BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP, (MATERIALS MANAGEMENT)
Integrated Office Complex, 3rd Floor,
Lodhi Road, New Delhi – 110 003, INDIA
Phone: 011 – 41793299, Fax: 011 - 24365869
Email :smmittal@bhelindustry.com

TENDER ENQUIRY NO.: **E - 4583195** **DATE : 20/10/2008**

DUE ON DATE : 19/12/2008 **TIME : 10.15 Hrs. (IST)**

PROJECT : 1 X 500 MW UNIT-6 UKAI TPS- 420/220KV SUBSTATION, GSECL, UKAI, GUJARAT, INDIA

ITEM : 400KV & 220 KV HT CABLES & ACCESSORIES AS PER CLAUSE 1.2 OF TECHNICAL SPECIFICATION NO. TB-308-316-024

Please find herewith enclosed above mentioned tender enquiry along with following enclosures:

√1. Tender Enquiry
√2. Our Terms and conditions
√3. Schedule of prices (BHEL/TBG/SP/01)
√4. Activity schedule (BHEL/TBG/ATS/01)
√5. Checklist (BHEL/TBG/SOI/01)
√6. Schedule of commercial & technical deviations
√7. Technical Specification
√8. Packing and other erection marks

You are requested to submit your most competitive offer so as to reach us positively by the tender opening date and 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 "TERMS AND CONDITIONS FOR INDIGENOUS TENDER ENQUIRY". INCOMPLETE BIDS AND / OR BIDS NOT COMPLYING WITH TENDER CONDITIONS SHALL BE TREATED AS NON RESPONSIVE & ARE LIKELY TO BE IGNORED.

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

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

EXECUTIVE (TBMM) :
NAME : S.P. SINHA
DESIGNATION : DY. MANAGER / TBMM

ACKNOWLEDGEMENT BY TENDERER

We acknowledge the receipt of tender:

a) The offer against subject enquiry shall be submitted by the scheduled date & 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.

(Signature and Seal of Tenderer)

TENDER ENQUIRY NO.: E – 4583195, DATE 20/10/2008

TO
MR. S.M. MITTAL, AGM / TBMM
Fax No. 011 – 24365869

BHARAT HEAVY ELECTRICALS LTD.

(TRANSMISSION BUSINESS GROUP)

GENERAL TERMS AND CONDITIONS FOR ENQUIRY

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.

Sr. No	ENQUIRY NO. E-4583195, DATE 20/10/2008
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 10.15 AM of the due date of opening in **Material Management Division,** **Transmission Business Group,** **BHEL, Integrated Office Complex,** **Lodhi Road, New Delhi – 110 003, India.** **Phone : 091-11- 41793299, Fax :091-11-24365869,** **Email: smmittal@bhelindustry.com** 3. The same shall be opened at 10.30 AM 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. If there is a calculation mistake in multiplication of unit rate with quantity, then the unit rate quoted will be considered for calculation. 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 **Shri Saroj Kumar, Sr. Engineer / TBEM** **BHEL, Integrated Office Complex,** **Lodhi Road, New Delhi – 110 003, India** **Phone : 091-11- 41793480, Fax :091-11-24369509,** **Email: sarojkumar@bhelindustry.com** For any commercial clarification please contact person issuing enquiry. 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.

Sr. No	ENQUIRY NO. E-4583195, DATE 20/10/2008
	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. Withdrawal 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:** **A.** The prices as quoted in price schedule part –II are firm through out the currency of contract. **B.** The break-up of price shall be as under:- **i) Ex-works Price:** FOB price including seaworthy packing and forwarding charges. **ii) Freight & Insurance:** Freight and insurance charges from works and upto site must be quoted separately **iii) 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:** - a) **FOR SUPPLY PORTION**:- By irrevocable LC which will be opened after placement of order and receipt of performance bank guarantee for 10% of order value. All bank charges to supplier's account. **90%** against original invoice, original bill of lading, packing list, MICC (dispatch clearance given by BHEL quality group), guarantee certificate, certificate of origin, Transit Insurance Certificate. **10%** against material receipt at site against material receipt certificate by BHEL Site Incharge. b) **FOR INSTALLATION SERVICES:**- 100% direct payment within 15 days after acceptance of the installation services work.
4.	**GUARANTEE:** The equipment / material shall be guaranteed for 18 months from the date of delivery or 12 months from the date of commissioning, which ever is earlier. The defective material / component shall be replaced free of cost at site.

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5.	**SECURITY CUM PERFORMANCE BANK GUARANTEE**: In the event of an order, tenderer shall furnish BG towards Security Cum Performance for 10% of total value of P.O., within two weeks of placement of P.O. valid till 60 days beyond the guarantee period, from a reputed Bank of the bidder's country, subject to Purchaser's approval, in our prescribed format. The original BG shall be sent by issuing bank directly to AGM - FINANCE, INDUSTRY SECTOR, BHARAT HEAVY ELECTRICALS LIMITED, INTEGRATED OFFICE COMPLEX, LODHI ROAD, NEW DELHI – 110 003, (INDIA).
6.	**INSPECTION:** BHEL and / or customer may inspect the Equipment/Material before dispatch. In the event BHEL / Customer waives off inspection, certified TEST REPORTS and RESULTS shall be submitted for approval. Supplier shall obtain approval on Test reports and MICC (Material Inspection Clearance Certificate), before dispatch of equipment. BHEL / Customer may also carry out stage inspection during manufacturing of the ordered item.
7.	**DISPATCH DOCUMENTS:** Dispatch documents (Negotiable documents) shall normally comprise Original Invoice, AWB / Bill of Lading, Shipping / Packing lists (case wise), Transit Insurance certificate, Certificate of country of origin, Material Inspection Clearance certificate (MICC), Test Certificates & approval of acceptance & routine test certificates and manufacturer's guarantee certificate.
8.	**DELIVERY PERIOD:** Bidder to specify delivery period in weeks from the date of LOI / PO in the activity schedule format enclosed with enquiry. Time for conduction of type test, if required, is to be separately indicated. Note: BOL/AWB date or Invoice date whichever is later shall be considered as delivery date for supply portion and date of completion of installation work shall be considered as delivery date for installation work.
9.	**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.
10.	**VALIDITY:** The offer shall be valid for 120 days from the due date of opening.
11.	**ACCEPTANCE / REJECTION OF TENDER**: 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.
12.	**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.
13.	**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.
14.	**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.
15.	**LEGAL SETTLEMENT:** All suits/claims in respect of this contract shall be in the courts having jurisdiction at New Delhi.

Sr. No	ENQUIRY NO. E-4583195, DATE 20/10/2008
16.	**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.
17.	**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.
18.	**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.
19.	**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

SCHEDULE OF PRICE

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

TENDER ENQUIRY NO. : E-4582195, DATE 20/10/2008

SL. NO.	DESCRIPTION OF ITEM	UNIT	QUANTITY	UNIT FOB PRICE	TOTAL FOB PRICE	UNIT FREIGHT AND INSURANCE UP TO SITE	TOTAL FREIGHT AND INSURANCE UP TO SITE	UNIT SUPERVISION / ETC PRICE (*)	TOTAL SUPERVISION / ETC PRICE
1	2	3	4	5	6	7	8	9	10
	TOTAL PRICE								

NOTE: 1. PLEASE NOTE THAT UNPRICED COPY OF PRICE BID (i.e. WITH ALL PRICES BLANKED) SHALL BE FURNISHED ALONG WITH TECHNO-COMMERCIAL BID.
2. REQUIRED COPIES OF FORMAT BE MADE & DETAILS MAY BE ANNEXED.
3. THE PRICES MUST BE QUOTED IN THE PRESCRIBED UNIT ONLY.
4. SEAWORTHY PACKING CHARGES ARE INCLUSIVE.

