) have a drop-off to pick-up ratio greater than 95%

(i) provide separate out-put contacts for each 'Phase' and stage for breaker trip relays, event logger and other scheme requirements

18.12. All trip relays used in transmission line protection scheme shall be of self/electrical reset type depending on application requirement.

19. **CIRCUIT BREAKER PROTECTION:**

This shall include following functions:

19.1. **Numerical AUTO RECLOSING** function shall

(a) have single phase reclosing facilities

(b) have a continuously variable single phase dead time range of 0.1-2 seconds

(c) have a continuously variable reclaim time range of 5-300 seconds

(d) Incorporate a **two** position selector switch, from which single phase auto-reclosure and non-auto reclosure mode can be selected. Alternatively, the mode of auto reclosing can be selected through

programming.

(e) be of single shot type

(f) have priority circuit to closing of both circuit breakers in case one and half breaker arrangements to allow sequential closing of breakers

(g) However, Auto-reclose as in built function of bay controller unit (BCU) (if supplied) provided for sub-station automation system is also acceptable.

19.2. **LOCAL BREAKER BACK-UP PROTECTION SCHEME** shall

(a) be triple pole type

(b) have an operating time of less than 15 milli seconds

(c) have a resetting time of less than 15 milli seconds

(d) have three over current elements

(e) be arranged to get individual initiation from the corresponding phase of main protections of line for each over current element. However, common three phase initiation is acceptable for other protections and transformer /reactor equipment protections

(f) have a setting range of 20-80% of rated current

(g) have a continuous thermal withstand two times rated current irrespective of the setting

(h) have a timer with continuously adjustable setting range of 0.1-1 seconds

(i) have necessary auxiliary relays to make a comprehensive scheme

(j) be similar relays for complete scope of work as per specification

20. REACTOR PROTECTION

20.1. **Differential Protection Relay shall**

(a) be triple pole type

(b) have operation time less than 25 milli-seconds at 5 times setting

(c) be tuned to system frequency

(d) have current setting range of 10 to 40% of 1 Amp. or a suitable voltage setting range

(e) be high impedance / biased differential type

(f) be stable for all external faults

20.2. **Restricted Earth Fault Protection Relay** shall

(a) be single pole type

(b) be of current/voltage operated high impedance type

(c) have a current setting of 10-40% of 1 Amp./have a suitable voltage setting range

(d) be tuned to system frequency

(e) have a suitable non-linear resistor to limit the peak voltage to 1000 Volts

20.3. **Back up impedance protection Relay** shall

(a) be triple pole type, with faulty phase identification/ indication

(b) be single step polarised 'mho' distance/ impedance relay suitable for measuring phase to ground and phase to phase faults

(c) have adequate ohmic setting range to cover at least 60% of the impedance of the reactor and shall be continuously variable

(d) have an adjustable characteristic angle of 30-80 degree

(e) have a definite time delay relay with a continuously adjustable setting range of 0.2-2.0 seconds

(f) include VT failure relay which shall block the tripping during VT fuse failure condition

20.4. **Further, Reactor auxiliary protections contacts (Buchholz, PRV, Oil Temperature, Winding Temperature etc.) can be wired suitably in above protections or provide separate Flag relays/Auxiliary relays as per scheme requirements.**

21. TRANSFORMER PROTECTION

All transformer protection functions may be grouped into Group-I and Group-II protections in the following manner:

<u>Group-I Protection:</u> Following protection functions may be provided in Group-I Transformer protection relay:

a) Differential Protection as per clause no. 21.1

b) Over fluxing Protection for HV side as per clause no. 21.2

c) Direction Over current and earth fault protection for HV side as per clause no. 21.4

d) Over Load Protection as per clause no. 21.5

<u>Group-II Protection:</u> Following protection functions may be provided in Group-II Transformer protection relay:

e) REF Protection as per clause no. 21.3

f) Over fluxing Protection for IV/LV side as per clause no. 21.2

g) Direction Over current and earth fault protection for IV/LV side as per clause no. 21.4

h) Neutral Current Relay for Single Phase Transformer Bank as per clause no. 21.6

The various protections as built-in function of Group I/II protections shall be accepted only if the functional requirements

of corresponding protections as specified in clause no. 21.1 to 21.6 are met otherwise separate protection relay(s) shall be offered.

21.1. **Transformer differential protection** scheme shall

(a) be triple pole type, with faulty phase identification/ indication

(b) have an operating time not greater than 30 milli seconds at 5 times the rated current

(c) have three instantaneous high set over-current units

(d) have an adjustable bias setting range of 20-50%

(e) be suitable for rated current of 1 Amp.

(f) have second harmonic or other inrush proof features and also should be stable under normal over fluxing conditions. Magnetising inrush proof feature shall not be achieved through any intentional time delay e.g. use of timers to block relay operation or using disc operated relays

(g) have an operating current setting of 15% or less

(h) include necessary separate interposing current transformers for angle and ratio correction or have internal feature in the relay to take care of the angle & ratio correction

(i) have a fault recording feature to record graphic form of instantaneous values of following analogue channels during faults and disturbances for the pre fault and post fault period:

current in all three windings in nine analogue channels in case of 400kV class and above transformers or 6 analogue channels for lower voltage transformers and Voltage in one channel

The disturbance recorder shall have the facility to record the following external digital channel signals apart from the digital signals pertaining to differential relay:

1. REF protection operated
2. HV Breaker status (Main and tie)
3. IV Breaker status
4. Bucholz /OLTC Bucholz alarm / trip etc.
5. WTI/OTI/PRD alarm/trip of transformer etc.

Necessary hardware and software, for automatic up-loading the data captured by disturbance recorder to the personal computer (DR Work Station) available in the substation, shall be included in the scope.

21.2. **Over Fluxing Protection Relays** shall

(a) operate on the principle of Voltage to frequency ratio and shall be phase to phase connected

(b) have inverse time characteristics, matching with transformer over fluxing withstand capability curve

(c) provide an independent 'alarm' with the time delay continuously adjustable between 0.1 to 6.0 seconds at values of 'v/f' between 100% to 130% of rated values

(d) tripping time shall be governed by 'v/f' Vs. time characteristics of the relay

(e) have a set of characteristics for Various time multiplier settings. The maximum operating time of the relay shall not exceed 3 seconds and 1.5 seconds at 'v/f' values of 1.4 and 1.5 times, the rated values, respectively.

(f) have an accuracy of operating time, better than ±10%

(g) have a resetting ratio of 95 % or better

21.3. **Restricted Earth Fault Protection** shall

(a) be single pole type

(b) be of current/voltage operated type

(c) have a current setting range of 10-40% of 1 Amp./ have a suitable voltage setting range

(d) be tuned to the system frequency

21.4. **Back-up Over Current and Earth fault protection scheme with high set feature**

(a) Shall have three over current and one earth fault element(s) which shall be either independent or composite unit(s).

(b) The scheme shall include necessary VT fuse failure relays for alarm purposes

(c) Over current relay shall

- have directional IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting and have a variable setting range of 50-200% of rated current
- have low transient, over reach high set instantaneous unit of continuously variable setting range 500-2000 % of rated current
- have a characteristic angle of 30/45 degree lead
- include hand reset flag indicators or LEDs.

(d) Earth fault relay shall

- have directional IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting and have a variable setting range of 20-80% of rated current
- have low transient, over reach high set instantaneous unit of continuously variable setting range 200-800 % of rated current
- have a characteristic angle of 45/60 degree lag

- include hand reset flag indicators or LEDs
- include necessary separate interposing voltage transformers or have internal feature in the relay for open delta voltage to the relay

21.5. **Transformer Overload Protection Relay** shall

(a) be of single pole type

(b) be of definite time over-current type

(c) have one set of over-current relay element, with continuously adjustable setting range of 50-200% of rated current

(d) have one adjustable time delay relay for alarm having setting range of 1 to 10.0 seconds, continuously.

(e) have a drop-off/pick-up ratio greater than 95%.

21.6. **Transformer Neutral Current Protection relay** (for 1-Phase transformer bank neutral) shall

(a) have directional IDMT characteristic with a definite minimum time of 3.0 seconds at 10 times setting and have a variable setting range of 20-80% of rated current

21.7. **Further, Transformer auxiliary protections contacts (Buchholz, PRV, Oil Temperature, Winding Temperature, OLTC Buchholz etc.) can be wired suitably in above protections or provide separate Flag relays/Auxiliary relays as per scheme requirements.**

22. TEE DIFFERENTIAL PROTECTION RELAYS

22.1. **TEE-1 Differential protection relay** shall

(a) be triple pole type

(b) have an operating time less than 30 milliseconds at 5 times the rated current

(c) have three instantaneous high set over current units

(d) have an adjustable bias setting range of 20-50%

(e) have an operating current setting of 15% of 1 Amp or less

22.2. **TEE-2 Differential Protection relay** shall

(a) be triple pole type

(b) have operating time less than 25 milliseconds at 5 times setting

(c) be tuned to system frequency

(d) have current setting range of 20 to 80% of 1 Amp

(e) be voltage operated, high impedance type

(f) be stable for all external faults

(g) be provided with suitable non linear resistors across the relay to

limit the peak voltage to 1000 volts

23. **TRIP CIRCUIT SUPERVISION RELAY**

(a) The relay shall be capable of monitoring the healthiness of each 'phase' trip-coil and associated circuit of circuit breaker during 'ON' and 'OFF' conditions.

(b) The relay shall have adequate contacts for providing connection to alarm and event logger.

(c) The relay shall have time delay on drop-off of not less than 200 milli seconds and be provided with operation indications for each phase

24. **TRIPPING RELAY**

High Speed Tripping Relay shall

(a) be instantaneous (operating time not to exceed 10 milli-seconds).

(b) reset within 20 milli seconds

(c) be D.C. operated

(d) have adequate contacts to meet the requirement of scheme, other functions like auto-reclose relay, LBB relay as well as cater to associated equipment like event logger, Disturbance recorder, fault Locator, etc.

(e) be provided with operation indicators for each element/coil.

25. **DC SUPPLY SUPERIVISION RELAY**

(a) The relay shall be capable of monitoring the failure of D.C. supply to which, it is connected.

(b) It shall have adequate potential free contacts to meet the scheme requirement.

(c) The relay shall have a 'time delay on drop-off' of not less than 100 milli seconds and be provided with operation indicator/flag.

26. **BUS BAR PROTECTION**

26.1. Redundant (1+1) numerical Bus Bar protection scheme for each bus system (Bus1 +Bus2+Transfer Bus wherever applicable) for 400kV and 765kV shall be provided**.** The scheme shall be engineered so as to ensure that operation of any one out of two schemes connected to main faulty bus shall result in tripping of the same.

26.2. Single bus bar protection scheme shall be provided for each main bus and transfer bus (as applicable) for 220KV and 132 KV voltage levels

26.3. Each Bus Bar protection scheme shall

(a) have maximum operating time up to trip impulse to trip relay for all types of faults of 25 milli seconds at 5 times setting value.

(b) operate selectively for each bus bar

(c) give hundred percent security up to 63 KA fault level for 400KV and 220KV and 31.5 KA for 132 KV

(d) incorporate continuous supervision for CT secondary against any possible open circuit and if it occurs, shall render the relevant zone of protection inoperative and initiate an alarm

(e) not give false operation during normal load flow in bus bars

(f) incorporate clear zone indication

(g) be of phase segregated and triple pole type

(h) provide independent zones of protection (including transfer bus if any). If the bus section is provided then each side of bus section shall have separate set of bus bar protection schemes

(i) include individual high speed electrically reset tripping relays for each feeder. However, in case of distributed Bus bar protection, individual trip relay shall not be required if bay unit is having trip duty contacts for breaker tripping.

(j) be transient free in operation

(k) include continuous D.C. supplies supervision

(l) not cause tripping for the differential current below the load current of heaviest loaded feeder. Contractor shall submit application check for the same.

(m) shall include necessary C.T. switching relays wherever C.T. switching is involved and have 'CT' selection incomplete alarm

(n) include protection 'IN/OUT' switch for each zone

(o) shall include trip relays, CT switching relays (if applicable), auxiliary CTs (if applicable) as well as additional power supply modules, input modules etc. as may be required to provide a Bus-bar protection scheme for the complete bus arrangement i.e. for all the bays or breakers including future bays as per the Single line diagram for new substations. However for extension of bus bar protection scheme in existing substations, scope shall be limited to the bay or breakers covered under this specification. Suitable panels (if required) to mount these are also included in the scope of the work.

(p) In case of distributed Bus bar Protection, the bay units for future bays may be installed in a separate panel and the same shall be located in switchyard panel room where bus bar protection panel shall be installed.

26.4. Built-in Local Breaker Backup protection feature as a part of bus bar protection scheme shall also be acceptable.

26.5. At existing substations, Bus-bar protection scheme with independent zones for each bus, will be available. All necessary co-ordination for 'AC' and 'DC' interconnections between existing schemes (Panels) and the bays proposed under the scope of this contract shall be fully covered by the bidder. Any auxiliary relay, trip relay, flag relay and multi tap auxiliary CTs (in case of biased differential protection) required to facilitate the operation of the bays covered under this contract shall be fully covered in the scope of the bidder.. .

26.6. The test terminal blocks (TTB) to be provided shall be fully enclosed with removable covers and made of moulded, non-inflammable plastic material with boxes and barriers moulded integrally. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. Terminal block shall have shorting, disconnecting and testing facilities for CT circuits.

27. WEATHER PROOF RELAY PANELS (If Applicable)

(a) This panel shall include necessary number of electrically reset relays each with at least eight contacts for isolator auxiliary contacts multiplication and for changing the CT and DC circuits to relevant zones of bus bar protection.

(b) The panel shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be at least 2.0 mm thick and properly braced to prevent wobbling.

(c) The enclosures of the panel shall provide a degree of protection of not less than IP-55 (as per IS: 2147).

(d) The panel shall be of free standing floor mounting type or pedestal mounting type as per requirement.

(e) The panel shall be provided with double hinged doors with padlocking arrangement.

(f) All doors, removable covers and panels shall be gasketed all around with synthetic ~~rubber~~ gaskets Neoprene/EPDM generally conforming with provision of IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh

(g) Cable entries shall be from bottom. Suitable removable cable gland plate shall be provided on the cabinet for this purpose.

(h) All sheet steel work shall be degreased, pickled, phosphated and then applied with two coats of zinc chromates primer and two coats of finishing synthetic enamel paint, both inside and outside. The colour of the finishing paint shall be light grey in accordance with shade no.697 of IS: 5.

(i) Suitable heaters shall be mounted in the panel to prevent condensation. Heaters shall be controlled by thermostats so that the cubicle temperature does not exceed $30^{O}C$. On-off switch and fuse shall be provided. Heater shall be suitable for 240V AC supply Voltage.

(j) The test terminal blocks (TTB) to be provided shall be fully enclosed with removable covers and made of moulded, non-inflammable plastic material with boxes and barriers moulded integrally. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. Terminal block shall have shorting, disconnecting and testing

facilities for CT circuits.

28. **FAULT RECORDER**

28.1. The fault recorder shall be provided for transmission line and the fault recorder as in-built feature of line distance relay is also acceptable provided the requirements of following clauses are met.

28.2. Fault recorder shall be microprocessor based and shall be used to record the graphic form of instantaneous values of voltage and current in all three phases, open delta voltage & neutral current, open or closed position of relay contacts and breakers during the system disturbances.

28.3. The Fault recorder shall consist of individual acquisition units, one for each feeder and an Evaluation unit which is common for the entire Substation. Whenever, more than one acquisition units are connected to an Evaluation unit, necessary hardware and software shall also be supplied for on line transfer of data from all acquisition units to Evaluation unit.

28.4. The acquisition unit is connected with evaluation unit being supplied as described in section sub-station automation through bus conforming to IEC 61850. In case of extension sub-station which is equipped with Sub-station Automation System based on IEC 61850, one set of evaluation software shall be supplied and loaded in existing fault recorder evaluation unit. Automatic uploading of disturbance files from acquisition unit to evaluation unit shall be done through existing station bus only conforming to IEC 61850. Necessary configuration/updation including hardware if any shall be in the scope of the contractor.

28.5. In case of extension of existing substation(s) which are without sub-station automation system, one set of Evaluation unit shall be supplied for each substation where ever disturbance recorders are required to be supplied along with necessary evaluation software as specified above. The Evaluation unit shall consist of a desktop personal computer (including at least 17" TFT colour monitor, mouse and keyboard) and printer. The desktop PC shall have Pentium - IV processor or better and having a clock speed 3.0GHz or better. The hard disk capacity of PC shall not be less than 300 GB and RAM capacity shall not be less than 3 GB

28.6. The evaluation unit hardware, for substations having SAS, shall be as described in clause no. 4.0 of section sub-station automation system.

28.7. Fault recorder shall have atleast 8 analogue and 16 digital channels for each feeder.

28.8. Acquisition units shall acquire the Disturbance data for the pre fault and post fault period and transfer them to Evaluation unit automatically to store in the hard disk. The acquisition units shall be located in the protection panels of the respective feeders.

28.9. The acquisition unit shall be suitable for inputs from current transformers with 1A rated secondary and capacitive voltage transformers with 63.5V (phase to neutral voltage) rated secondary. Any device required for processing of input signals in order to make the signals compatible to

the Fault recorder equipment shall form an integral part of it. However, such processing of input signals shall in no way distort its waveform.

28.10. The equipment shall be carefully screened, shielded, earthed and protected as may be required for its safe functioning. Also, the Fault recorder shall have stable software, reliable hardware, simplicity of maintenance and immunity from the effects of the hostile environment of EHV switchyard which are prone to various interference signals typically from large switching transients.

28.11. Necessary software for transferring the data automatically from local evaluation unit to a remote station and receiving the same at the remote station through owner's PLCC/VSAT/LEASED LINE shall be provided.

28.12. Evaluation software shall be provided for the analysis and evaluation of the recorded data made available in the PC under ~~DOS/~~WINDOWS environment. The Software features shall include repositioning of analog and digital signals, selection and amplification of time and amplitude scales of each analogue and digital channel, calculation of MAX/MIN frequency, phase difference values, recording of MAX/MIN values etc. of analogue channel, group of signal to be drawn on the same axis etc, listing and numbering of all analogue and digital channels and current, voltage, frequency and phase difference values at the time of fault/tripping. Also, the software should be capable of carrying out Fourier /Harmonic analysis of the current and voltage wave forms. The Disturbance records shall also be available in COMTRADE format (IEEE standard- Common Format for Transient data Exchange for Power System)

28.13. The Evaluation unit shall be connected to the printer to obtain the graphic form of disturbances whenever desired by the operator.

28.14. Fault recorder acquisition units shall be suitable to operate from 220V DC or 110V DC as available at sub-station. Evaluation unit along with the printer shall normally be connected to 230V, single phase AC supply. In case of failure of AC supply, Evaluation unit and printer shall be switched automatically to the station DC through Inverter of adequate capacity which shall form a part of Fault recorder system. The inverter of adequate capacity shall be provided to cater the requirement specified in section sub-station automation clause no. 8.0 and DR evaluation unit.

28.15. The acquisition unit shall have the following features

(a) Facility shall exist to alarm operator in case of any internal faults in the acquisition units such as power supply fail, processor / memory fail etc and same shall be wired to annunciation system.

(b) The frequency response shall be 5 Hz on lower side and 250 Hz or better on upper side.

(c) Scan rate shall be 1000 Hz/channel or better.

(d) Pre-fault time shall not be less than 100 milliseconds and the post fault time shall not be less than 2 seconds (adjustable). If another system fault occurs during one post-fault run time, the recorder shall also be able to record the same. However, the total memory

of acquisition unit shall not be less than 5.0 seconds

(e) The open delta voltage and neutral current shall be derived either through software or externally by providing necessary auxiliary transformers.

(f) The acquisition unit shall be typically used to record the following digital channels :

1 Main CB R phase open
2 Main CB Y phase open
3 Main CB B phase open
4 Main-1 carrier received
5 Main-1 protection operated
6 Main/Tie /TBC Auto reclosed operated
7 Over Voltage -Stage-1 /2 operated
8 Reactor / Stub/TEE-1/2/UF protection operated
9 Direct Trip received
10 Main-2 carrier received
11 Main- 2/ Back Up protection operated
12 Bus bar protection operated
13 LBB operated of main /tie/TBC circuit breaker
14 Tie/TBC CB R phase open
15 Tie/TBC CB Y phase open
16 Tie/TBC CB B phase open

(g) In case the Fault recorder is in-built part of line distance protection, above digital channels may be interfaced either externally or internally.

(h) Any digital signal can be programmed to act as trigger for the acquisition unit. Analog channels should have programmable threshold levels for triggers and selection for over or under levels should be possible.

28.16. The **colour laser** printer shall be provided which shall be compatible with the desktop PC and shall use Plain paper. The print out shall contain the Feeder identity, Date and time (in hour, minute and second up to 100th of a second), identity of trigger source and Graphic form of analogue and digital signals of all the channels. Two packets of **A4 size** paper (500 sheets in each packet) suitable for printer shall be supplied.

28.17. Each Fault recorder shall have its own time generator and the clock of the time generator shall be such that the drift is limited to $\pm$0.5 seconds/day, if allowed to run without synchronisation. Further, Fault recorder shall have facility to synchronise its time generator from Time Synchronisation Equipment having output of following types

- Voltage signal : (0-5V continuously settable, with 50m Sec.

minimum pulse duration)

- Potential free contact (Minimum pulse duration of 50 m Sec.)
- IRIG-B
- RS232C

The recorder shall give annunciation in case of absence of synchronising within a specified time.

28.18. Substations where Time Synchronisation Equipment is not available, time generator of any one of the Fault recorders can be taken as master and time generators of other Fault recorders and Event loggers in that station shall be synchronised to follow the master.

29. **DISTURBANCE RECORDER** (for 765 KV Feeders only)

A separate numerical disturbance recording function shall be provided for each 765kV lines. The following requirements shall be met:

29.1. The disturbance recorder shall record the analogue values form of the instantaneous values of voltage and current in all three phases, the open delta voltage and the neutral current. The open or closed position of relay contacts and circuit breakers during system disturbances shall also be recorded.

29.2. The disturbance recorder shall comprise distributed individual acquisition units, one for each feeder and an evaluation unit which is common for the entire substation. The acquisition units shall acquire the disturbance data for the pre-fault, fault and post-fault periods and transfer them to the evaluation unit automatically for storage on a mass storage device. The acquisition unit shall be suitable for inputs from current transformers with 1 A rated secondaries and capacitive voltage transformers with 63.5 V (phase-to-neutral voltage) rated secondaries.

29.3. The acquisition units shall have the following features:

(a) A facility to alert the operator in the case of any internal faults (such as power supply fail, processor/memory fail etc.) in any of the acquisition units and this alarm shall be wired to the station annunciation system.

(b) The pre-fault time shall not be less than 200 milliseconds and the post fault time shall not be less than 2 seconds (adjustable). If another system disturbance occurs during a post-fault run time, the recorder shall also be able to record this subsequent disturbance. The scan rate should be selectable in the range from 1000 Hz to 5000 Hz.

(c) The open delta voltage and neutral current shall be derived either through software or externally by providing necessary auxiliary transformers.

(d) The acquisition unit shall be typically used to record the following digital channels:

1. Main circuit-breaker R-phase open

2. Main circuit-breaker Y-phase open
3. Main circuit-breaker B-phase open
4. Main 1 carrier received
5. Main 1 protection operated
6. Main/Tie auto-reclose operated
7. Overvoltage stage 1/2 operated
8. Reactor/Stub-1/2 protection operated
9. Direct trip received
10. Main 2 carrier received
11. Main 2 protection operated
12. Busbar protection operated
13. Breaker failure protection of main/tie circuit-breaker operated
14. Tie circuit-breaker R-phase open
15. Tie circuit-breaker Y-phase open
16. Tie circuit-breaker B-phase open

29.4. The necessary hardware and software shall also be supplied for the on-line transfer of data from all acquisition units to the evaluation unit. The disturbance recording system shall be capable of handling the full complement of feeders in the substation.

29.5. The disturbance recording equipment shall be screened, shielded, earthed and protected as may be required for its safe and proper functioning. Also, the disturbance recorder shall have stable software, reliable hardware, simplicity of maintenance and immunity from the effects of the hostile environment of a 765 kV EHV switchyard which is prone to numerous interference signals such as large switching transients.

29.6. The evaluation unit shall comprise all the necessary hardware and software for the proper evaluation of disturbances. The hardware would typically consist of a desktop personal computer (including a large high resolution colour monitor, mouse and keyboard) and a high-speed colour printer. The desktop PC shall have Pentium P4 processor or better and shall have a clock speed of 1600 MHz or better. The mass storage capacity of PC shall not be less than 32 GB and the RAM capacity shall not be less than 1 GB. The evaluation software required for the analysis and evaluation of the recorded data shall run on the PC under Microsoft Windows environment. The software features shall provide:

- clear and unambiguous display of all channels;
- the ability to reposition the analog and digital traces;
- recording of maximum/minimum values etc. of the analog channels;

- calculation of maximum/minimum frequency and phase difference values;
- grouping of signals for drawing on the same axis;
- listing and identification of all analog and digital channels as well as and current, voltage, frequency and phase difference values at the time of fault/tripping;
- the capability of carrying out Fourier/Harmonic analysis of the current and voltage waveforms; and,
- the availability of the disturbance records in COMTRADE format

29.7. The evaluation unit shall be permanently connected to the printer so as to obtain the graphic display of disturbances whenever desired by the operator. The printer shall be compatible with the desktop PC and shall use plain paper. The print out shall contain the feeder identity, date and time (in hour, minute and second up to 100th of a second), identity of the trigger source and graphic representation of the analog and digital signals of all the channels.

29.8. The disturbance recorder acquisition units shall be suitable to operate from the station DC. The evaluation unit along and the printer shall normally be connected to the 230 V, single phase AC supply. In the case of a failure of the AC supply, the evaluation unit and printer shall be automatically switched to the station DC through an inverter of adequate capacity and which shall form part of disturbance recording system.

29.9. The disturbance recorder shall be capable of being triggered by the following user-specified quantities:

(a) external start, both software and hardware

(b) cross triggering of groups of channels, either software or hardware or both

(c) binary channel (NO and NC contacts)

(d) over voltage and under voltage

(e) over current

(f) negative sequence voltage

(g) zero sequence voltage

(h) rate of change, voltage or current

(i) over frequency or under frequency

(j) logical or Boolean expressions, programmable

(k) power swing

(l) rate of change of active or reactive power

29.10. The disturbance recorder shall have its own time generator and the clock of the time generator shall be such that the drift is limited to less than ± 0.5 seconds per day, if allowed to run without synchronisation. Further, the disturbance recorder shall have the facility to synchronise its

time generator from the station Time Synchronisation Equipment using IRIG-B. The recorder shall give an alarm in the case of the absence of the synchronising pulse for a pre-determined time.

30. **DISTANCE TO FAULT LOCATOR** shall

a) be electronic or microprocessor based type

b) be 'On-line' type

c) be suitable for breaker operating time of 2 cycles

d) have built-in display unit

e) the display shall be directly in percent of line length or kilometres without requiring any further calculations

f) have an accuracy of 3% or better for the typical conditions defined for operating timings measurement of distance relays

g) The above accuracy should not be impaired under the following conditions:

- presence of remote end infeed
- predominant D.C. component in fault current
- high fault arc resistance
- severe CVT transients

h) shall have mutual zero sequence compensation unit if fault locator is to be used on double circuit transmission line

i) built in feature of line distance relay is acceptable provided the requirements of above clauses are met

31. TIME SYNCHRONISATION EQUPMENT

31.1. The Time synchronisation equipment shall receive the co-ordinated Universal Time (UTC) **transmitted** through Geo Positioning Satellite System (GPS) and synchronise equipments to the Indian Standard Time in a substation.

31.2. Time synchronisation equipment shall include antenna, all special cables and processing equipment etc.

31.3. It shall be compatible for synchronisation of Event Loggers, Disturbance recorders and SCADA at a substation through individual port or through Ethernet realised through optic fibre bus.

31.4. Equipment shall operate up to the ambient temperature of 50 degree centigrade and 80% humidity.

31.5. The synchronisation equipment shall have 2 micro-second accuracy. Equipment shall give real time corresponding to IST (taking into consideration all factors like voltage, & temperature variations, propagation & processing delays etc).

31.6. Equipment shall meet the requirement of IEC 60255 for storage & operation.

31.7. The system shall be able to track the satellites to ensure no interruption

of synchronisation signal.

31.8. The output signal from each port shall be programmable at site for either one hour, half hour, minute or second pulse, as per requirement.

31.9. The equipment offered shall have six (6) output ports. Various combinations of output ports shall be selected by the customer, during detailed engineering, from the following :

- Potential free contact (Minimum pulse duration of 50 milli Seconds.)
- IRIG-B
- RS232C
- SNTP Port

31.10. The equipment shall have a periodic time correction facility of one second periodicity.

31.11. Time synchronisation equipment shall be suitable to operate from 220V DC or 110V DC as available at Substation.

31.12. Equipment shall have real time digital display in hour, minute, second (24 hour mode) & have a separate time display unit to be mounted on the top of control panels having display size of approx. 100 mm height.