(*) ETC PRICE: ERECTION, TESTING & COMMISSIONING

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.**

ENQUIRY NO. E-4583195, DATE 20/10/2008

SL. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS	CUMULATIVE TIME IN WEEKS FROM LOI/PO DATE	REMARKS IF ANY
1.	Submission of documents necessary for getting manufacturing clearance like Drawings, date sheet etc.			
2.	Approval of documents in Cat-I from BHEL / Customer *			
3.	Manufacturing time			
4.	Inspection call			
5.	Customer Inspection and Despatch Clearance			
6.	Transportation to destination.			
7.	Installation Services			

Note : 1) * 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.

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

3) 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. E-4583195, DATE 20/10/2008

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
10.	Schedule of commercial deviation exception from the General Terms and Conditions	YES / NO

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal .....

Date .....

ENQUIRY NO. E-4583195, DATE 20/10/2008

SCHEDULE OF COMMERCIAL DEVIATION

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

SL. NO.	CLAUSE NO. OF GENERAL TERMS & CONDITIONS	STATEMENT OF DEVIATION

Incase, 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.

Place .....

Date .....

Signature of the authorized representative of

Bidder's Name .....

Designation .....

Company seal .....

ENQUIRY NO. E-4583195, DATE 20/10/2008

SCHEDULE OF TECHNICAL DEVIATION

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

SL. NO.	CLAUSE NO. OF TECHNICAL SPECIFICATIONS	STATEMENT OF DEVIATION

Incase, 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.

Place .....

Date .....

Signature of the authorized representative of

Bidder's Name .....

Designation .....

Company seal .....

BHARAT HEAVY ELECTRICALS LTD.
(TRANSMISSION BUSINESS GROUP)

TERMS & CONDITIONS FOR SUPERVISION / INSTALLATION SERVICES

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.	Terms & Conditions
1.0	**SCOPE OF WORK:** As per our Technical Specification No. TB-308-316-024.
2.0	**COMMENCEMENT OF WORK**: Project start / zero date for this work shall be intimated by BHEL.
3.0	**COMPLETION SCHEDULE**: Bidder to specify delivery period in weeks from the date of Project start / zero date in the activity schedule format enclosed with enquiry.
4.0	**OVER RUN CHARGES**: No over run charges are payable.
5.0	**IDLE LABOUR CHARGES:** No idle labour charges will be admissible in the event of any stoppage of work resulting in the contractor's workmen being rendered idle due to any reason at any time.
6.0	**SECURITY-CUM-PERFORMANCE GUARANTEE:** The contractor shall furnish security-cum-performance BG for 10% of total contract value within two weeks of placement of work order valid till guarantee period from a reputed Bank of the bidder's country, subject to Purchaser's approval n the prescribed format . The BG should be sent directly by your banker to AGM - FINANCE, INDUSTRY SECTOR, BHARAT HEAVY ELECTRICALS LIMITED, INTEGRATED OFFICE COMPLEX, LODHI ROAD, NEW DELHI – 110 003, (INDIA).
7.0	**INSURANCE:** The Contractor shall take insurance cover(s) to cover his Tools and Plant assets, workman compensation and third party liability. The contractor shall make available the original insurance cover(s) to the Engineer for necessary verification before commencement of work.
8.0	**GUARANTEE:** Though the work will be carried out under the supervision of BHEL Engineers, the contractor shall be responsible for the quality of the workmanship and shall guarantee the work done for a period of 15 months from the date of putting the complete system into commercial operation or 18 months from the date the system is declared completely erected, duly tested and accepted by customer, whichever is later and shall rectify free of cost all defects due to faulty erection detected during the guarantee period starting from the date of the completion of rectification. In the event of the contractor failing to repair the defective works within the time specified by the engineer, BHEL may proceed to undertake the repairs of such defective works at the contractor's risk and cost without prejudice to any other rights under the contract and recover the same from security deposit/ other dues of this project or any other project executed by the contractor.
9.0	**TERMS OF PAYMENT:** The terms of payment shall be as specified under Clause 3 of General Terms and Conditions of Overseas Enquiry.

SL. No.	Terms & Conditions
10.0	**ESCALATION / PRICE VARIATION:** Prices shall be firm for total contract period and extended period, if any, and no price escalation / price variation will be applicable.
11.0	**COMPENSATION FOR DELAY IN EXECUTION:** In case the contractor fails to complete the work within the time specified or any extension thereof subject to force major condition, the contractor shall be liable to pay by way of compensation, a sum equal to half percent (½%) of the contract price, per calendar week or part thereof by which the commissioning is delayed, subject to a ceiling of 5% of the contract price.
12.0	**ADDITIONAL EXPENDITURE:** In case any additional expenditure is incurred in the works arising out of the faulty execution of the works by the contractor, such additional expenditure shall be borne by the contractor.
13.0	**REGULATION OF LOCAL AUTHORITIES AND STATUS :** The contractor shall adhere to the regulation of local authorities and status.
14.0	**DISCIPLINE OF WORKMEN:** The contractor shall adhere to the disciplinary procedure set by the owner in respect of his employees and workman at site.
15.0	**FORCE MAJEURE:** The force majeure shall be as specified under Clause 19 of General Terms and Conditions of Overseas Enquiry.
16.0	**ARBITRATION:** The arbitration shall be as specified under Clause 14 of General Terms and Conditions of Overseas Enquiry.

We understand that the bids having deviation (s) w.r.t tender are to be out rightly rejected. BHEL, however at their discretion, if consider the bid, have undisputable right to load the prices for price comparison as they deem fit.

Signature of Supplier
With seal

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-308-316-024	Rev no.-00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	SK	DS	SN
TITLE		SIGN			
SPECIFICATION FOR 420/245kV HT POWER CABLES		DATE	12.09.08	12.9.08	12.9
		GROUP	TBEM	W.O. No	88004

CUSTOMER/ CONSULTANT	GUJRAT STATE ELECTRICITY CORPORATION LTD. VADODARA/ TCE CONSULTING ENGINEERS LTD. BANGALORE
PROJECT	1X500MW Unit-6 TPS-400/220kV Substation Ukai

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To Copies	TBTS	O/C	TBMM	TBQM	TBCM
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SECTION 1
SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacturing, testing at works, packing and dispatch, transporting, laying of cable at site in BHEL provided trenches, testing and commissioning at site of 400kV and 220kV XLPE Cables , termination etc complete in all respect along with accessories .

Name of customer : Gujrat State Electricity Corporation Ltd. Vadodara

Name of Consultant : TCE Consulting Engineers Ltd. Bangalore

Name of the project : 1X500MW Unit-6 TPS-400/220kV Substation at Ukai

The specification comprise of following sections:

Section-1: Scope & Bill of Quantities.
Section-2: Specific technical requirements for the equipment under scope of supplies.
Section-3: General technical requirements for all equipments under the project.
Section-4: Equipment Data Sheet

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

A. SUPPLIES

I. Supply of power cable, single core, Copper conductor compacted circular stranded, XLPE-insulated, corrugated Aluminium /laminated Aluminium sheathed, HDPE outer sheathed with outer conductive layer. Other configurations can also be considered if technically superior subject to approval by BHEL/GSECL.
II. Supply of cable accessories, essential spares, tools and tackles.

B. INSTALLATION SERVICES

Complete cable installation services including laying , termination, clamping , testing and commissioning of the cable system, point to point.