32. RELAY TEST KIT

32.1. One relay test kit shall comprise of the following equipment as detailed here under

3 sets	Relay tools kits
2 nos.	Test plugs **for TTB**
2 nos.	Test plugs for using with modular type relays ~~cases~~ (if applicable)

33. TYPE TESTS

33.1. The reports for following type tests shall be submitted during detailed engineering for the Protective relays, Fault Recorder, Fault locator and Disturbance recorder:

a) Insulation tests as per IEC 60255-5

b) DC Voltage dips and interruptions/Variation as per IEC 6100-4-29.

c) High frequency disturbance test as per IEC 61000-4 16, Class IV (Not applicable for electromechanical relays)

d) Electrostatic discharges as per IEC 61000-4-2, level; 4 (not applicable for Electromechanical relays)

e) Fast transient test as per IEC 61000, Level I**V** (Not applicable for electromechanical relays)

f) Relay characteristics, performance and accuracy test as per IEC 60255

- Steady state Characteristics and operating time

- Dynamic Characteristics and operating time for distance protection relays and current differential protection relays
- Conformance test as per IEC 61850-10.

For Fault recorder, Disturbance recorder; only performance tests are intended under this item.

g) Tests for thermal and mechanical requirements as per IEC 60255-6

h) Tests for rated burden as per IEC 60255-6

i) Contact performance test as per IEC 60255-0-20 (not applicable for Distance to fault locator and Disturbance recorder)

In case there is a change either in version or in model (Except firmware) of the relay, the contractor has to submit the type test reports for the offered revision/model.

33.2. Steady state & Dynamic characteristics test reports on the distance protection relays, as type test, shall be based on test programme specified in Appendix A on simulator/network analyser/PTL. Alternatively, the files generated using Electromagnetic transient Programme (EMTP) can also be used for carrying out the above tests. Single source dynamic tests on transformer differential relay shall be/ should have been conducted based on general guidelines specified in CIGRE committee 34 report on Evaluation of characteristics and performance of Power system protection relays and protective systems.

34. CONFIGURATION OF RELAY AND PROTECTION PANELS

The following is the general criteria for the selection of the equipments to be provided in each type of panel. However, contractor can optimise the requirement of panels by suitably clubbing the feeder protection and CB relay panels. It may be noted that Main-I and Main-II protections for line can not be provided in single panel. **Similarly, Group-I & Group-II protections for transformer can not be provided in single panel.**

CONTROL PANEL

Various types of control panels shall consist of the following

a	Ammeter	3 set	for each Line, BC, TBC Bus section , Bus Reactor and Transformer
b	Ammeter with Selector switch	1 set	for each line reactor
c	Wattmeter with transducer	1 set	for each line, transformer
d	Varmeter with transducer	1 set	for each line, transformer, Bus reactor
e	Varmeter with transducer	1 set	for each Line Reactor
f	CB Control switch	1 no.	for each Circuit breaker

g	Isolator Control switch	1 no.	for each isolator
h	Semaphore	1 no.	for each earth switch
i	Red indicating lamp	1 no.	for each Circuit breaker
j	Red indicating lamp	1 no.	for each isolator
k	Green indicating lamp	1 no.	for each Circuit breaker
l	Green indicating lamp	1 no.	for each isolator
m	White indicating lamp (DC healthy lamp)	2 nos	for each feeder
n	Annunciation windows with associated annunciation relays	18 nos	for each feeder
o	Push button for alarm Accept/reset/lamp test	3 nos	for each control panel
p	Synchronising Socket	1 no.	for each Circuit Breaker if required
q	Synchronising selector Switch	1 no.	for each Circuit Breaker switch if required
r	Protection Transfer Switch	1 no.	for each breaker in case of DMT /DM*/SMT schemes (Except TBC and BC breaker) - * with by pass isolator
s	Mimic to represent SLD	Lot	in all control panels
t	Voltmeter with selector Switch	1 no	for each line, transformer , bus reactor
u	Cut out, mounting and wiring for RWTI and selector switch	Lot	for transformers/reactors

Notes:

1 For transformer feeders, all equipments of control panel shall be provided separately for HV and MV sides.

2. In case of incomplete diameter (D and I type layouts), control panel shall be equipped fully as if the diameter is complete, unless otherwise specified. Annunciation relays shall also be provided for the same and if required, necessary panel shall be supplied to accommodate the same.

3. The above list of equipments mentioned for control panel is generally applicable unless it is defined elsewhere and in case of bay extension in existing substations, necessary equipments for matching the existing control panel shall be supplied.

4. Common synchronising switch is also acceptable in Synchronising trolley for new Substations. In this case. individual synchronising selector switch is not required for each Circuit Breaker in control panel

5. Each line /HV side of transformer/MV/LV side of transformer /Bus reactor /TBC /BC/ Bus Section shall be considered as one feeder for above purpose.

LINE PROTECTION PANEL

The Line Protection panel for transmission lines shall consist of following protection features/schemes

Sl. No.	Description	765/400kV	220kV	132kV
1.	Main-1 Numerical Distance protection scheme	1 Set	1 Set	1 Set
2.	Main-2 Numerical Distance protection scheme	1 Set	1 Set	NIL
3.	Over Voltage Protection Scheme	1 Set	NIL	NIL
4.	Fault Recorder	1 Set	1 Set	NIL
5.	**Disturbance Recorder***	1 Set	NIL	NIL
6.	Distance to fault Locator	1 Set	1 Set	1 Set
7.	3 Phase Trip Relays	2 Nos.	2 Nos.	2 Nos.
8.	Flag relays, carrier receive relays, aux. Relays, timers etc as per scheme requirements	As required	As required	As required
9.	Under Voltage protection relay for isolator/earth switch	2 Nos	2 Nos	2 Nos
10. .	Cut-out and wiring with TTB for POWERGRID supplied energy meter	1 Set	1 Set	1 Set
11.	Directional Back up Over current and E/F protection scheme	NIL	NIL	1 Set
	* Applicable for 765kV Lines Only			

In a substation where 765kV, 400kV and 220 KV lines are under the scope of the contract, bidder is required to give identical Main-1 and Main-2 distance protection schemes for all voltage levels.

TRANSFORMER PROTECTION PANEL

The protection panel for Auto transformer/Transformer shall consists of the following features/schemes:

Sl. No.	Description	HV side	MV/LV side
1.	Transformer Differential Protection scheme	1 Nos.	Nil
2.	Restricted Earth fault protection scheme	1 no.	1 no@
	@ Not applicable for auto-transformer		
3.	Directional back up O/C and E/F relay with non directional high set feature	1 set	1 set
4.	Over Fluxing Protection scheme	1 no.	1 no.$
	$ Applicable only for 400/220kV Transformer & 765/400 Transformer		
5.	Overload protection scheme	1 nos.	NIL
6.	Three phase trip relays	2 nos.	2 nos.
7.	CVT selection relays as per scheme requirement	Lot	Lot
8.	Cut-out and wiring with TTB for POWERGRID supplied energy meter	1 set	1 set
9.	Transformer Neutral Current relay for 1-Phase transformer bank	1 Set	
10.	**Flag Relays/Aux. Relays for wiring Transformer auxiliary protection contacts such as Buchholz, Oil Temperature, Winding Temperature, PRV, OLTC Buchholz etc. as per scheme requirements**	**As required**	

The above protection schemes may be clubbed in Group-I/II as per clause no. 21 of technical specification.

REACTOR PROTECTION PANEL

The protection panel for Reactor shall consist of the following protection features/schemes:

Sl. No.	Description	Qty.
1.	Reactor Differential Protection scheme	1 no.
2.	Restricted Earth fault Protection scheme	1 no.
3.	Reactor back up impedance protection scheme	1 set
4.	Three phase trip relays	2 nos.
5.	CVT selection relay as per scheme requirement	Lot
6.	**Flag Relays/Aux. Relays for wiring Reactor auxiliary protection contacts such as Buchholz, Oil Temperature, Winding Temperature, PRV etc. as per scheme requirements**	**As required**

BREAKER RELAY PANEL

The breaker relay panel shall comprise of the following:

Sl. No.	Description	With A/R	With out A/R
1.	Breaker failure Protection Scheme	1 No.	1 No.
2.	DC supply Supervision relay	2 Nos.	2 Nos.
3.	Trip Circuit supervision relays#	6 Nos.	6 Nos.
4.	Auto-reclose scheme (if standalone)	1 Nos.	NIL
5.	Flag relays, aux relays, timers, trip relays as per scheme requirements	As required	As required

Trip supervision relays shall be 2 **or 6** numbers **as per no. of trip coils** for each 132KV Circuit breaker

Note: Equipment/relays to be provided under CB Relay Panel may be accommodated in the Protection Panels to be provided for Transmission Line/Transformer/Reactor as applicable.

35. ERECTION AND MAINTENANCE TOOL EQUIPMENTS

All special testing equipment required for the installation and maintenance of the apparatus, instruments devices shall be furnished in relevant schedule

36. TROPICALISATION

Control room will be normally air-cooled/air- conditioned. All equipments shall however be suitable for installation in a tropical monsoon area having hot, humid climate and dry and dusty seasons with ambient conditions specified in the specification. All control wiring, equipment and accessories shall be protected against fungus growth, condensation, vermin and other harmful effects due to tropical environment.

37. MONITORING, CONTROL & PROTECTION FOR AUXILIARY TRANSFORMER

Suitable monitoring, control (operation of associated circuit breaker & isolator) and protection for 630/800/1000KVA transformer, connected to tertiary winding of auto transformer for the purpose of auxiliary supply shall be provided by the contractor. Over current and open delta protection is required to be provided for the auxiliary transformer. These protection and control shall be also be acceptable as built in feature either in the bay controller to be provided for the auxiliary system or in the control & protection IEDs to be provided for autotransformer.

Test programme for distance relays

General Comments:

1. These test cases are evolved from the report of working group 04 of study committee 34 (Protection) on evaluation of characteristics and performance of power system protection relays and protective systems. For any further guidelines required for carrying out the tests, reference may be made to the above document.
2. The test shall be carried out using network configuration and system parameters as shown in the figure-1
3. All denotations regarding fault location, breakers etc are referred in figure –1
4. The fault inception angles are referred to R- N voltage for all types of faults
5. The fault inception angle is zero degree unless otherwise specified
6. Where not stated specifically, the fault resistance (Rf) shall be zero or minimum as possible in simulator
7. Single pole circuit breakers are to be used
8. The power flow in double source test is 500 MW

System parameters

System voltage =400KV

CTR= 1000/1

PTR = 400000/110 (with CVT, the parameters of CVT model are shown in figure –2)

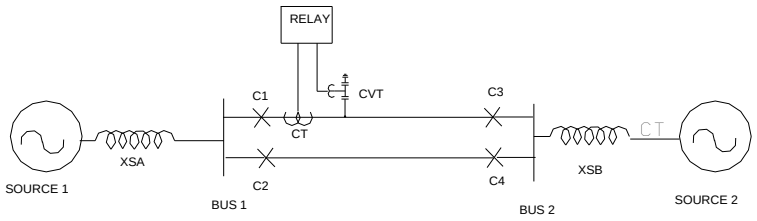


FIGURE 1

Line parameters/km

Positive Sequence Resistance, (r1) = 0. 02897 Ω

Positive Sequence Reactance (x1) = 0.3072 Ω
Zero Sequence Resistance (r0) = 0.2597 Ω
Zero Sequence Reactance (x1) = 1.0223 Ω
Zero Sequence Mutual Resistance (rm) = 0.2281 Ω
Zero Sequence Mutual Reactance (xm) = 0.6221 Ω
Zero Sequence succeptance (bo) = 2.347 µ mho
Positive Sequence succeptance (b1) =3.630 µ mho

Type of line	**Short**		**Long**
Secondary line impedance	2 Ω		20 Ω*
Length of line in Kms	23.57		235.7
SIR	4	15	4
Source impedance (pry) (at a time constant of 50 ms)	29.09 Ω (5500 MVA)	109.09 Ω (1467 MVA)	290.9 Ω (550 MVA)

* Alternatively , the tests can be done with 10 Ω secondary impedance and source impedance may accordingly be modified

CVT Model

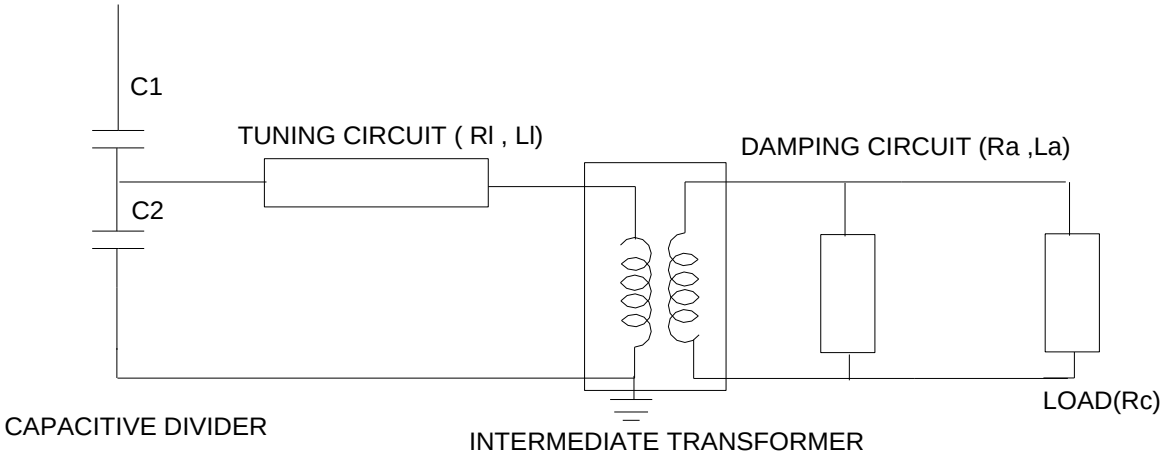


Figure-2

XC1 1.455 µ mho
XC2 27.646 µ mho

Rl	320 Ω
XLl	34243 Ω
Ra	4.200 Ω
Xla	197.92 Ω
Rc	14.00 Ω
Transformation ratio of Intermediate transformer	181.8