The Specification envisages turnkey execution of a COMPLETE, POINT TO POINT, 400 kV and 220kV CABLE SYSTEM and the scope includes all materials and service necessary to execute the job to satisfaction of GSECL and BHEL. Any other item /service required for the execution for the complete job shall be included in the offer , Whether specifically mentioned in the specification or not, The Bill of quantities included in the offer shall clearly reflect such items along with their respective quantities.

The Payment of cables length will be as per actual measurement at site jointly.

Bidder shall offer both Supplies and Installtion Services as per this Technical Specification. Bids in which only Supplies or only Installation Services are offered shall be rejected.

1.1 SPECIFIC TECHNICAL REQUIREMENTS-

Sl. no.	Particulars	Unit	400kV	220kV
1.	Rated System Voltage	kV	400	220
2.	Highest System Voltage	kV	420	245
3.	Number of phases	Nos.	3	3
4.	System Frequency	Hz	50	50
5.	System earthing		Effectively earthed (solidly grounded)	
6.	Rated peak withstand current	kA	100	
7.	System fault current for one second	kA	40	40
8.	One minute power frequency withstand voltage	kV	630	460
9.	Rated lightning impulse withstand voltage (1.2/50μs)	kVp	1425	1050
10.	Conductor area	mm^2	1200 for 400kV GT and 300 for 400kV ST	300 for 220kV ST
11.	Type of conductor		Copper	
12.	Insulation		XLPE	
13.	Transformer rating to which the cables are proposed to be connected		For 400kV GT- 3X 1 Phase 200MVA, (420/√3)/21kV , YNd11 For 400kV ST- 63/28/35MVAMVA, 400/11.5/6.9kV , YNyn0yn0 For 220kV ST- 63/28/35MVAMVA, 220/11.5/6.9kV , YNyn0yn0	
14.	Continuous Current rating considering 10% overloading of Transformer	A	953 for 400kV GT, 101 for 400kV ST	182 for 220kV ST
15.	Nos of core per circuit	Nos.	3 for main circuit and 1 spare for 400kV GT , 3 for 400kV ST	3 for main circuit and 1 spare for 220kV ST

16.	Metallic sheath		Corrugated Aluminium /laminated Aluminium
17.	Outer sheath		HDPE with outer conductive layer
18.	Creepage distance for termination	mm/kV	31
19.	Maximum permissible operating temperature of the conductor under (a) Rated continuous current (c) Short circuit	 °C °C	 90 250
20.	Daily load	Hours	24
21.	Sheath voltage	V	Sheath voltage to ground under normal operating condition shall not exceed 65
22.	Laying method	-	In separate RCC trench supported on rack with removable cover (one circuit in one trench with partition)
23.	Cable configuration	-	Trefoil for 3 phase and flat for spare cable
24.	Screen earthing method	-	Single point bonding
25.	Design ambient temperature	°C	50
26.	Minimum ambient temperature	°C	8

1.2 QUANTITIES

Material and Services required for the execution of the job are listed below. All item listed in the following BOQs shall be offered. Any item not appearing herein but clearly mentioned in Section 2 shall be included in the offer. The BOQs included in the offer to be submitted by the Bidder shall be exhaustive in this respect and shall cover completely the requirements of Section 1 and Section 2.

SUPPLY ITEMS

(1) 400kV Cables: GT yard to GT bay in 400kV Switchyard

Sl. no.	Description	Unit	Main Quantities	Spare quantities
1.	400kV 1C X 1200mm^2 Copper conductor corrugated Aluminium /laminated Aluminium sheath, XLPE cable complete with necessary auxiliary equipment	m	3300	1100
2.	400kV outdoor type cable termination kit complete with porcelain terminal bushing for GT bay	Nos.	06	02
3.	Straight through joints for 400kV cable between GT and GT bays	Nos.	06	02

4.	Single pole link box without SVL at GT side including the cable/cable accessories required for the connection	Nos.	03	01
5.	Single pole link box with SVL at switchyard side including the cable/cable accessories required for the connection	Nos.	03	01
6.	Trefoil clamps for 400kV cables	Nos.	400	0
7.	Single type cleats for 400kV	Nos.	0	400

(2) 400kV Cables: ST yard to ST bay in 400kV Switchyard

Sl. no.	Description	Unit	Main Quantities	Spare Quantities
1.	400kV 1C X 300mm^2 Copper conductor corrugated Aluminium /laminated Aluminium sheath, XLPE cable complete with necessary auxiliary equipment	m	3180	0
2.	400kV outdoor type cable termination kit complete with porcelain terminal bushing for ST bay	Nos.	06	0
3.	Straight through joints for 400kV cable between ST and ST bays	Nos.	03	0
4.	Single pole link box without SVL at ST side including the cable/cable accessories required for the connection	Nos.	03	0
5.	Single pole link box with SVL at switchyard site including the cable/cable accessories required for the connection	Nos.	03	0
6.	Trefoil clamps for 400kV cables	Nos.	400	0

(3) 220kV Cables: ST yard to ST bay in 220kV Switchyard

Sl. no.	Description	Unit	Main Quantities	Spare Quantities
1.	220kV 1C X 300mm^2 Copper conductor corrugated Aluminium /laminated Aluminium sheath, XLPE cable complete with necessary auxiliary equipment	m	2400	800
2.	220kV outdoor type cable termination kit complete with porcelain terminal bushing for ST bay	Nos.	06	02
3.	Straight through joints for 220kV cable between ST and ST bays	Nos.	03	01
4.	Single pole link box without SVL at ST side including the cable/cable accessories required for the connection	Nos.	03	01
5.	Single pole link box with SVL at switchyard site including the cable/cable accessories required for the connection	Nos.	03	01
6.	Trefoil clamps for 220kV cables	Nos.	300	0
7.	Single type cleats for 220kV	Nos.	0	300

Note

(1) Manufacturing lengths and drum length shall be determined as per the joint route survey with GSECL/BHEL & the quantities of joints will increases/decreases as per requirements.

(2) Refer Annexure -A for cable proposed trench rout.

(3) The exact length may vary by ±20% .

(4) Spare cables shall be laid as a spares run. Both the end of spare cable shall be terminated .

(5) Supplier will submit detailed cable sizing calculation for justifying the size of the cable.

(6) Supplier will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning.

(7) Earthing of HT cables shall be in supplier scope.

(8) The cable trench and support angles in the trenches will be supplied by BHEL as per supplier recommendation.

(9) Support structure for cable sealing end shall be provided by BHEL based on the input provided by supplier.

(10) The spare 400kV cable will be used to replace any one of the cables of 400kV GT. The spare 220kV cable will be used to replace any one of the cables of 220kV ST.

(4) Other services for cables

Sl. no.	Description	Unit
1.	Laying , erection, testing and supervision of following cables	
(i)	400kV 1C X1200 mm^2 Cables	4400 m
(ii)	400kV 1C X300 mm^2 Cables	3180m
(iii)	220kV 1C X300 mm^2 Cables	3200m
2.	Erection of 400kV outdoor cable termination kit	14 nos.
3.	Erection of 220kV outdoor cable termination kit	8 nos.
4.	Erection of single pole link box without SVL for 400kV	7 nos.
5.	Erection of single pole link box without SVL for 220kV	4 nos.
6.	Erection of single pole link box with SVL for 400kV	7 nos.
7.	Erection of single pole link box with SVL for 220kV	4 nos.
8.	Erection of cable straight joint for following cables	
(i)	400kV 1C X1200 mm^2 Cables	8 nos.
(ii)	400kV 1C X300 mm^2 Cables	3 nos.
(iii)	220kV 1C X300 mm^2 Cables	4 nos.
9.	Training	1 lot

1.3 TYPE TESTS

Bidder shall submit valid type test reports (as per relevant IEC/IS standard) for the tests carried out within last five years from the date of LOA (**i.e. 07.09.2007**) . The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 5 years old (from the date of LOA) or the reports of type tests are found to be technically unacceptable , the type test shall be conducted by the vendor without cost and delivery implication to BHEL.

1.4 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, provided by the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

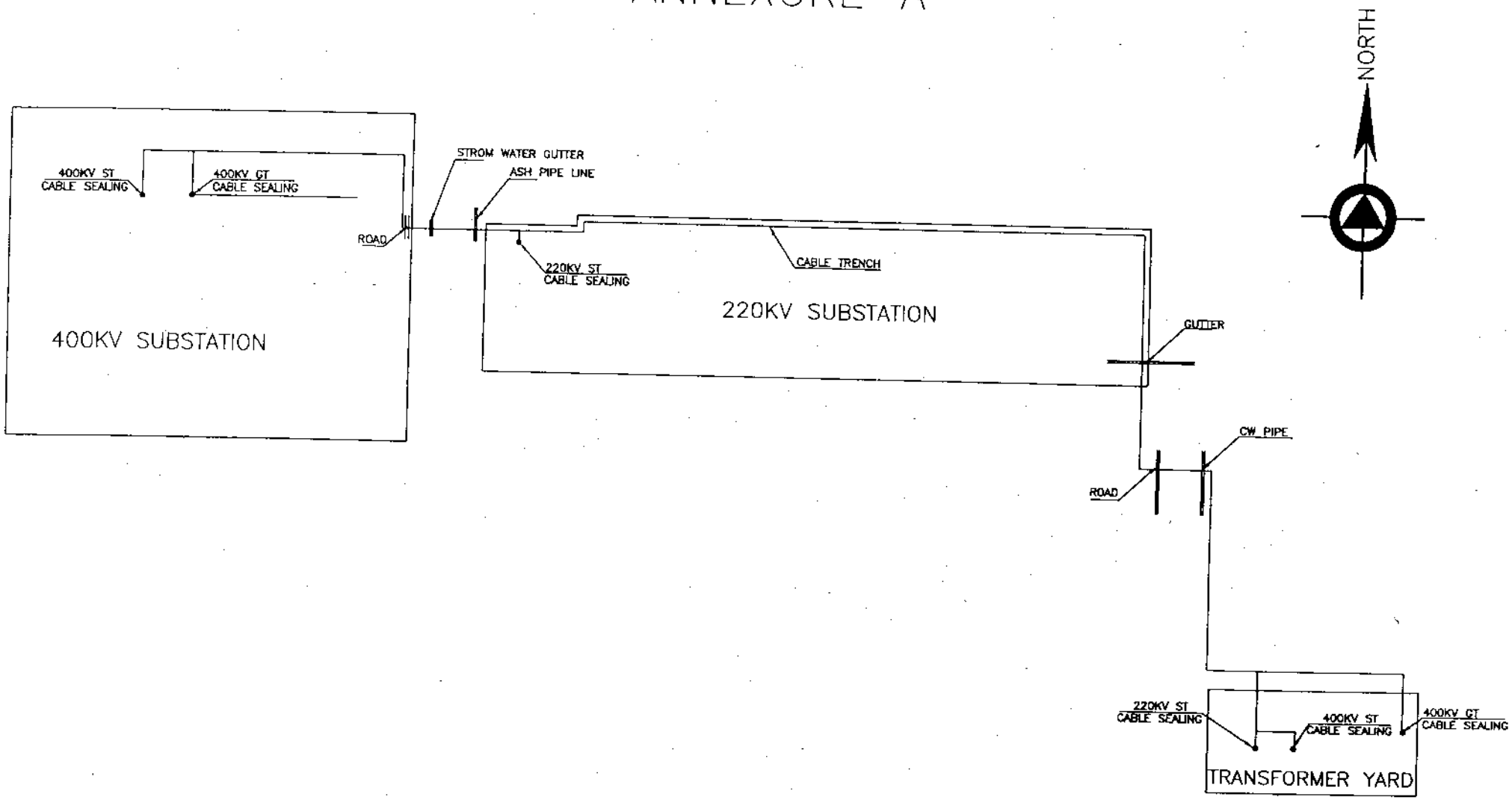
Prior to dispatch, the routine & acceptance tests shall be carried out on cables and accessories in accordance with the applicable IEC /IS and the material shall be offered for final inspection by BHEL and GSECL in accordance with agreed quality plan with 3 weeks advance information.

Type test reports on identical rating cables and accessories shall be submitted for approval. In event of non-acceptability of submitted test reports on technical grounds at the contract stage, the type tests shall be conducted at no additional cost.

1.5 QUALITY PLAN

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

ANNEXURE-A



400KV AND 220KV PROPOSED HT CABLE TRENCH ROUTE

SECTION 2
EQUIPMENT SPECIFICATION

1.0 GENERAL

The section covers the broad technical specifications of 400kV and 220 kV single core Copper conductor XLPE insulated, Aluminium corrugated /laminated Aluminium sheathed cable system complete with accessories and spares etc.,

2.0 GENERAL REQUIREMENTS

The design and workmanship of the cable and accessories covered under this specification shall be in accordance with the best engineering practices to ensure satisfactory performance and service life of 50 years. The cable accessories shall also be designed for maximum reliability and acceptability.

Unless brought out clearly, the offer shall be deemed to confirm to be this specification. Any deviation between this specifications and bid offered, if not clearly brought out and accepted by BHEL/GSECL will not be considered as avalid deviation.

The vendor shall bring out clearly any additional feature which they deem to include to give a complete and comprehensive offer. The vendor shall, however sustain his reasons for offering such additional feature/item in his proposal.

3.0 STANDARDS

The XLPE Cables and the associated accessories shall conform to the following International standards, as amended/ revised till date, as appropriate:

IEC 62067(2001)	Power cables with extruded insulation and their accessories for rated voltage above 150 kV up to 500kV – Test methods and requirements.
IEC 60060 Part-1	High voltage test techniques
IEC 60187	General definitions & test requirements
IEC 60068	Seismic test methods for the equipment
IEC 60183	Guide to the selection of High Voltage Cables
IEC 60228	Conductors for insulated cables
IEC 60229	Tests on cable over sheaths
IEC 60230	Impulse test on cables and their accessories
IEC 60270	Partial Discharge Measurements
IEC 60287	Calculation of continuous current carrying capacity & losses

IEC 60332 Part-1	Test on Electric Cables under fire conditions
IEC 60502	Power Cables with extruded insulation and their accessories
IEC 60506	Switching Impulse test on EHV Insulators
IEC 60540	Test methods for insulations and sheaths of electric cables and cords
IEC 60811 Part-1 to Part-4	Common test methods for insulating and sheathing materials of electric cables
IEC 60840	Tests for power cables with extruded insulation
IEC 60859	Cable connections for gas insulated metal enclosed cwitchgear
IEC -60885 Part-3	Electrical test methods for electric cables
IEC 62087	
CIGRE WG21.03 (Electra 151) (Dec 1993)	Recommendation for electrical tests on extruded cables and accessories
IEEE 48	Test procedures and requirements for high voltage cable terminations
IEEE 404	Joints for use with solid dielectric cables
IEEE 635	Guide for selection and design of aluminium sheath

4.0 TECHNICAL PARAMETERS OF CABLES:

The rating and electrical characteristics of the single core, XLPE cables shall be as follows:

a) **TYPE OF CABLE:**
400kV and 220 kV single core, stranded, annealed, copper conductor, segmental compacted, circular, XLPE insulated, corrugated Alumimium /laminated Aluminium sheath , High Density Polyethylene outer sheathed cable .