Details of fault cases to be done

Sl no	**Description**	**Single source with short line (2 Ω)**		**Single source long line (20 Ω)**	**Double source with short double line (2 Ω)**	**Double source with long single line (20 Ω)**
		CLOSE C1, OPEN C2,C3,C4		CLOSE C1, OPEN C2,C3,C4	CLOSE C1, C2,C3,C4	CLOSE C1,C3 OPEN C2,C4
		SIR=4	SIR=15	SIR =4	SIR = 4	SIR=4
1	Dynamic accuracy for zone 1	Tests to be done at 2 locations (84 % and 76 % of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°, 90°)= 16 cases	Tests to be done at 2 locations (84 % and 76 % of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°,90°)= 16 cases	Tests to be done at 2 locations (84 % and 76 % of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°,90°)= 16 cases		Tests to be done at 2 locations (84% and 76% of line length) X 4 faults (RN , YB, YBN, RYB) X 2 fault inception angle (0°, 90°)= 16 cases
2	Operating time for zone 1 at SIR =4	Tests to be done at 3 locations (0% , 40% and 64% of line length) X 4 faults (RN, YB, YBN, RYB) X 4 fault inception	Tests to be done at 3 locations (0 % , 40 % and 64 % of line length) X 4 faults (RN , YB, YBN, RYB) X 4 fault inception	Tests to be done at 3 locations (0 % , 40 % and 64 % of line length) X 4 faults (RN , YB, YBN, RYB) X 4 fault	Tests to be done at 1 location (40 % of line length) X 4 faults (RN, YB, YBN, RYB) X 4 fault inception angle	Tests to be done at 1 location (40 % of line length) X 4 faults (RN, YB, YBN, RYB) X 4 fault inception angle (0°,30°,60°

Sl no	Description	Single source with short line (2 Ω)		Single source long line (20 Ω)	Double source with short double line (2 Ω)	Double source with long single line (20 Ω)
		angle (0°, 30°,60° and 90°) = 48 cases	angle (0°,30°,60°and 90°)= 48 cases	inception angle (0°, 30°,60° and 90°)= 48 cases	(0°,30°,60° and 90 °)= 16 cases	and 90°)= 16cases
3	Operating time for zone II and Zone III	Tests to be done at 1 location (100 % of line length) X 1 faults (RN, YB, YBN, RYB) X 2 zones (II and III) = 2 cases	Tests to be done at 1 location (100 % of line length) X 1 faults (RN , YB, YBN, RYB) X 2 zones (II and III) = 2 cases	Tests to be done at 1 location (100 % of line length) X 1 faults (RN , YB, YBN, RYB) X 2 Zones (II and III) = 2 cases		
4	Switch on to fault feature			Tests to be done at 2 location (0 % and 32 %) X 1 faults (RYB) Any fault inception angle = 2 cases		
5	Operation during current reversal				Tests to be done at 2 location (0 % and 80 % of line length) X 1 faults (RN) X 1 fault inception angle (0 degrees) = 2 cases	
		CLOSE C1, OPEN C2,C3,C4		CLOSE C1, OPEN C2,C3,C4	CLOSE C1, C2,C3,C4	CLOSE C1,C3 OPEN C2,C4
		SIR=4	SIR=15	SIR =4	SIR = 4	SIR=4
6	Operation at simultaneou				Tests to be done at 2	

Sl no	Description	Single source with short line (2 Ω)		Single source long line (20 Ω)	Double source with short double line (2 Ω)	Double source with long single line (20 Ω)
	s faults				location (8 % and 64 % of line length) X 2 faults (RN in circuit 1 to BN in circuit 2 and RN in circuit 1 to RYN in circuit 2 in 10 ms) X 1 fault inception angle (0 °) = 4 cases (*1)	
7	Directional sensitivity					Tests to be done at 1 location (0% reverse) X 6 faults (RN ,YB, YBN , RYB,RN with Rf=13.75 ohm(sec) and RYN with Rf= 13.75 Ohm (sec) X 2 fault inception angle (0° ,90°) = 12cases
8	Limit for fault resistance					Tests to be done at 2 location (0% and 68 % of line length) X 1 fault (RN with Rf=13.75 ohm(sec) X 2 fault inception angle (0°,90°) = 4 cases
9	Operation at evolving faults					Tests to be done at 2 location (32 % and 0% of line

Sl no	Description	Single source with short line (2 Ω)		Single source long line (20 Ω)	Double source with short double line (2 Ω)	Double source with long single line (20 Ω)
						length) X 2 faults (RN to RYN) x in 2 timings (10 ms and 30 ms) X 2 load direction (from A to B and from B to A) = 16 cases
9	Fault locator function , in case the same is offered as built in feature	Measure fault location for all cases under 1 and 2	Measure fault location for all cases under 1 and 2	Measure fault location for all cases under 1 and 2	Measure fault location for all cases under 2 and 6	Measure fault location for all cases under 2, 7 and 9

SECTION-III

PROJECT DETAILS & GENERAL SPECIFICATION

SITE INFORMATION

	Particular	Details
a)	Customer	**Power Grid Corporation of India Limited**
b)	Project Title	Extension of I) 400kV Biharshariff S/s, II) 400kV Jamshedpur S/s, III) 400 kV Gazuwaka S/s, IV) 400 kV Rengali S/s, V) 400 kV Rourkela S/s, VI) 400 kV Durgapur S/s & VII) 400 kV Gorakhpur S/s Extension package under ERSS-IX
c)	Location	Biharshariff (Bihar) Jamshedpur (Jharkhand) Gazuwaka (Andhra Pradesh) Rengali/ Rourkela (Orissa) Durgapur (West Bengal) Gorakhpur (Uttar Pradesh)
d)	Transport Facilities	Nearest Rail Head Biharshariff (Biharshariff), Jamshedpur (Jamshedpur), Gazuwaka (Vizag), Rengali (Talcher Road), Rourkela (Rourkela), Durgapur (Durgapur) & Gorakhpur (Gorakhpur)
SITE CONDITIONS		
a)	Altitude above sea level	Less than 1000m
b)	Ambient air temp. (Max)	50°C
c)	Average Humidity	Shall be informed during detailed engg.
d)	Special corrosion conditions	-do-
e)	Solar Radiation	-do-
f)	Atmospheric UV radiation	-do-
g)	Seismic Acceleration	0.3g horizontal
h)	Pollution Severity	High Pollution level (25mm/kV)
WIND DATA		
a)	Wind velocity	As per IS
b)	Average No. of thunderstorm days per annum	As per IS

1.0 GENERAL

This Chapter covers Technical Requirements and requirements of auxiliary items.

a) 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 unless included in the list of exclusions.

b) Material and components not specifically stated in this specification but which are necessary for satisfactory operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded and shall be supplied at no extra cost.

c) Whenever a material or article is specified or described 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.

d) In case any Deviation Schedule, Bid Proposal Sheet, Schedule of Data Requirements (DRS), test reports or any other document/information are not furnished along-with the bid, the bid is liable to be rejected. Unless brought out clearly, the Bid will be deemed to conform to the specification scrupulously. All deviations from the specification shall be clearly brought out in the respective deviation schedule.

e) Auxiliary supplies as described below would be available at site.

Normal Voltage	Variation in Voltage	Frequency in HZ	Phase/Wire	Neutral connection
415V	± 10%	50 ± 5%	3/4 Wire	Solidly Earthed.
240V	± 10%	50 ± 5%	1/2 Wire	Solidly Earthed.
220V	190V to 240V	DC	-	Isolated 2 wire System
110V	95V to 120V	DC	-	Isolated 2 wire System
48V	_	DC	_	2 wire system (+) earthed

NOTE: Combined variation of frequency and voltage shall be limited to ±10 %.

f) The Bidder shall clearly indicate in the bid, the specific standards in accordance with which the works will be carried out.

g) The equipment must be new, of highest grade, the best quality of their kind, to best engineering practice and latest state of art, and in accordance with purpose for which they are intended and ensure satisfactory performance throughout the service life.

h) All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same materials and workmanship as the corresponding parts of the equipment. Where feasible, common components, units shall be employed in different pieces of equipment in order to optimize the spare part stock-up and utilization.

i) The requirement regarding external RIV as specified for equipment shall include the terminal fittings and the equipment shall have been tested preferably with fittings, if any.

j) All drawings, schedules, annexures appended to this specification shall form part of the specification.

2.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

a) The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, restrike etc.

b) The equipment shall be able to withstand forces due to wind load, short circuit, system over voltages, fluctuations, frequency variations etc., all forces considered together.

3.0 SUPPORT STRUCTURES

a) The support structures should be hot dip galvanised with minimum 610 gram/m^2 net of zinc.

b) The design calculations taking into account the environmental conditions of the substations shall be furnished for sizing of the structures.

4.0 STANDARDS

a) The equipment to be furnished under this specification shall conform to latest issue with all amendments of standard specified under respective Chapters of this Specification. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other. The Contractor shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. When the specific

requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

b) Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.

c) In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in additional information schedule alongwith English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Employer's approval.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 The list of drawings/documents which are to be submitted to the Purchaser shall be discussed and finalised by the Purchaser at the time of award. The Contractor shall necessarily submit all the drawings/ documents unless anything is waived.

5.2 The Contractor shall submit 4 (four) sets of drawings/ design documents/ data / detailed bill of quantity and 1 (one) set of test reports for the approval of the Purchaser. The contractor shall also submit the softcopy of the above documents in addition to hardcopy.

5.3 Drawings

5.3.1 All drawings submitted by the Contractor 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, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.

5.3.2 Drawings submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. POWERGRID has standardized a large number of drawings/documents of various make including type test reports which can be used for all projects having similar requirements and in such cases no project specific approval (except for list of applicable drawings alongwith type test reports) is required. However, distribution copies of standard drawings/documents shall be submitted as per provision of the contract. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in SI units.

5.3.3 The review of these data by the Purchaser will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of

the dimensions which might affect substation layout. This review by the Purchaser may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, 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.

5.4 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.

5.5 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 works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Purchaser in Writing.

5.6 **Approval Procedure**

The scheduled dates for the submission of the drawings as well as for, any data/information to be furnished by the Purchaser would be discussed and finalised at the time of award. The following schedule shall be followed generally for approval and for providing final documentation.

i)	Approval/comments/ by Purchaser on initial submission	As per agreed schedule
ii)	Resubmission (whenever required)	Within 3 (three) weeks from date of comments
iii)	Approval or comments	Within 3 (three) weeks of receipt of resubmission.
iv)	Furnishing of distribution copies (5 hard copies per substation and one scanned copy (pdf format) for Corporate Centre)	2 weeks from the date of approval
v)	Furnishing of distribution copies of test reports	
	(a) Type test reports (one scanned softcopy in pdf format per substation plus one for corporate centre & one hardcopy per substation)	2 weeks from the date of final approval

	(b) Routine Test Reports (one copy for each substation)	-do-
vi)	Furnishing of instruction/ operation manuals (2 copies per substation and one softcopy (pdf format) for corporate centre & per substation)	As per agreed schedule
(vii)	As built drawings (two sets of hardcopy per substation & one softcopy (pdf format) for corporate centre& per substation)	On completion of entire works

NOTE :

(1) The contractor may please note that all resubmissions must incorporate all comments given in the earlier submission by the Purchaser or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) All drawings should be submitted in softcopy form, however substation design drawings like SLD, GA, all layouts etc. shall also be submitted in AutoCAD Version. SLD, GA & layout drawings shall be submitted for the entire substation in case of substation extension also.

(3) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

(4) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Purchaser.

(5) The Contractor shall furnish to the Purchaser catalogues of spare parts.

(6) All As-built drawings/documents shall be certified by site indicating the changes before final submission.

6.0 DESIGN IMPROVEMENTS

6.1 The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes, the specification shall be modified accordingly.

6.2 The Bidder should however note that changes proposed by him will have to be supported with applicable type test reports.

6.3 If any such agreed change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

7.0 QUALITY ASSURANCE PROGRAMME

7.1 To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's Works or at his Sub-contractor's premises or at the Employer's site or at any other place of Work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Employer after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following :

a) The organisation structure for the management and implementation of the proposed quality assurance programme.

b) System for Document and Data Control.

c) Qualification and Experience data of Bidder's key personnel.

d) The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

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

f) System for Control of non-conforming products including Deviation Dispositioning, if any and system for corrective and preventive actions based on the feed back received from the Customers and also internally documented system for Customer complaints.

g) Inspection and test procedure both for manufacture and field activities.

h) System for Control of calibration of testing and measuring equipment and the indication of calibration status on the instruments.

i) System for indication and appraisal of inspection status.

j) System of Internal Quality Audits and Management review and initiation of corrective and Preventive actions based on the above.

k) System for authorising release of manufactured product to the Employer.

l) System for maintenance of records.

m) System for handling storage and delivery.

n) A quality plan detailing out the specific quality control measures and procedure adopted for controlling the quality characteristics relevant to each item of equipment furnished and /or service rendered.

o) System for various field activities i.e. unloading, receipt at site, proper storage, erection, testing and commissioning of various equipment and maintenance of records". In this regard, the Employer has already prepared Standard Field Quality Plan for transmission line/substation equipments as applicable, Civil/erection works which is required to be followed for associated works.

The Employer or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the bidder/his vendor's quality management and control activities.

7.2 **Quality Assurance Documents**

The Contractor shall be required to submit the following Quality Assurance Documents.

i) All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication, and reports including radiography interpretation reports.

ii) Welder and welding operator qualification certificates.

iii) Welder's identification list, welding operator's qualification procedure and welding identification symbols.

iv) Raw Material test reports on components as specified by the specification and in the quality plan.

v) The manufacturing Quality Plan indicating Customer Inspection Points (CIPs) at various stages of manufacturing and methods used to verify that the inspection and testing points in the quality plan were performed satisfactorily.

vi) Factory test results for testing required as per applicable quality plan/technical specifications/GTP/Drawings etc as applicable.

viii) Stress relief time temperature charts/oil impregnation time temperature charts, wherever applicable.

8.0 INSPECTION, TESTING & INSPECTION CERTIFICATE

8.1 The Employer, his duly authorised representative and/or outside inspection agency acting on behalf of the Employer shall have at all reasonable times access to the Contractor's premises or Works and shall have the power 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 at other premises or works, the Contractor shall obtain for the Employer 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. The equipment if found unsatisfactory as to workmanship or material is liable to be rejected.

8.2 The Employer reserves the right to witness any or all type, acceptance and routine tests specified for which at least 30 days notice in advance shall be given by the Contractor. Contractor shall ensure before giving notice for type test that all drawings and quality plans have been got approved. The equipment shall be dispatched to site only after approval of Routine and Acceptance test results and Issuance of Dispatch Clearance in writing by the Employer.

8.3 The Contractor shall give the Employer/Inspector Twenty one (21) days written notice of any material being ready for testing far each stage of testing as identified in the approved quality plan as customer inspection point. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Employer/inspector, unless witnessing of the tests is waived, will attend such tests within Twenty one (21) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector six copies of tests, duly certified.

8.4 The Employer or Inspector shall, within Twenty (21) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Employer/Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

8.5 When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Employer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Employer/Inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Employer/Inspector. Failure of the Employer/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 certificate shall not bind the Employer to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract.