The tests shall be as per IEC-62067- 2001 with latest amendments.

Voltage Grade	As per section-1
Maximum operating conductor temperature	90° C
Maximum conductor temperature under short Circuit for 1 Sec.	250° C

b)	Construction	Single core stranded, annealed, copper conductor, segmental, compacted, circular, conductor screen, cross linked polyethylene (XLPE) insulation, core screen of semi-conducting water swellable layer, Corrugated Aluminium/laminated Aluminium sheathed, semi-conducting bedding tapes, helically applied plain round copper wire, plain copper tape in open helix, water swellable tape with overall extruded High-Density Polyethylene sheath coated with graphite along with outer conductive layer.
c)	Conductor :	Plain, annealed, high conductivity copper wires stranded, segmental conductor
d)	Conductor Screen :	Extruded semi-conducting layer with adequate capacity
e)	Insulation :	Dry cured cross linked polyethylene. In any particular point, the thickness may differ from the nominal thickness, however, the measured thickness shall be within the limits.
f)	Core/Insulation Screen	Extruded semi-conducting layer.
g)	Longitudinal Water barrier	Semi-conducting water swellable tape/s
h)	Radial Moisture Barrier	Corrugated Aluminium /laminated Aluminium sheath
i)	Bedding	Semi-conducting tape/s.
j)	Armour Screen	Helically applied non-magnetic plain copper wires
k)	Contact Tape	Annealed plain copper tape in open helix.
l)	Water swellable tape	Non-conducting water swellable tape.
m)	*Outer Sheath*	Extruded High Density Polyethylene type ST 7 (black), anti-termite treated. Extruded outer conducting layer coated with graphite. Nominal thickness 3.5 mm (approx).

5.0 GENERAL TECHNICAL REQUIREMENTS OF CABLE

5.1 The cable and all its accessories shall conform in all respects, to the requirement of the latest standards of IEC/IS except in so far as they are modified in these specifications. Whenever a standard is specifically mentioned in the specification, it is understood that the corresponding

standard or standard from amongst the source mentioned above shall also apply. It is, however, understood that the cable and accessories etc., supplied shall conform to one consistent set of standards except in so far as they are modified by the requirement of these specifications.

5.2 Cables/Cable accessories satisfying the quality requirements of other National/International standards, which ensure equal or better quality than the standards mentioned above shall also be acceptable. Where the equipment offered by the supplier conforms to other standards, salient points of difference between the standards preferred and the specified standards shall be informed. Four (4) copies of the reference standards in English language shall be furnished for reference.

5.3 The general principle on which these specifications are drawn up, is to permit the adaptation of modern manufacturing standards. The Contractor shall supply his own standard equipment as far as possible, provided they comply with the requirements of these specifications. However, should the Contractor wish to depart from the provisions of these specifications either on account of manufacturing practice or for any other reasons, he shall draw the attention of the Corporation to the proposed items of departure and shall submit such full information, drawings and specifications, full justification as will enable the relative merits.

5.4 In the event of these specifications or part thereof and of the Contractor's drawings, specifications, forms, tables etc., being found to disagree during the execution of the contract, these specifications shall be held as binding unless, the departures have been duly approved in writing by the Corporation.

5.5 All similar component parts of similar equipment supplied shall be interchangeable with one another.

5.6 The size of the conductors of the cable shall be sufficient to carry continuously Current at a maximum temperature of 90° C under site conditions.

5.7 Insulation Curing: Dry curing process should be adopted in cross-linking the insulation.

5.8 Triple Extrusion:

The conductor screen, insulation and insulation screen shall be extruded in single process (triple extrusion) and cross linked by continuous vulcanization process or MDCV process (Mitsubishi Dainichi Continuous Vulcanization process) or any other equivalent process using dry curing technology to ensure homogeneity and absence of micro voids.

5.9 The cable shall be designed to have a minimum useful life of not less than fifty years.

5.10 Each cable length shall be provided with a pulling socket, pulling eye, which shall be fitted to pulling end to withstand the maximum pulling force.

5.11 The contractor shall furnish the details of any specific construction features which will be provided to ensure specific water tightness of cable both transversely and longitudinally.

6.0 MECHANICAL CHARACTERISTICS OF CABLE:

The cable shall withstand the electro-mechanical forces due to short circuit current of 40 kA and shall withstand the stresses in the insulation due to faults. The cable shall withstand the mechanical stress during installation.

6.1 TEMPERATURE RISE:

The maximum conductor temperature shall not exceed 90°C during continuous operation of current. The temperature after a short circuit for one second shall not exceed 250° C, with initial conductor temperature of 90° C.

6.2 CABLE MATERIAL:

a) Conductor :The conductor shall be of plain annealed high conductivity copper wires, stranded, segmental conductor conforming to IEC-60228. The Copper used for the conductor shall be of highest purity. The minimum number of wires and conductors and DC resistance of conductor shall be as per IEC-60228.

b) Conductor Screen :The conductor screen shall be provided over the conductor by extrusion of semi-conducting compound or by a combination of semi-conducting tape/s and extruded semi-conducting compound.

c) Insulation :Cross-linked polyethylene insulation by dry curing process shall be provided over the conductor screen. The insulation shall be of high quality and shall be as far as possible free from contaminants, moisture and voids. The size of voids and contaminants shall be within limits of recognised Standards.

The insulation shall be suitable for operation in wet or dry locations at conductor temperature not exceeding 90° C for normal operation and 250° C for short circuit conditions.

d) Insulation Screen:Shall be by extruded semi-conducting compound .The semi-conducting screen shall be suitable for the operating temperatures of the cable and compatible with the insulation.

e) Moisture Barrier (Longitudinal):This shall be semi-conducting synthetic non-woven tape with suitable swellable absorbent for longitudinal water sealing covering the whole surface area of the non-metallic part of insulation screening. This barrier shall restrict longitudinal water penetration under the metallic sheath.

f) Metal Sheath/Moisture Barrier (Radial):This shall be Corrugated Aluminium/laminated Aluminium sheath.The nominal thickness of sheath shall meet the Electrical and Mechanical properties as per standards. The minimum thickness shall be as per IEC-62067.

g) Bedding Tapes:Suitable semi-conducting bedding tapes shall be used under metallic screen .

h) Metallic Screen (Armour): The metallic screen shall be of non-magnetic SS316 stainless steel tapes or 1% bronze tapes/ plain copper round wires, helically applied over the semi-conducting bedding tape/s.

A binder tape of suitable material/annealed plain copper shall be applied in the form of an open helix, over the metallic screen.

Note: Requirement of Metallic Sheath/Screen:

The cross section of the metallic sheath that is corrugated Aluminium /laminated Aluminium sheath in combination with stainless steel tapes/bronze tapes/plain copper round wire screen shall be designed to meet the following requirements:

i) Sustaining the system short circuit rating of 40 KA for 1 Sec. The temperature of metallic sheath at the time of short circuit (cable operating at maximum conductor temperature) shall be indicated in the short circuit calculations of the design of metallic screen/sheath.

ii) Ensuring mechanical protection of the cable.

iii) Ensuring radial water tightness of the cable.

Test report ensuring the above compliance shall be furnished by the contractor.

i) Outer Sheath: The outer sheath shall be extruded black colour, High Density Polyethylene, type ST7 conforming to requirement of IEC. The High Density Polyethylene compound used shall be brand new from a reputed manufacturer and in no case shall recycled material be used.

The Corporation reserves the right to seek documentary proof of the source of material (insulation, outer sheath and other cable components) and to cross check with the supplier.

The outer sheath shall be designed for protecting against termite and rodent attack by adding suitable additives, which are harmless to operating personnel to High Density Polyethylene (HDPE) compound.

j) Coating: A hard baked one layer of graphite shall be applied over the outer sheath as outer electrode for testing sheath.

7.0 IDENTIFICATION:

The following information shall be embossed on the outer sheath of the cable continuously repeated through out the length of the cable.

i) Brand Name of Manufacturer

ii) Year of Manufacture

iii) Voltage rating/conductor cross Section

iv) Customer:

v) XLPE

vi) Running length of cables

The embossed letters and figures shall be raised and consist of upright block characters along one or more lines.

The maximum size of the characteristics shall be 20 mm and the minimum size not less than 15 percent of the nominal or specified external dia of cable or 3 mm whichever is greater

The gap between the end of one set of embossed characters and the beginning of the next shall not exceed 1 m. Any additional information embossed on the sheath shall not affect the spacing between repetitions of the legend.

Further as a safety if any additional ground wire is required for grounding all clamping equipment at ground potential shall also be supplied.

8.0 CABLE END TERMINATIONS

a) The cable end termination shall be outdoor type on both end suitable for cable size as specified in section-1 and shall confirm to the relevant IEC.

b) The outdoor termination should have a device for electrical stress control at the end of screen/shield. It should avoid partial discharges and surface Corona under the service conditions. It should seal any ingress of atmospheric elements. The total creepage distance shall not be less than 31 mm/kV.

c) The terminations shall be suitable for insulation voltage, conductor size and current rating of the cable.

d) Cable terminations (Sealing end pre-moulded type) – The sealing ends shall conform to the latest International Standards and shall be of thoroughly proven design. The internal electric stress by the pre-moulded cone epoxy resin unit arrangement preferably with epoxy bell mouth and all other accessories. The cable terminations shall be outdoor type. The outdoor type sealing end shall be suitable for installation in polluted atmosphere and shall be completely weather proof. Each outdoor type sealing end shall be supplied complete with mounting plate insulators to insulate the sealing end from the supporting structures and to control the sheath current. The required terminal connectors and bimetallic clamps shall also be supplied. Each sealing end shall be provided with consumable materials such as viper and cleanant for cleaning. The power cable leading to sealing end shall be provided with proper sunshield cover.

e) The material for the housing of the termination should be resistant to tracking, ultra violet radiation (U-V exposure) weathering and should have stable hydrophobic properties.

f) The contractor shall provide necessary arrangement to limit flow of current in the structure supporting the sealing end.

g) The sealing ends shall withstand the power frequency, impulse and cable testing voltage after installation as specified.

h) The cable and accessories shall withstand all thermal and mechanical stresses under steady state and transient operating conditions.

9.0 SPARE CABLE

(a) One standby spares for 400 kV and 220kV cable as per section -1 shall be supplied and installed complete with all accessories. The spare 400kV cable and 220kV cables will be used to replace any one of the three cables of 400kV GT and 3 cables of 220kV ST respectively which may fail under normal service and shall be installed in such a manner as to permit rapid replacement and reconnection of the faulty circuit without exposing workmen to dangerous situations. The details of the installation and the method of moving and connecting to the existing terminal ends shall be furnished by the contractor

(b) The spare cable shall be sufficient in length so that it can be used on the 400kV GT and 220kV ST transformer for replacement of a damaged cable.

10.0 SUPPORTS HARDWARES AND ACCESSORIES

(a) The supporting structure (in BHEL scope) for the outdoor shall be fabricated from lattice steel material and the detailed drawing showing foundation particulars shall be furnished by the successful bidder. The Contractor shall also arrange the required foundation area ready for erection of the support structure. The Contractor shall furnish necessary information such as foundation load and mounting details to the Corporation.

(b) Cable cleats, clamps, fire barriers, fixing bandage, miscellaneous accessories and hardware required for the assembly of the cable support system shall be supplied. The complete detailed fixing arrangement/ installation drawings of the cables shall be furnished.

11.0 PROTECTION AGAINST EARTH QUAKE

Cable system shall be so designed as to be secured to the foundation clamps to withstand earthquake forces of the above.

12.0 CABLE DRUMS

Immediately after the inspection, both ends of each cable length shall be sealed by means of end caps in the presence of the inspector. Cable drums shall be of rugged construction, with a drum diameter of ample dimensions to accommodate the single- conductor cables. The drum cable length shall be chosen considering the lengths to be laid at site. No negative tolerance on the

required lengths may be adopted.

Each drum shall be marked, by stenciling thereon, with an arrow the direction in which the drum should be rolled. The cable shall be wound on non-returnable strong steel drums. The dimensional drawings of steel drums shall be furnished. The drum shall be provided with circumferential lagging of strong wooden planks. The ends of the cable shall be sealed with good quality heat shrink sealing caps. The required additional sealing caps of sufficient quantity shall be supplied for use for testing during laying at site and to seal spare lengths of cable.

The cable drums shall be supplied with definite cable length (to be informed before start of manufacturing) within +/- 2 m tolerance. Contractor shall not be reimbursed for excess lengths supplied. Cable drums with shorter lengths shall not be accepted.

[illegible]

Cable drum shall be unloaded, handled and stored on hard and well drained surface so that they may not sink. In no case , the drum shall be stored flat i.e. with horizontal. Rolling of drums shall be avoided as far as possible. For un-reeling the cable, drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that the cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall always be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture.

While laying the cable, power rollers shall be used at required interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangement. Pulling tension shall not exceed recommended values. Selection of cable drum for each run shall be planned so as to avoid using straight through joint. Cable splices will not be allowed unless approved by customer.

The cables shall be laid and terminations installed by skilled and experienced workers, fully qualified to carry out the work. The supplier shall also be responsible for providing clamps, required to support cables on racks for cable laying in trenches.

In surface trench, cable will be laid in trefoil arrangement on support angle and will be fixed with angle by clamps made of non-magnetic material. These surface trenches will be covered by suitable trench covers.

The sheath voltage under full load conditions shall be within safe limits. The value of sheath voltage shall be furnished for approval. Sheath shall be solidly grounded at both end. The connection to earth shall be as short as possible to prevent HV impulses and spikes. A sheath voltage limiter shall be provided as per section-1 to control the sheath voltage. These voltage limiters shall be without boxes.

[illegible]

The cables and cable terminations shall be subjected to tests as per applicable standards in the presence of GSECL and/ or his authorized representative. After installation the cables shall also be subjected to tests at sites. All tests shall be carried out generally as per the different standards listed in Cl. 3 above. Following test but not limited to this as mentioned below shall be submitted as per latest IEC.

14.1 TYPE TESTS (IEC 62067)

In lieu of conducting the fresh type tests, supplier should submit the valid type test reports for BHEL/GSECL approval. In absence of valid type test reports (Type test reports more than 5 years old will not be valid), supplier shall conduct the type tests as per relevant IEC standards at no extra cost to customer. The supplier shall offer material for selection of samples for type testing, only after getting quality assurance plans approved. The sample shall be manufactured strictly in accordance with the approved Quality Assurance Plan.