8.6 In all cases where the Contract provides for tests whether at the premises or works of the Contractor or of any Sub- Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour,

materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Employer/Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Employer/Inspector or to his authorised representative to accomplish testing.

8.7 The inspection and acceptance by Employer 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, or if such equipment is found to be defective at a later stage.

8.8 Material Inspection clearance certificate (MICC) shall be issued by the Employer after inspection of the equipment. Employer may waive off the presence of Employer's inspecting engineer. In that case test will be carried out as per approved QP and test certificate will be furnished by the supplier for approval. MICC will be issued only after review and approval of the test reports.

8.9 The Employer will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

8.10 The Employer reserves the right for getting any field tests conducted on the completely assembled equipment at site.

9.0 ENGINEER'S SUPERVISION

a) To eliminate delays and avoid disputes and litigation it is agreed between the parties to the Contract that all matters and questions shall be referred to the Engineer and without prejudice to the provision of Section GCC, the contractor shall proceed to comply with the Engineer's decision.

b) The work shall be performed under the direction and supervision of the Engineer. The scope of the duties of the Engineer, pursuant to the contract, will include but not be limited to the following :

i) Interpretation of all the terms and conditions of these documents and specifications ;

ii) Review and interpretation of all the Contractor's drawings, engineering data etc. ;

iii) Witness or authorise his representative to witness tests and trial either at the manufacturer's works or at site, or at any place where work is performed under the Contract ;

iv) Inspect, accept or reject any equipment, material and work under the Contract ;

v) Issue certificate of acceptance and/or progressive payment and final payment certificates ;

vi) Review and suggest modifications and improvements in completion schedules from time to time ; and

vii) Supervise the quality Assurance programme implementation at all stages of the Works.

10.0 TESTS

10.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective sections and shall be included in the Contractor's quality assurance programme.

10.2 Commissioning Tests

a) The available instrumentation and control equipment will be used during such tests and the Purchaser will calibrate, all such measuring equipment and devices as far as practicable.

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

c) The specific tests to be conducted on equipment have been brought out in the respective sections of the technical specification.

10.3 Test Codes

The provisions outlines in the IS & IEC codes or other international and Indian approved equivalents shall generally be used as a guide for all the above test procedures unless otherwise specified in the Technical Specifications.

11.0 HANDLING, STORING AND INSTALLATION

a) In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Employer or his representative, the Contractor shall unload, store, erect, install, wire,

test and place into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

b) Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

c) In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Employer. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

d) Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

e) The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Employer in an operating condition after commissioning. Con tractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Employer, as well as protection of the same against theft, element of nature, corrosion, damages etc.

f) Where material/equipment is unloaded by Employer before the Contractor arrives at site or even when he is at site, Employer by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.

g) Contractor shall be responsible for the proper storage and maintenance of all materials/equipment entrusted to him. He shall take all required steps to carry out frequent inspection of material/equipment stored as well as erected until the same is taken over by the Employer.

h) The words 'erection' and 'installation' used in the specification are synonymous.

i) Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

j) Clearances and spacings shall be provided as per relevant IS.

Bidder shall confirm in their technical offer that all clearances and spacing as stated above will invariably be provided. Even though phase to earth clearance under normal conditions will be as above at certain points where there can be bird faults (i.e. a bird sitting on the earthed metal part coming in contact with the HT terminal) adequate clearance as required shall be provided between the HT terminal and nearest grounded metal part.

12.0 TAKING OVER

Upon successful completion of all the tests to be performed at Site on equipment furnished and erected by the Contractor, the Engineer shall issue to the contractor a taking over certificate as a proof of the final acceptance of the equipment. such certificate shall not unreasonably be withheld nor will the Engineer delay the issuance thereof on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

13.0 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with protecting device. All ends of equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

14.0 PRESERVATIVE SHOP COATING

14.1 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 beforehand be treated and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scale, oxide 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 with at least two coats of primer. Transformers and other electrical equipment, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colours shall be selected and specified by the Employer at a later date.

14.2 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 deg.C. 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 temperatures higher than 95 deg.C. and such primers shall also be subject to the approval of the Employer.

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

15.0 PROTECTIVE GUARDS

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

16.0 DESIGN CO-ORDINATION

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

17.0 DESIGN CO-ORDINATION MEETING

The Contractor will be called upon to attend design co-ordination meetings with the Employer, other Contractor’s and the Consultants of the Employer during the period of Contract. The Contractor shall attend such meetings at his own cost at New Delhi or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

18.0 BUS POST INSULATORS

The post insulators shall conform in general to latest IS:2544, IEC-168 and IEC-815.

CONSTRUCTIONAL FEATURES

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

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

18.3 Glazing of the porcelain shall be of uniform brown in colour, free from blisters, burrs and other similar defects.

18.4 The insulator shall have alternate long and short sheds with aerodynamic profile. The shed profile shall also meet the requirements of IEC-815 for the specified pollution level.

18.5 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 insulators by the formation of substance produced by chemical action.

18.6 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

18.7 All ferrous parts shall be hot dip galvanised in accordance with the latest edition of IS:2633 and IS :4579. The zinc used for galvanising shall be grade Zn 99.95 as per IS:209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The metal parts shall not produce any noise generating corona under the operating conditions.

18.8 If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the Contractor.

18.9 **Tests**

The post insulators shall be subject to type, acceptance, sample and routine tests as per IS:2544 and IEC-168.

18.10 TECHNICAL REQUIREMENTS FOR BUS POST INSULATORS

a)	Type	:	Solid Core
b)	Voltage class (kV)	:	420
c)	Dry & wet one minute power frequency withstand voltage (kV rms)	:	680
d)	Dry lightning impulse withstand voltage (kVp)	:	$\pm$1425

e)	Wet switching surge withstand voltage (kVp)	:	±1050
f)	Max. radio interference voltage (in microvolts) at voltage of 305 KVrms between phase to ground	:	1000
g)	Corona extinction voltage (kV rms)		320 (Min.)
h)	Total minimum cantilever strength (kg)		800
i)	Minimum torsional moment		As per IEC-273
j)	Total height of insulator (mm)		3650
k)	Pollution level as per IEC-815		Heavy (III)
l)	Minimum total creepage distance for heavy pollution (mm)		10500

19.0 REQUIREMENT OF AUXILIARY ITEMS

19.1 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS

a) 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: 5621/IEC:61264, as applicable. The support insulators shall be manufactured and tested as per IS:2544/IEC:168 and IS:2099/IEC:273. The insulators shall also conform to IEC:815 as applicable.

b) Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, 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.

c) Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

d) 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.

e) When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio

interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

f) Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and 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.

g) All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up 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.

h) **TESTS :**

In accordance with the requirements stipulated, bushings, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS : 2099 & IS : 2544.

i) Parameters of bushings/Hollow column insulators/support insulators :

a)	Rated Voltage	:	420 kV*****
b)	Impulse withstand voltage (Dry & Wet)	:	± 1425 kVp*****
c)	Switching surge withstand voltage(Dry & Wet)	:	± 1050 kVp*****
d)	Power frequency with-stand voltage	:	630 kVrms*****
e)	Total creepage distance	:	25mm/kV*****
f)	Pollution level	:	Class-III : Heavy (as per IEC-71)

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

NOTE : * The equipment rating is only indicative. Appropriate rating equipment may be supplied if so required in view of the series capacitor requirement.

19.2 **CONTROL PANELS, RELAY PANELS, CABINETS, JUNCTION BOXES, TERMINAL BOXES, MARSHALING BOXES AND MARSHALING KIOSKS:**

a) All types of boxes, cabinet/panels shall generally conform to IS : 5039, IS : 8623, IEC : 439, as applicable and the clauses given below :

b) Control cabinet/panels, junction boxes, Marshaling box & terminal boxes shall be sheet steel/Al. enclosed and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled/2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of Al. enclosed box the thickness of Al. shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

c) The enclosures of all outdoor type control cabinets/panel, junction boxes, terminal box & marshaling boxes shall provide a degree of protection of not less than IP 55 as per IS : 13947 and the same for indoor type enclosures shall be IP 31 as per IS : 13947and one control cabinet/panel, junction box, terminal box & marshaling box of each type shall be tested for the same, if the type test reports submitted are not to the satisfaction of the owner.

d) Control cabinet/panels, junction boxes, marshaling box & terminal box shall be provided with padlocking arrangements.

e) All doors, removable covers and plates shall be gasketed all around with neoprene gaskets. The neoprene gasket shall be tested in the presence of Employer’s representative.

f) All sheet steel work shall be degreased, pickled, phosphated and then applied with two coats of zinc chromate primer and two coats of finishing synthetic enamel paint. The colour of finishing paint shall be light admiralty grey in accordance with shade No. 697 of IS : 5 outside and inside shall be glossy white.

g) All terminal boxes, control cabinet/panels, junction boxes & marshaling boxes shall be designed for the entry of cable from bottom by means of weather proof and dust-proof connections. Boxes and cabinet/panels shall be so designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet/panel. Suitable cable gland plate on the base of the box shall be provided for this purpose. Necessary number of cable glands of suitable sizes shall be supplied

and fitted on this gland plate. This removable gasketted gland plate shall have provision for spare glands to be used in future. The glands shall project at least 25 mm above the gland plate to prevent the entry of moisture in the cable crutch. The roof of the outdoor cabinet/panels/boxes shall preferably be of sloping design to prevent stagnation of water.

h) Suitable heaters shall be provided in the cabinet/panel, junction boxes & marshaling boxes to prevent condensation. Heaters shall maintain cubicle temperature approximately 10^{o}C above the outside air temperature. The heaters shall be suitable for 240 V AC supply voltage. On-off switch and fuse for this shall be provided.

i) **Terminal Block :**

All internal wiring to be connected to the external equipment shall terminate on terminal blocks, preferably vertically mounted on the side of cabinet/panel, junction box, terminal box and marshaling box.

The terminal blocks shall be made of moulded, non-inflammable thermosetting plastic. The material of terminal block moulding shall not deteriorate because of varied conditions of heat, cold, humidity, dryness, etc. that would be anticipated at the location where the equipment is proposed to be installed.

The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CAT - M4/CST.

The terminal blocks shall be of extensible design.

The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be of ***650*** V grade and shall be rated to carry continuously the maximum current that is expected to be carried by the terminals.

The terminal blocks used for CT circuits shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulting barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

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

All boxes shall be provided with 20 % spare terminals unless otherwise specified.

j) There shall be a minimum clearance of 250 mm between the first row of terminal block and the cable gland plate or side of the box. Also the clearance between two rows of terminal blocks or side of the box shall be a minimum of 150 mm.

k) The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet/panel is live. Cabinet/panel wiring should be suitable for 60°C as the space heaters will keep the temperature 10°C higher than the ambient.

l) **Wiring :**

All wiring shall be carried out with ***650*** V grade, stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows :
i)All circuits except CT circuits – 1.5/ 0.75.00.4 sq.mm (depending on the device current rating)

ii) CT circuits- 4sq mm; minimum no. of strands shall be 3 per conductor.

iii) Wrapping wires shall be used for electronic rack connection.

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

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

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 ferrule purposes.

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.

A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet/panel with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

For illumination of Control cabinet/panel a 20 Watts Fluorescent Tube/Incandescent Lamp shall be provided.

All control switches shall be of rotary switch type or push button type and toggle/piano switches shall not be accepted.

In accordance with the requirements stipulated under this Chapter control cabinet/panels, junction boxes, terminal boxes & marshaling boxes shall conform to type tests and shall be subjected to routine tests in accordance with IS : 5039. In addition to the type tests, verification of the degree of protection as per IS : 13947, shall be conducted, if the type test reports submitted by the Contractor are not to the satisfaction of the owner. After protection degree tests on control cabinet/panel, power frequency voltage of 2.0 kV rms for 1 minute shall be applied for checking insulation resistance and functional test shall also be conducted.

m) **Earthing :**

Positive earthing of the cabinet/panel shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of star or self etching washers. Earthing of hinged door shall be done by using a separate earth wire.

19.3 MOTORS :

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. The motors shall be of approved make.

19.4 TERMINAL CONNECTORS AND CLAMP CONNECTORS :

The Terminal Connectors of all types shall meet the following requirements:

a) Terminal connectors shall be manufactured and tested as per IS: 5561.

b) All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

c) No part of a clamp shall be less than 10 mm thick.

d) All ferrous parts shall be hot dip galvanised conforming to IS: 2633.

e) For bimetallic connectors, copper alloy liner of minimum thickness of 2 mm shall be provided.

f) Flexible connectors shall be made from tinned copper/ aluminium sheets or cables.

g) All current carrying parts shall be designed and manufactured to have minimum contact resistance.

h) Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS: 5561.

i) All test/checks on terminal connectors shall be as per IS: 5561.

19.5 **AUXILIARY SWITCH :**

The type test reports or the following tests on auxiliary switch shall be furnished :

a) Electrical endurance test - A minimum of 2000 operations for 2A DC 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 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.

c) Heat run test on contacts.

d) IR/HV test etc.

ANNEXURE-I

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1. General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona (for 400kV & above) both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV) for 132kV above.

2. 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. 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 -1. 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 results 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 measurements 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%, and 110% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 765kV, 400 kV, 220 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 recommendation 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 voltage read by noisel meter.

4. Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of 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 110% of specified corona

extinction voltage and maintained there for five minutes. In case corona inception does not take place at 110%, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The 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 visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, and 110**%**. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall be such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

For recording purpose, modern devices utilizing UV recording methods such as image intensifier may also be used.

4.1 The test shall be recorded on each photograph. Additional photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.

4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

5. Test Records:

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

a) Background noise before and after test.

b) Detailed procedure of application of test voltage.

c) Measurements of RIV levels expressed in micro volts at each level.

d) Results and observations with regard to location and type of interference sources detected at each step.

e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.

f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

SEISMIC WITHSTAND TEST PROCEDURE

The seismic withstanding test on the complete equipment (for 132kV and above) shall be carried out alongwith supporting structure.

The Bidder shall arrange to transport the structure from his Contractor's premises/POWERGRID sites for the 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 any other point as agreed by the Purchaser. 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.