Following type tests shall be carried out.

a) **Electrical type test on complete cable system (Cl 12.4)**
i) Check for insulation thickness of cable for electrical type test (Cl 12.4.1)
ii) Bending test (Cl 12.4.4)
iii) Partial discharge test (Cl 12.4.5)
iv) Tan δ measurement (Cl 12.4.6)
v) Heating cycle voltage test (Cl 12.4.7)
vi) Lightning impulse voltage test followed by a.c. voltage test (Cl 12.4.9)
vii) Examination (Cl 12.4.10)
viii) Resistivity of semi-conducting screens (Cl 12.4.11)

b) **Non electrical type test on cable components and on complete cable (Cl 12.5)**

i) Check of cable construction (Cl 12.5.1)
ii) Tests for determining the mechanical properties of insulation before and after ageing (Cl 12.5.2)
iii) Tests for determining the mechanical properties of oversheaths before and after ageing (Cl 12.5.3)
iv) Ageing tests on pieces of completed cable to check compatibility of materials (Cl 12.5.4)
v) Loss of mass test on PVC sheaths of type ST2 (Cl 12.5.5)
vi) Pressure test at high temperature on oversheaths (Cl 12.5.6)
vii) Test on PVC oversheath ST2 at low temperature (Cl 12.5.7)
viii) Heat shock test on PVC oversheath ST2 (Cl 12.5.8)
ix) Hot set test for XLPE insulation (Cl 12.5.10)
x) Test under fire conditions (Cl 12.5.13)
xi) Water penetration test (Cl 12.5.14)

14.2 Acceptance Tests (Sample Tests) on Cables (Cl. 10 of IEC 62067)

Following tests shall be carried out on minimum 10% of the drums subject to minimum one sample in each lot:

a) Tests on conductor (Cl 10.4 & 10.5)
b) Measurement of thickness of insulation and oversheaths (Cl 10.6)
c) Measurement of thickness of metallic sheath (Cl 10.7)
d) Measurement of diameters (Cl 10.8)
e) Hot set test for XLPE insulation (Cl 10.9)
f) Measurement of capacitance (Cl 10.10)
g) Lightning impulse voltage test followed by power frequency voltage test (Cl 10.12)

14.3 SAMPLE TESTS ON ACCESSORIES

Tests and its procedure to be proposed by the supplier for GSECL/BHEL's approval.

14.4 ROUTINE TESTS

Following routine test shall be carried out as per Clause 9 of IEC 62067 on samples drawn from each drum and each accessory.

a) Partial discharge test (Cl 9.2)
b) Voltage test (Cl 9.3)
c) Electrical test on non metallic sheath of the cable (Cl 9.4)
d) Voltage test on outer sheath as per Clause 3.1 of IEC 60229

14.5 SITE TESTS

The suppliers shall furnish field quality assurance plans giving different checks and tests, including high voltage tests, to be carried out at site to ensure a maintenance-free installation. Atleast following site test shall be carried out as detailed in Clause 14 of IEC 62067.

a) DC voltage test of the oversheath (Cl 14.1)
b) AC voltage test of the insulation by applying a voltage U_0 to be applied for 24 hours (Cl 14.2) –

15.0 DESIGN REQUIREMENTS

Supplier of the cable system shall furnish the details calculations along with technical data sheet for verification/approval of design parameters elected. Detail design calculations/documents will be submitted for approval to GSECL/BHEL:

a) Calculation of continuous current capacity for specified cable laying conditions
b) Adequacy of XLPE insulation thickness.
c) Calculation for short circuit currents for metal sheath or screen.
d) Calculation for adequacy of metallic sheath/ screen for short circuit current carrying capability.
e) Calculation of sheath induced voltage for single end bounding/ double end bounding.
f) Manufacturing Quality plan
g) Field quality plan for site installation, commissioning and testing
h) Instruction manual for jointing and cable laying.

16.0 PACKING AND MARKING

The packing should be able to withstand the rigors of transport.

The following information in bold letters in English shall be painted on the flanges.

(i) Name and address of the Manufacturer, Trade name/Trade Mark/Brand.
(ii) Size of cable (cross section) rated voltage, standard, insulation, cable code, drum number, year of manufacture.
(iii) Length of cable (metres)
(iv) Direction of Rolling
(v) Net weight (in Kg)
(vi) Gross weight (in Kg)
(vii) Purchase order reference.

SECTION-3

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Gujrat State Electricity Corporation Ltd. Vadodara
b)	Consultant	TCE Consulting Engineers Ltd. Bangalore
c)	Project Title	1X500MW Unit-6 TPS-400/220kV Substation at Ukia
d)	Location	Ukai is situated in Surat district of Gujarat , 200 kM from Vadodara,100kM from NH , Nearest village-Songarh
e)	Elevation above MSL	86m
f)	Transport Facilities	Road/Rail, Nearest railway station is Songarh
g)	Postal Address	To follow
SITE CONDITIONS		
a)	Max. Ambient temp.	50°C
b)	Min. ambient temp.	8°C
c)	Design ambient temp.	50°C
d)	Latitude/Longitude	21^0 21'North/74^0 15' East
e)	Relative humidity (for design)	100 %
f)	Pollution Severity	Highly Polluted
g)	Seismic acceleration	0.3g
h)	Seismic zone	III
	Wind Pressure	150 kg/sq.m
j)	Average Annual rainfall during June to September	1500mm

SYSTEM PARAMETERS

Nominal system voltage	**400 kV**	**2202 kV**
Highest system voltage	400 kV	220 kV
Basic Impulse level	1425kVP	1050kVP
Power frequency withstand voltage	630kVrms	460kVrms
Switching Impulse withstand voltage	1050kVrms	-
Frequency	50 Hz	
Rated short time current	40 kA for 1 sec	
Creepage distance	25mm/kV	
System Earthing	Effectively Earthed	

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V, 50 Hz, 3-phase 3 wire, solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%.
1 phase A.C power supply	240V, 50 Hz, 1-phase AC supply with variation in frequency of +/-5% and variation in voltage +/-10%.
D.C. power supply	220V(variation from 190V to 240V) , 2-wire ungrounded 50V, 2 wire system (+) earthed

Combined variation of voltage and frequency shal be +/- 10%

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 QUALIFYING REQUIREMENT

(A) Operational Experience

Offered equipment supplied to any public sector electricity utility viz . State electricity board/ Corporations, NTPC, PGCIL etc. should have given three years proven trouble free operational service in tropical climate during last 10 years. However , in case of equipment being manufactured in India under valid foreign collaboration, operating experience in tropical climate of offered collaborator's equipment, shall also be acceptable provided copy of valid collaboration agreement for the equipment offered is submitted with the tender. Further , in case of offer of imported equipment the three years operating experience will be considered in respect of those areas only which are similar to tropical conditions prevailing in India.

(B) Manufacturing experience

The indigenous manufacturers or their foreign collaborator must have manufactured at least 20% of the specified quantities of each item of identical or similar equipment.

3.2.2 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type.The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of LOA (i.e. 07.09.2007)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract.All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.3 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

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

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

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modem practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.
All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

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

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc shall be painted with non-corrosive plant on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGISTATIC VARNISH

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

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be throughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for paintaing shall bc made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitabley wrapped or other wise protected. All

paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 631 of IS:5.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvasized. Minimum weight of zinc coating shall be 610 gm/sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Net weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

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.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-31

c) Installed in covered area IP:52

d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41

e) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.13 DOCUMENTATION

3.13.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal

which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.13.2 DRAWINGS

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

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant ,the unit designation, GSECL contract no. , and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

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

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing 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 Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.13.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.

iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed **Annexure-1** for details of Title block.

3.13.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) Manufacturing Quality Plan

3.13.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	10	13	-
2	Drawings "As Built"	-	-	13	05
3	Type Test Reports	1	05	13	-
4	Erection Manuals	-	11	13	-
5	Operation and Maintenance Manuals	-	11	13	-
6	Manufacturing Quality Plan	1	11	13	-
7	Field Quality Plan	1	11	13	-
8	Inspection Test Reports	-	-	13	-

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top .