SECTION -4
TECHNICAL DATA REQUIREMENTS

Control and Relay panels

1 Name & country of Manufacture of panels

2 Manufacturer's type & and designation

3 Type of construction (Simplex / Duplex)

4 Thickness of sheet steel
(I) Front

(ii) Back

(iii) Sides

5 Degree of Protection

6 Name of the manufcaturer of relays

7 DC Voltage of the relays

8 Make and model of static (0.2 accuracy class type) energy meters

9 Confirm whether offered C&R panel manufacturer and protective relays have tested commissioned and they are in successful operation for at least two years in 400kV System

SECTION -4
TECHNICAL DATA REQUIREMENTS

TRANSMISSION LINE PROTECTION

Directional O/C and E/F Relay

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Three over current and one E/F element(s) are whether independent or composite units

4 Type of relay Electromechanical/ static/ Numerical

5 Whether charateristics will confirm to IEC255-3

6 Directional sensitivity

7 Overcurrent unit setting range

   a) Inverse time

   b) High set inst. Unit

8 Earth fault unit setting range

   a) Inverse time

   b) High set inst. Unit

9 VT fuse failure relay/ feature included for Alarm

SECTION -4
TECHNICAL DATA REQUIREMENTS

Line Over voltage Protection relay

1	Name & country of Manufacture
2	Manufacturer type & designation
3	Type of Relay (Electromechanical/ Static Numerical)
4	Operating indicator provided
5	Operating time
6	Resetting time
7	Whether monitors all three phases ?
8	Built in feature of Main 1/Main 2 distance relay is offered. If so which stage is offered as built in

Disturbance Recorder
a. Acquisition unit

1	Name & country of Manufacture
2	Manufacturer's type & and designation
3	No. of Analogue Channels
4	No. of Digital recording Channels
5	Built in feature of Main 1 / Main 2 distance relay offered
6	Pre Fault memory (milli seconds)

SECTION -4
TECHNICAL DATA REQUIREMENTS

7 Post Fault memory (seconds)

8 Total storage memory in seconds

9 Sampling Frequency

10 Resolution of event channels (msec)

11 Time display present?

12 Data output in COMTRADE is available

b. Evaluation Unit

1 Name & country of Manufacture

2 Manufacturer's type & and designation

3 No. of acquisition unit that can be connnected to one evaluation unit

4 Technical paramters of evaluation unit
a. Processor & Speed
b. RAM & Hard Disk Capacity
c. Additional facilities
d. Details of Printer

5 Details of Power supply arrangement for acquistion unit (including printer)

SECTION -4
TECHNICAL DATA REQUIREMENTS

TRANSFORMER PROTECTION

Differential relay

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Second harmonic restraint feature provided ?

4 Whether three instantaneous units provided

5 Operating current setting range

6 Bias setting range

7 Operating time at 5x setting current

8 Resetting time

9 How ratio / phase angle corrections are being done (inter posing transformer / internal feature in the relay)

Restricted Earth Fault Relay

1 Name and country of Manufacturer

2 Manufacturer type and designation

3 Operating time at 2 x setting

SECTION -4
TECHNICAL DATA REQUIREMENTS

Overfluxing relays _____

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Whether inverse time operating charcateristics provided ?

4 Maximum operating time

5 Accuracy operating time

6 Resetting time

Directional O/C and E/F Relay

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Whether charateristics will confirm to IEC255-3

4 Directional sensitivity

5 Overcurrent unit setting range

a) Inverse time

b) High set inst. Unit

6 Earth fault unit setting range

a) Inverse time

b) High set inst. Unit

SECTION -4
TECHNICAL DATA REQUIREMENTS

REACTOR PROTECTION

Differential relay

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Second harmonic restraint feature provided ?

4 Whether three instantaneous units provided

5 Operating current setting range

6 Bias setting range

7 Operating time at 5x setting current

8 Resetting time

9 How ratio / phase angle corrections are being done (inter posing transformer / internal feature in the relay)

Restricted Earth Fault Relay

1 Name and country of Manufacturer

2 Manufacturer type and designation

3 Operating time at 2 x setting

SECTION -4
TECHNICAL DATA REQUIREMENTS

Back up Impedance Protection Relay

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Whether charateristics will confirm to IEC255-3

4 Directional sensitivity

5 Overcurrent unit setting range

a) Inverse time

b) High set inst. Unit

6 Earth fault unit setting range

a) Inverse time

b) High set inst. Unit

GENERAL PROTECTION / MONITORING EQUIPMEMT

Trip circuit supervision relay

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Whether preclosing and post closing supervision provided ?

4 Time delay

SECTION -4
TECHNICAL DATA REQUIREMENTS

High Speed Trip Relays

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Contacts ratings
- a) Make & carry continously
- b) Make & carry for 0.5 sec
- c) Break
  - I. Resistive load
  - ii. Inductive load (With L/R = 40 msec)

4 Operating time at rated voltage (maximum)

5 Resetting time

6 Whether supervisory relays included

SECTION -4
TECHNICAL DATA REQUIREMENTS

Local Breaker Back - up protection

1 Name & country of Manufacture

2 Manufacturer type & designation

3 Operating time

4 Resetting time

5 Setting range
- (I) Current
- (ii) Time

SECTION 5

List of Enclosures with Technical Specification:

1. **Annexure-II** - Technical specification for NTAMC SCADA System
2. **Single Line Diagrams for ERSS-IX**:

(a) SLD of Extension of 400kV Rourkela Substation Drwg no.- TB-3-370-316-001 Rev 00
(b) SLD of Extension of 400kV Gazuwaka Substation Drwg no.- TB-3-370-316-002 Rev 00
(c) SLD of Extension of 400kV Biharshariff Substation Drwg no.- TB-3-370-316-003 Rev 00
(d) SLD of Extension of 400kV Rengali Substation Drwg no.- TB-3-370-316-004 Rev 00
(e) SLD of Extension of 400kV Jamshedpur Substation Drwg no.- TB-3-370-316-005 Rev 00
(f) SLD of Extension of 400kV Durgapur Substation Drwg no.- TB-3-370-316-006 Rev 00
(g) SLD of Extension of 400kV Gorakhpur Substation Drwg no.- TB-3-370-316-007 Rev 00

NTAMC SCADA SYSTEM

Annexure- II

1. **Signal List** - A typical list of signals to be provided to the NTAMC control centers shall be given to successful Bidder during detailed engineering. The contractor shall provide all these signals either through the BCU or through the numerical relays over IEC 61850 protocol and integrate with the Gateways/RTU under NTAMC project.

2. **Control Panel:** The conventional control panels are to be augmented with provision of Bay control unit with one BCU per bay. The Bay control unit shall provide telemetry and tele-control for remote operation from NTAMC control centers. The Bay control unit shall acquire all the analog measurements, Status of Circuit breakers, Isolators and Earth switches, status of alarms, and provide Control of devices (Circuit breaker/Isolators/Reset of Relays/position selection for Auto reclose etc).

   The Bay control unit shall also provide synchronization check facility for the circuit breakers suitable for the bus bar scheme. It shall allow synchronization between the Bus-1 & Line, Bus-2 & Line, Bus-1 & Bus-2, Line-1 & Line-2 for a 400kV Scheme One and Half breaker scheme and Bus-1 & Line, Bus-2 & Line for 220 /132 kV DMT / Double Main Scheme. The Bay control unit can optionally have other provisions such as auto-reclose inbuilt into it as per design of the manufacturer. The Bay control unit shall communicate over IEC 61850 protocol to the Gateway/RTU provided under NTAMC project.

   A Local/Remote selection shall be provided to transfer the control between the BCU and the Control panel. The control shall be available to either the BCU or from the Control panel however data monitoring shall be available at both the devices.

   The Bay control unit shall be flush mounted in the Control panel with their mimic displays accessible from the front of the panel. The Bay control unit mimic shall dynamically represent the current value of the measurements, state of the devices and control of devices. The control panel shall have control switches, status indication lamp, semaphores, and synchronization sockets. The indicating meters shall be optimized by having only one voltmeter, one ammeter with selection for any of the three phases (R-Y/Y-B/B-R or R/Y/B).MW /MVAR/Temperature displays are not required. The conventional annunciation panel is not required but an annunciation system (One annunciation lamp and one hooter) shall be provided and each of the BCU shall energize this annunciation on occurrence of alarms.

3. **Local HMI** - No local HMI is required for control of the BCUs however all configuration and maintenance software for the BCUs and numerical relays are to be provided.

4. **Event Logger**- Separate hardware for Event Logging for the new bays is not required. However, the event logging provision shall be configured in the existing Gateways/RTU/SDC under NTAMC Project.

5. **Numerical Relays**: The numerical relays shall communicate all the status/events related to protection over IEC 61850 protocol to the existing redundant Gateways/RTU. The numerical relays shall all be connected on a IEC 61850 Substation LAN to be provided by the contractor.

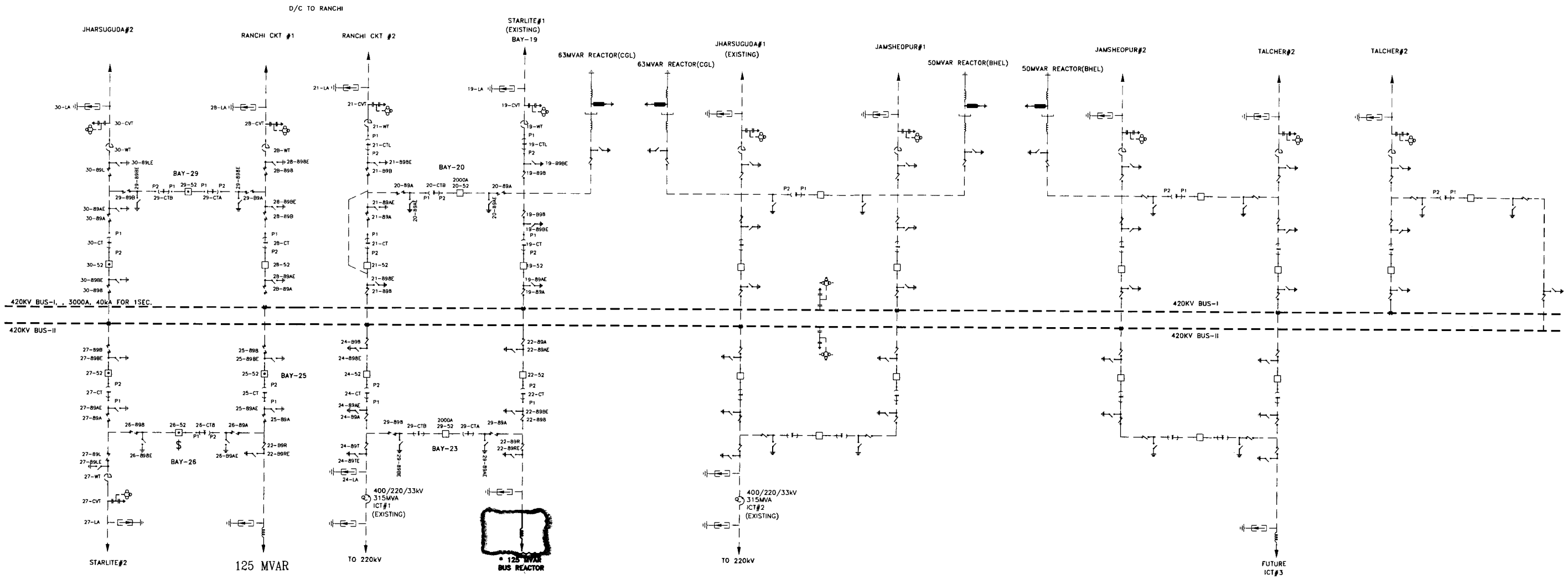
6. **Disturbance recorder**- Both the Main-1/Main-2 numerical relays for a transmission line/ICT/Reactor shall be provided with disturbance recorder facility. DR facility to be provided in the backup impedance protection relay for Reactor. These shall be communicated to the existing Redundant Station Data Concentrator (SDC) of NTAMC system over IEC 61850 protocol. The DR channels are to be configured in a particular sequence which shall be provided by POWERGRID to the successful bidder.

7. **Substation LAN switch** – The Bay Control unit and the numerical relays shall be connected to new substation LAN switch(s) (managed switch) to be supplied by the contractor. The substation LAN switch shall comply with IEC 61850-3 requirements. It shall have sufficient number of ports to accommodate all the IEDs of the new bays and at least 6 spare ports for integrating the numerical Relays/BCUs with NTAMC system i.e. redundant Gateways/RTU and redundant SDC and two spare ports. The IP addressing scheme for the devices shall be provided by POWERGRID.

8. **Auto reclose position selection –**Auto-reclose position selection between single phase auto and Non-Auto mode shall be provided from local as well as through BCU from Remote SCADA system. The selected position shall not change if the BCU/numerical relay's power is cycled.

9. **Protection transfer switch for DMT schemes-** The High Speed Bi-stable relays for protection transfer from 'Normal' to 'Transfer' and vice versa, whose position can be controlled locally as well as from remote through SCADA system shall be provided. The position once selected should not change in case of Power cycling.

10. Procurement of Camera for the substation is to be done as per the specification enclosed.



BILL OF QUANTITY

Sl.No.	DESCRIPTION	QTY.	SYMBOL
1	125 MVAR BUS REACTER 420kV, 3-ph	1	
2	336kV, SURGE ARRESTER (1-PH)	0	

LEGEND:-

PRESENT SCOPE

---------EXISTING/FUTURE SCOPE

NOTE-

1. * EXISTING 50 MVAR BUS REACTOR SHALL BE REPLACED BY 125 MVAR BUS REACTOR
2. 336KV LA OF EXISTING 50 MVAR BUS REACTOR SHALL BE UTILISED FOR 125 MVAR BUS REACTOR UNDER PRESENT SCOPE

FOR TENDER PURPOSE ONLY.

RECOMMENDED	
DGM(ENGG-S/S)	10/7/13
AGM(ENGG-CTU)	
AGM(ENGG-S/S)	10/7/13
GM(ENGG-S/S)	15.7.13
APPROVED	
ED(ENGG-S/S T/L)	16/7/13

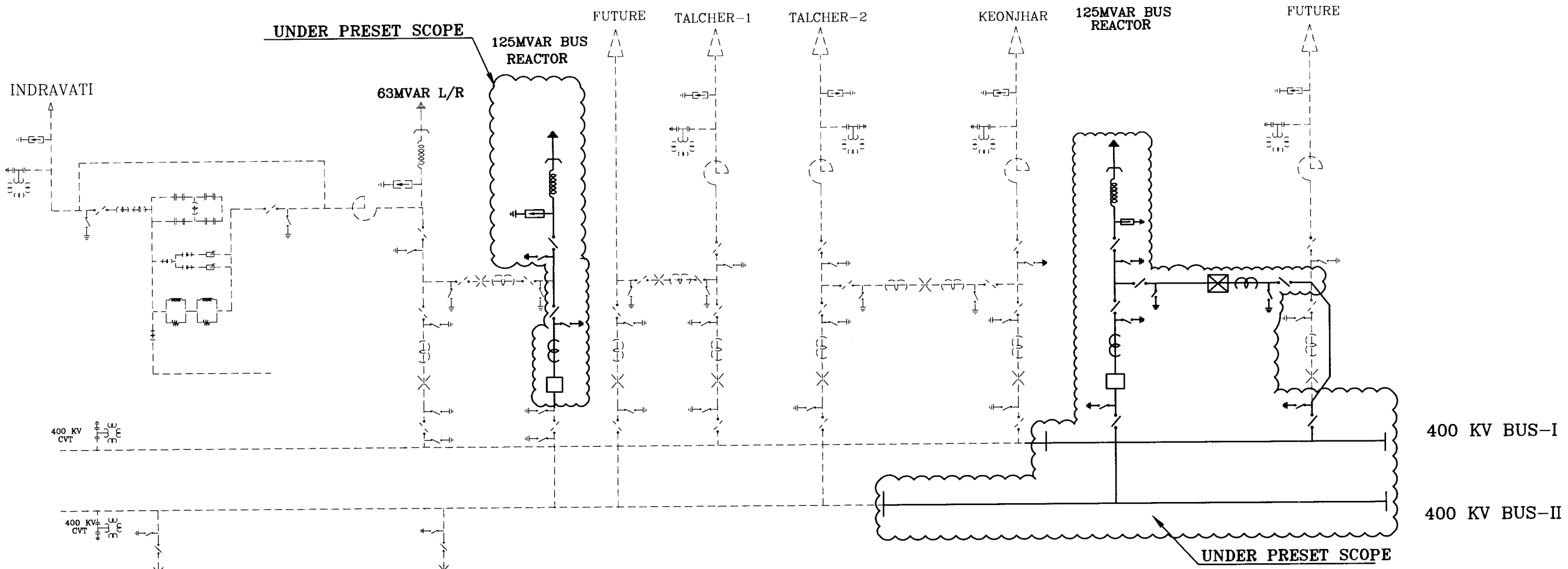
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: EASTERN REGION STRENGTHENING SCHEME-IX (PROJECT ID 393)

SUBSTATION: EXTN.OF 400KV ROURKELA S/STN. EXTN.

TITLE: SINGLE LINE DIAGRAM

DATE	PRPD.	CHKD.	DRG.NO.	REV
9/7/13			C/ENGG/ER-II/ROK/ERSS-IX/SLD/01	0



BILL OF QUANTITY - 400KV,40kA for 1 SEC.			
SL.	ITEM DESCRIPTION	QTY.	SYMBOL
1	125 MVAR BUS REACTER 420kV, 3-ph	2	
2	400kV,3150A Circuit Breaker(3-ph) WITH CR WITH CONTROLLED SWITCHING DEVICE.	1	
3	400kV,3150A Circuit Breaker(3-ph) WITHOUT CR WITH CONTROLLED SWITCHING DEVICE.	2	
4	400kV,3000A CT (1-ph) (with 120% extended current rating)	9	
5	400kV,3150A isolator with one E/S (3-Ph)(Double Break)	8	
6	336kV, SURGE ARRESTER (1-PH)	6	

LEGEND :

UNDER PRESENT SCOPE	
EXISTING/FUTURE	------

RECOMMENDED	
DGM(ENGG-S/S)	10/7/13
AGM(ENGG-CTU)	
AGM(ENGG-S/S)	10/7/13
GM(ENGG-S/S)	15.7.13
APPROVED	
ED(ENGG-S/S T/L)	16/7/13

FOR TENDER PURPOSE ONLY.

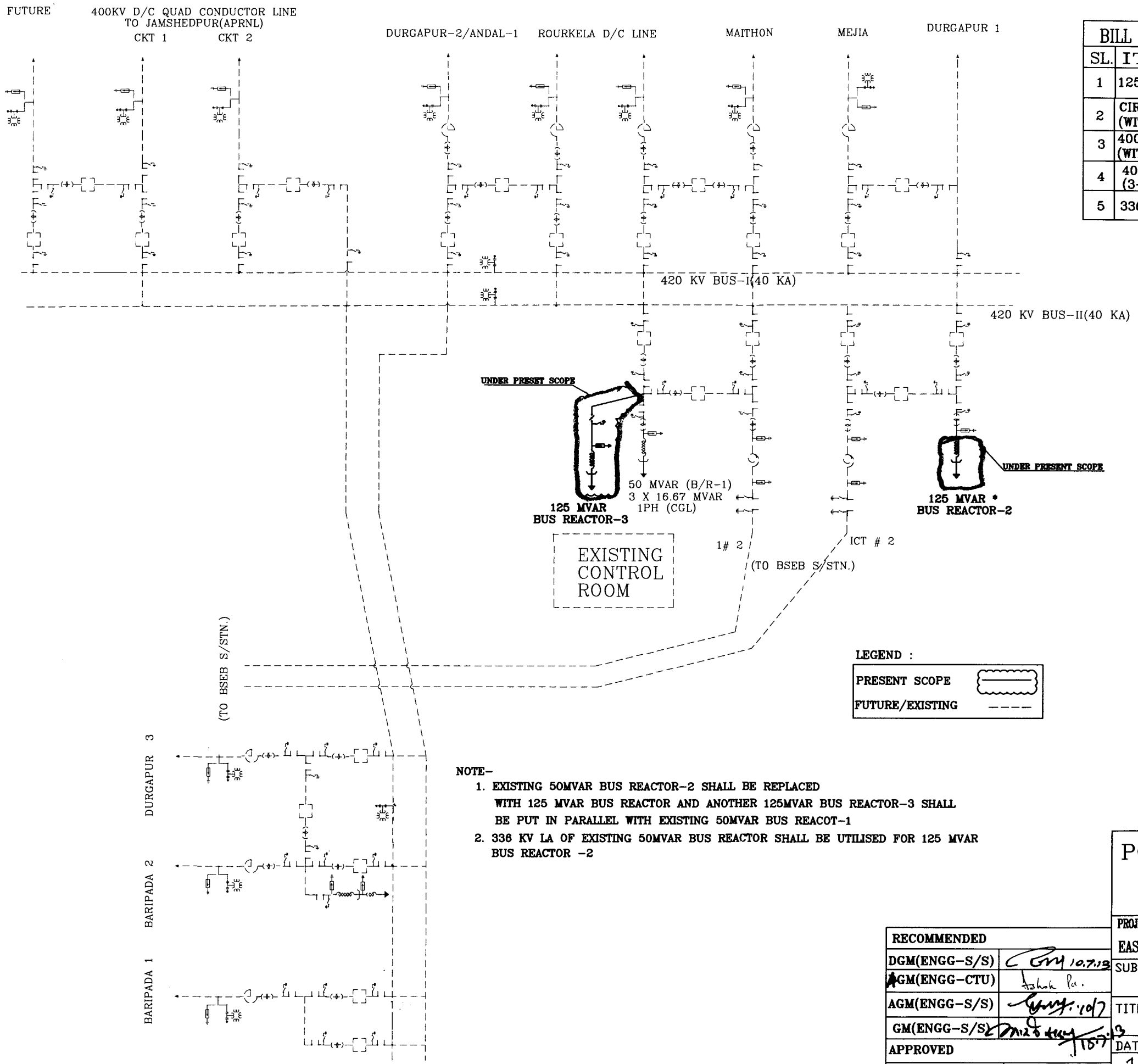
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: EASTERN REGION STRENGTHENING SCHEME-IX (PROJECT ID 393)

SUBSTATION: 400KV RENGALI S/STN. EXTN.

TITLE: SINGLE LINE DIAGRAM

DATE	PRPD.	CHKD.	DRG.NO.	REV
9/7/13			C/ENGG/ER-II/RGN/ERSS-IX/SLD/01	0



BILL OF QUANTITY – 400KV,40kA for 1 SEC.			
SL.	ITEM DESCRIPTION	QTY.	SYMBOL
1	125 MVAR BUS REACTER 420kV, 3-ph	2	
2	CIRCUIT BREAKER WITH OUT PIR(3-PH) (WITH CONTROLLED SWITCHING DEVICE.)	–	
3	400kV,3000A CT (1-ph) (WITH 120% EXTENDED CURRENT RATING)	–	
4	400KV,3150A ISOLATOR WITH ONE E/S (3-Ph)(DOUBLE BREAK)	1	
5	336kV, SURGE ARRESTER (1-PH)	3	

LEGEND :

PRESENT SCOPE	
FUTURE/EXISTING	----

NOTE–

1. EXISTING 50MVAR BUS REACTOR-2 SHALL BE REPLACED WITH 125 MVAR BUS REACTOR AND ANOTHER 125MVAR BUS REACTOR-3 SHALL BE PUT IN PARALLEL WITH EXISTING 50MVAR BUS REACOT-1
2. 336 KV LA OF EXISTING 50MVAR BUS REACTOR SHALL BE UTILISED FOR 125 MVAR BUS REACTOR -2

FOR TENDER PURPOSE ONLY.

POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

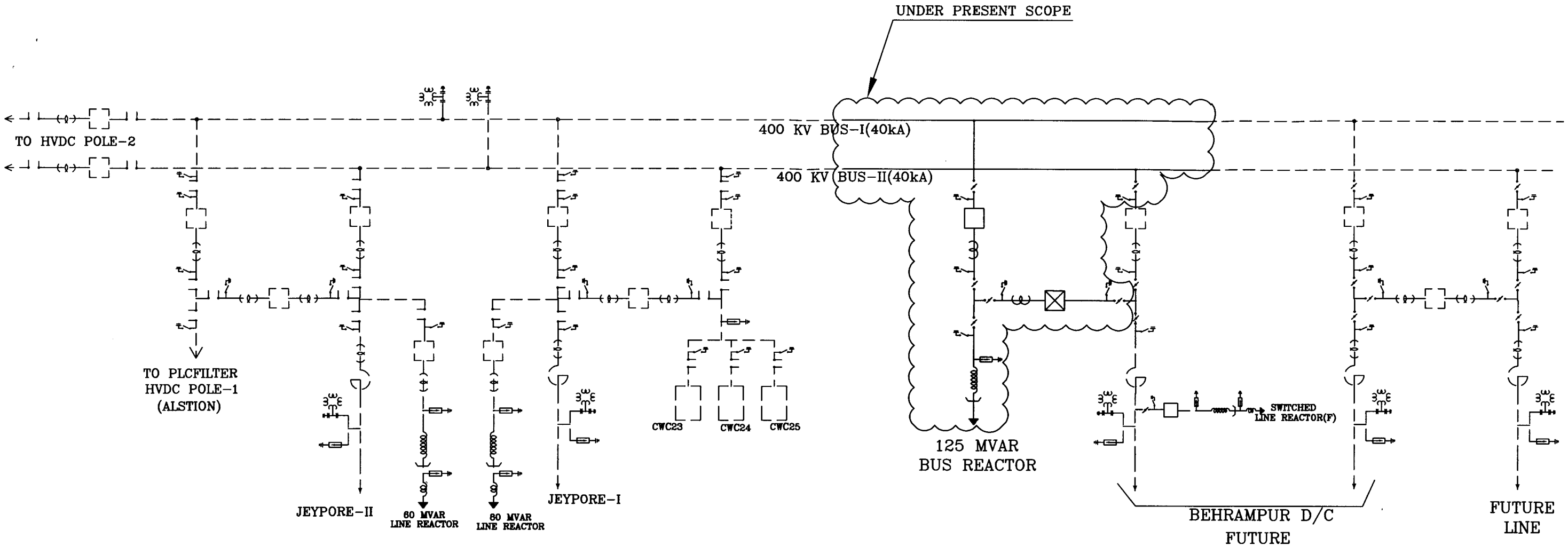
RECOMMENDED	
DGM(ENGG-S/S)	10.7.13
AGM(ENGG-CTU)	
AGM(ENGG-S/S)	10/7
GM(ENGG-S/S)	10.7.13
APPROVED	
ED(ENGG-S/S T/L)	

PROJECT: EASTERN REGION STRENGTHENING SCHEME-IX (PROJECT ID 393)

SUBSTATION: EXTN.OF 400KV JAMSHEDPUR S/STN. EXTN.

TITLE: SINGLE LINE DIAGRAM

DATE	PRPD.	CHKD.	DRG.NO.	REV
9/7/13			C/ENGG/ER-II/JMP/ERSS-IX/SLD/01	0



BILL OF QUANTITY–400kV			
SL. NO.	ITEM DESCRIPTION	SYMBOL	BOQ
1	125 MVAR BUS REACTOR (3–ph) WITH		1
2	CIRCUIT BREAKER with Closing Resistor 3150A, 40KA, 1SEC. (3–ph) (WITH CONTROLLED SWITCHING DEVICE.)		1
3	CIRCUIT BREAKER without Closing Resistor 3150A, 40KA, 1SEC. (3–ph) (WITH CONTROLLED SWITCHING DEVICE.)		1
4	ISOLATOR WITH 1 EARTH SWITCH (3–ph) 3150A, 40KA , 1SEC (DOUBLE BREAK)		6
5	CURRENT TRANSFORMER(1–ph) 3000A/1A, 120% extended current rating, 40KA, 1SEC.		6
6	SURGE ARRESTER(1–ph) 336 kV		3

LEGEND :

PRESENT SCOPE	
FUTURE/EXISTING	---

FOR TENDER PURPOSE ONLY.

RECOMMENDED	
DGM(ENGG–S/S)	10/7/13
AGM(ENGG–CTU)	
AGM(ENGG–S/S)	11/7/13
GM(ENGG–S/S)	15/7/13
APPROVED	
ED(ENGG–S/S T/L)	

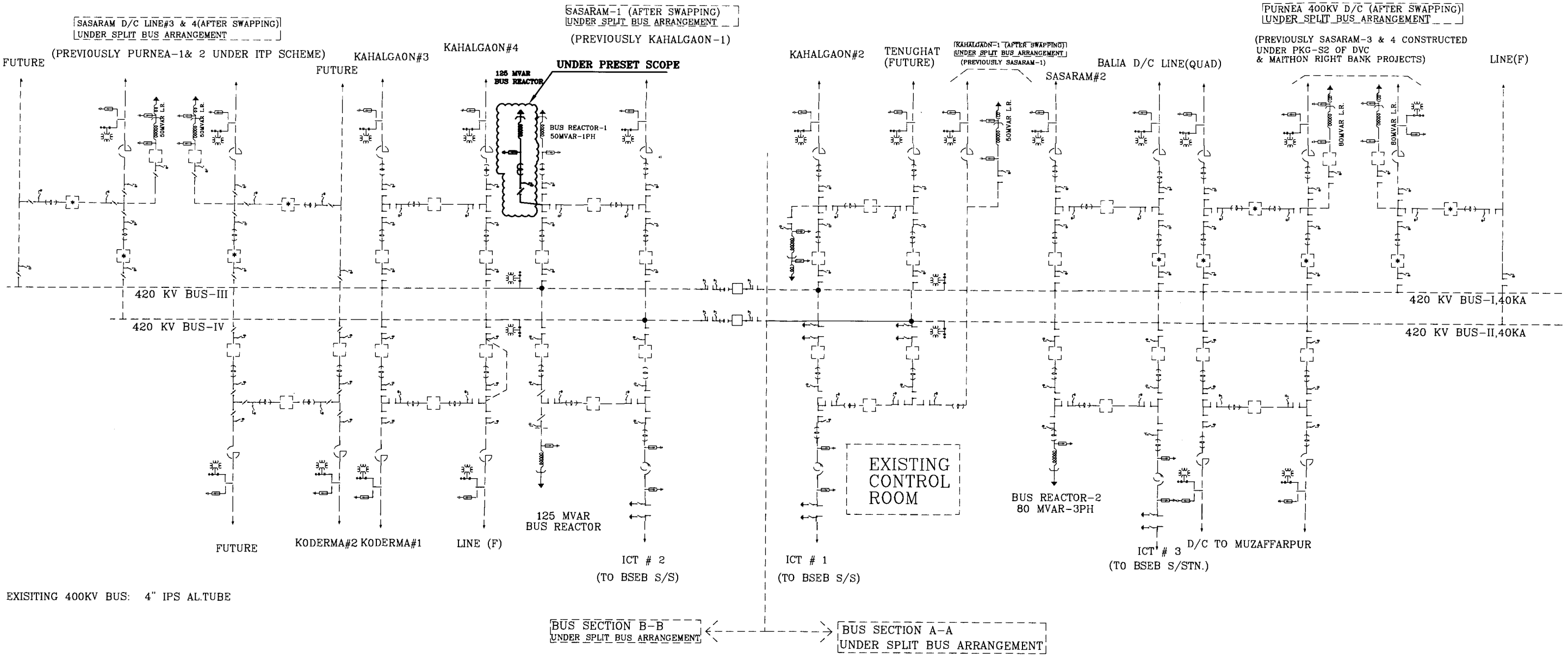
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: EASTERN REGION STRENGTHENING SCHEME–IX (PROJECT ID 393)

SUBSTATION: 400KV GAZUWAKA S/STN.EXTN.

TITLE: SINGLE LINE DIAGRAM

DATE	PRPD.	CHK'D.	DRG.NO.	REV
9/13			C/ENGG/ER–II/GZK/SLD/01	0



EXISITING 400KV BUS: 4" IPS AL.TUBE

BILL OF QUANTITY - 400KV,40kA for 1 SEC.			
SL.	ITEM DESCRIPTION	QTY.	SYMBOL
1	125 MVAR BUS REACTOR (3-ph)	1	
2	400kV,3000A Circuit Breaker(3-ph) (without Closing Resistor)	—	
3	400kV,3000A CT (1-ph) (with 120% extended current rating)	3	
4	400kV,3150A isolator with one E/S (3-Ph)	1	
5	336 kV SURGE ARRESTER(1-ph)	3	

LEGEND :

PRESENT SCOPE	
FUTURE / EXISTING	- - - - - -

NOTE-

1. ONE NO. 420KV,125MVAR BUS REACTOR SHALL BE PUT IN PARALLEL WITH EXISTING 50MVAR BUS REACTOR

RECOMMENDED		
DGM(ENGG-S/S)		10/7/13
AGM(ENGG-CTU)		
AGM(ENGG-S/S)		11/7/13
GM(ENGG-S/S)		
APPROVED		15.7.13
ED(ENGG-S/S T/L)		16/7/13

FOR TENDER PURPOSE

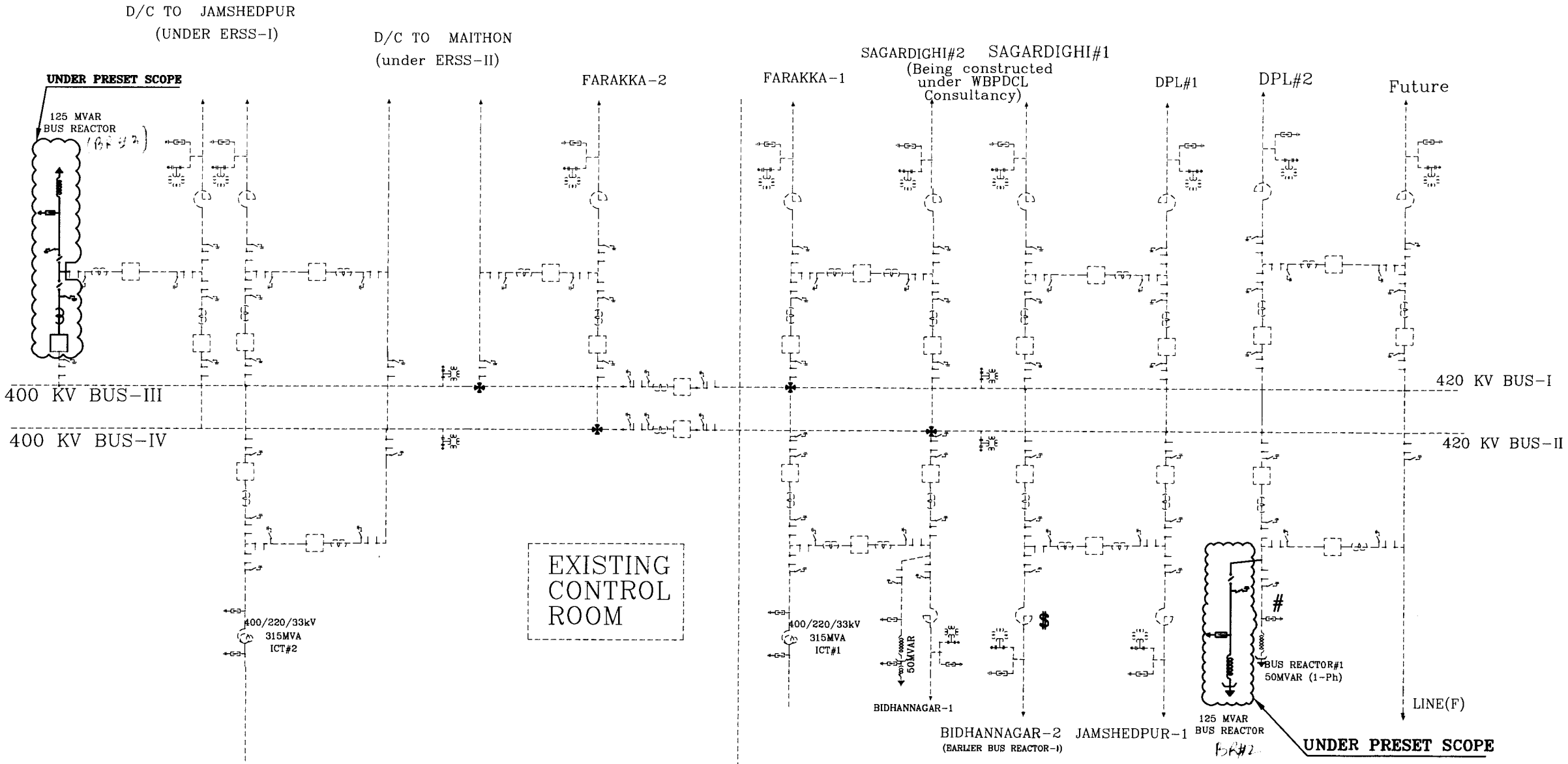
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT:
EASTERN REGION STRENGTHENING SCHEME-IX (PROJECT ID 393)

SUBSTATION:
EXTN.OF 400KV BIHARSHARIFF S/STN.EXTN

TITLE:
SINGLE LINE DIAGRAM

DATE	PRPD.	CHKD.	DRG.NO.	REV
			C/ENGG/ER-I/BHRF/ERSS-IX/SLD/01	0



BILL OF QUANTITY - 400KV,40kA for 1 SEC.			
SL.	ITEM DESCRIPTION	QTY.	SYMBOL
1	125 MVAR BUS REACTER 420kV, 3-ph	2	
2	CIRCUIT BREAKER WITH OUT PIR(3-PH) (WITH CONTROLLED SWITCHING DEVICE.)	1	
3	400kV,3000A CT (1-ph) (WITH 120% EXTENDED CURRENT RATING)	3	
4	400KV,3150A ISOLATOR WITH ONE E/S (3-Ph)(DOUBLE BREAK)	3	
5	400KV,3150A ISOLATOR WITH ONE E/S (3-Ph)(DOUBLE BREAK)	-	
6	336kV, SURGE ARRESTER (1-PH)	6	

LEGEND :

UNDER PRESENT SCOPE	
EXISTING/FUTURE	

NOTE- 1. THE BUS REACTOR PRESENTLY LOCATED AT BAY $ IS BEING SHIFTED AT BAY LOCATION # IN A SEPARATE CONTRACT
FURTHER LINE EQUIPMENTS LA, CVT, LINE TRAPS PRESENTLY AT LOCATION # IS BEING SHIFTED AT BAY LOCATION $ IN A SEPARATE CONTRACT

RECOMMENDED	
DGM(ENGG-S/S)	10/7/13
DGM(ENGG-CTU)	
AGM(ENGG-S/S)	11/7/13
GM(ENGG-S/S)	15.7.13
APPROVED	
ED(ENGG-S/S T/L)	

FOR TENDER PURPOSE ONLY.

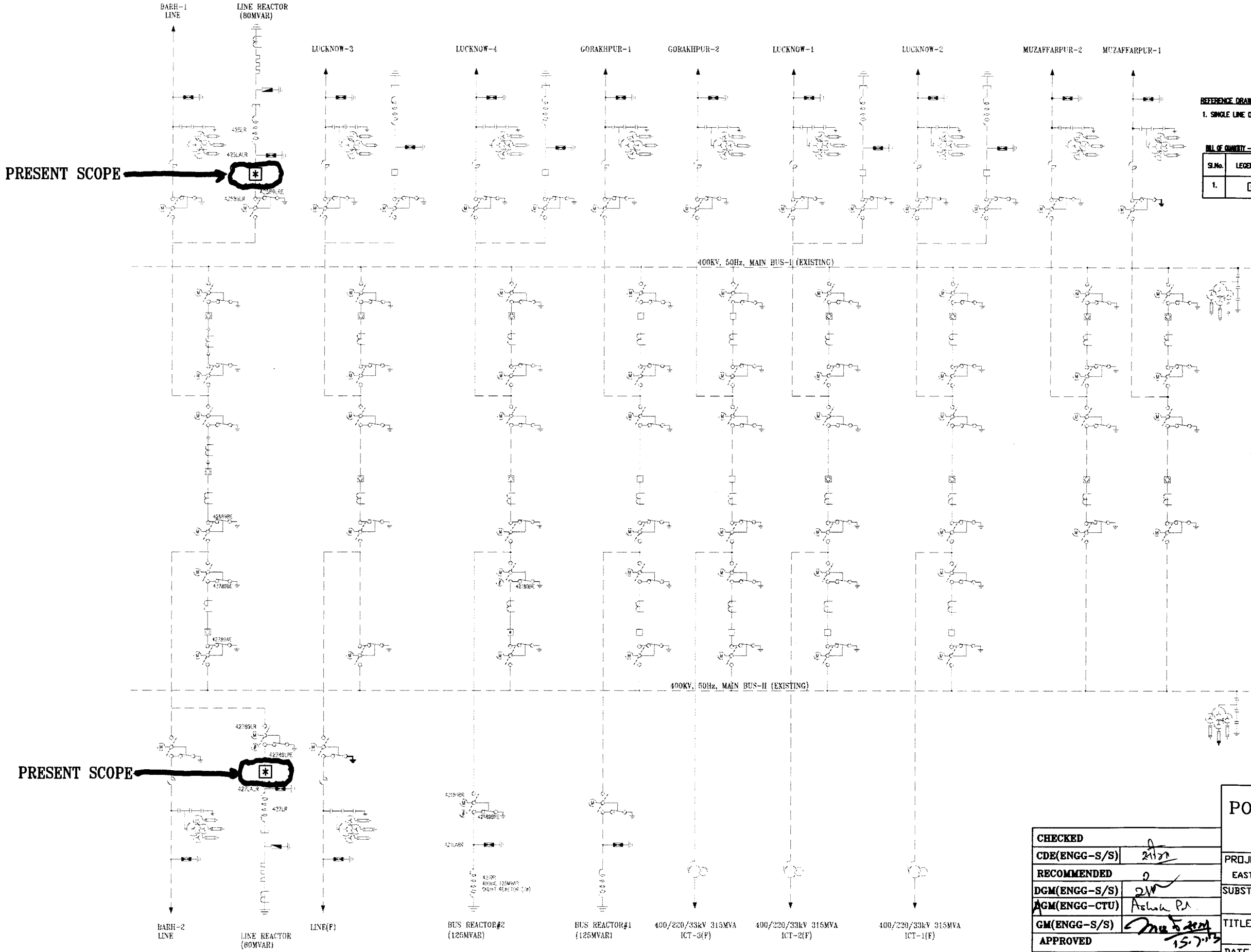
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: EASTERN REGION STRENGTHENING SCHEME-IX (PROJECT ID 393)

SUBSTATION: EXTN. OF 400KV DURGAPUR S/STN. EXTN.

TITLE: SINGLE LINE DIAGRAM

DATE	PRPD.	CHKD.	DRG.NO.	REV
9/7/13			C/ENGG/ER-II/DRP/ERSS-IX/SLD/01	0



REFERENCE DRAWING(S) & T)

1. SINGLE LINE DIAGRAM, DRG. No: 012058-E-SY-SY-1L-2001 REV A

BILL OF QUANTITY - 400 kV

Sl.No.	LEGEND	DESCRIPTION	QUANTITY
1.	⊡	420kV, 2000A, 3Φ, 50Hz, 40kA FOR 1Sec. SF6 CIRCUIT BREAKER WITHOUT CR & WITH CONTROLLED SWITCHING RELAY	2 Nos.

LEGEND

UNDER PRESENT SCOPE

FUTURE/EXISTING

FOR TENDER PURPOSE

CHECKED	
CDE(ENGG-S/S)	
RECOMMENDED	
DGM(ENGG-S/S)	
AGM(ENGG-CTU)	
GM(ENGG-S/S)	
APPROVED	
ED(ENGG-S/S CIVIL T/L)	

POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: EASTERN REGION STRENGTHENING SCHEME - IX (PROJECT ID 393)

SUBSTATION: 400KV GORAKHPUR SUBSTATION(EXTN.)

TITLE: SINGLE LINE DIAGRAM

DATE	DRAWN	DRG.NO.	REV.
JULY 2013		C/ENGG/NR-I/GKP/ERSS-IX/SLD/01	0