ANNEXURE -1

REV.	STATUS	TYPE	REASONS FOR REVISION	PREPARED BY	CHECKED BY	APPROVED BY	DATE

GSECL GUJARAT STATE ELECTRICITY CORPORATION LTD.

परियोजना का नाम / NAME OF PROJECT: 1X500MW,UNIT NO.6 UKAI THERMAL POWER STATION

TCE CONSULTING ENGINEERS LTD.

DRAWING TCE REF. No. :

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	DWN	NAME	SIGN	DATE
	PRPD.			
	CHKD.			
	APPD.			

BHEL SUB VENDORS

DEPT.	TBEM
CODE	422
SCALE	NTS
CARD CODE	
W.O. No.	

SHEET NO. 1 | NEXT SHEET NO.

DRAWING TITLE :

DRWG NO :

REV NO 00

9

Section-4

Guaranteed Technical Particulars for the 400kV and 220kV XLPE Insulated Cable

SL.NO.		Item Description		Unit	Data
1		Manufacturer's Name & Address			
2		Country of Manufacture			
3		Type of Cable			
4		Applicable Standards for manufacturing			
5		Applicable Standards for testing			
6		Rated Voltage		kV	
	i)	Normal			
	ii)	Highest		kV	
7		Conductor			
		i)	Material & Grade		
		ii)	Nominal cross sectional area	mm^2	
		iii)	No. Of strands		
		iv)	Nominal Diameter of each strand (before stranding)	mm	
8		Conductor Screen (conductor screen, insulation and extruded layer of insulated screen shall be extruded in a single process)			
		i)	Material		
		ii)	Thickness	mm	
9		XLPE Insulation (conductor screen, insulation and extruded layer of insulated screen shall be extruded in a single process)			
		i)	Composition		
		ii)	Type of Curing		
		iii)	Thickness of insulation	mm	
		iv)	Tolerance on thickness	%	
10		12/50μs Impulse wave withstand voltage		kVp	
11		1-min Power-frequency withstand voltage		kV	
12		Insulation Screen (conductor screen, insulation and extruded layer of insulated screen shall be extruded in a single process)			
		i)	Material / composition		
		ii)	Extruded/ wrapped		
		iii)	Thickness	mm	
13		Metal sheath			
		i)	Material/composition		
		ii)	Minimum radial thickness	mm	
		iii)	Nominal diameter over metallic sheath		
14		Copper Wire Screen			
		i)	Bedding over metal sheath		
		a.	Material		
		b.	Approx. Thickness	mm	
		ii)	Metallic Cu. Screen over bedding		
		a.	Material		
		b.	Min. Area of copper wire screen	Sq.mm	
		c.	Nominal thickness of open helix Cu tapes (for each tape)	mm	
		d.	Nominal width of copper tape	mm	
		e.	Nominal Diameter over metallic sheath		

		iii)	Earth fault current rating of metallic Cu screen & lead sheath (Combined) for 1 second duration	KA	
		iv)	Screen current corresponding to the rated current of the cable with both ends of screen earthed	A	
15		Protective Outer Covering			
		i)	Type & Composition		
		ii)	Colour of sheath		
		iii)	Nominal thickness	mm	
		iv)	Test Voltage at Works	kV	
16		Nominal overall diameter of completed single-core cable		mm	
		Nominal weight of completed cable		kg/m	
17		Short circuit capacities with a conductor temperature of 90°C at the commencement			
		i)	0.5 s duration		
		ii)	1.0-s duration		
		iii)	2.0-s duration		
		iv)	3.0 -s duration		
18		Min bending radius of the cable		mm	
19		Max. DC Resistance of conductor at 20°C		Ω/km	
20		Max. AC Resistance of conductor at 20°C		Ω/km	
21		Equivalent star reactance of 3- φ circuit at 50 Hz		Ω/km	
22		Max. Continuous current carrying capacity per cable when laid in ground in flat formation , with 500 mm center to center spacing between phase, at a depth of 1.0-m (Ground Temp. 40°C and soil thermal resistivity of 150°C/watt/cm, Max conductor temp. 90°C (with both end bonding)			
		i)	Only one 3-φ circuit loaded	A	
		ii)	Three circuits loaded	A	
23		Max. continuous current carrying capacity per cable when drawn into duct/pipes (conditions same as in 22 above)			
		i)	Only one 3-φ circuit loaded	A	
		ii)	Three circuits loaded	A	
24		Max. Continuous current carrying capacity per cable when laid in covered RCC trenches at an ambient air temperature of 50°C.(Considering cables laid in ventilated trench on tray with minimum one cable dia spacing)			
		i)	Only one 3-φ circuit loaded	A	
		ii)	Three circuits loaded	A	
25		Continuous current carrying capacity which will permit a further 10% overload for two hours without exceeding the max. conductor temp. 90°C, as in 22 above			
		i)	Only one 3-φ circuit loaded	A	
		ii)	Three circuits loaded	A	
26		Continuous current carrying capacity which will permit a further 10% overload for two hours without exceeding the max. conductor temp. 90°C, as in 23 above			
		i)	Only one 3-φ circuit loaded	A	
		ii)	Three circuits loaded	A	
27		Continuous current carrying capacity which will permit a further 10% overload for two hours without exceeding the max. conductor temp. 90°C, as in 23 above			

		iii)	Only one 3-φ circuit loaded	A	
		iv)	Three circuits loaded	A	
28		Max. power factor of charging current of the cable when laid direct in ground at normal voltage and frequency at conductor temperature of 15,30,45,65 and 90°C			
29		Max. power factor of charging current of the cable when laid in trench at normal voltage and frequency at conductor temperature of 15,30,45,65 and 90°C			
30		Max. dielectric power loss of the cable per km of three-phase circuit, laid direct in ground, at normal voltage and frequency at max. Conductor temperature.		W/km	
31		Max. dielectric power loss of the cable per km of three-phase circuit, laid direct in trench, at normal voltage and frequency at max. conductor temperature.		W/km	
32		Max. power factor of charging current of the cable when laid direct in ground at normal frequency at 20°C conductor temperature and 0.5, 1.0,1.5 and 2.0 times nominal voltage			
33		Max. power factor of charging current of the cable when laid direct in trench at normal frequency at 20°C conductor temperature and 0.5, 1.0,1.5 and 2.0 times nominal voltage			
34		Sheath loss of cable per km of three-phase circuit, at normal voltage and frequency at max. Conductor temperature.			
		i)	laid direct in ground (S.No.27 above)	W	
		ii)	Drawn into ducts (S.No. 28 above)	W	
		iii)	laid in air (S.No. 29 above)	W	
35		Impedance per km of three-phase circuit, at 50 Hz and max. Conductor temperature			
		i)	Positive and negative sequence	Ω	
		ii)	Zero sequence	Ω	
36		Attenuation to carrier current signals operating over a frequency range of 50 Hz to 200 kHz			
37	a)	Phase-to-ground characteristics impedance at 50Hz to 200 kHz		Ω	
	b)	Screen Factor		Ω	
38	Max. Drum length of cable			m	
39	Approx. Shipping weight and size of drums			m	
40	Details of recommended method of laying of single-core cables in ground and in trench to be enclosed				
41	Details of warning tape				
	a)	Width		mm	
	b)	Thickness		mm	
	c)	Colour			
	d)	Tensile Strength		kg/mm^2	
	e)	Breaking load		kg	
42	Details of RCC Cable Covers				
	a)	Dimensions		mm	
	b)	Design			
	c)	Drawing			
43	Details of Cable Markers				
	a)	Size		mm	
	b)	Design			
	c)	Drawing			
44	Safe pulling force when pulled by pulling eye			N/mm^2	

45	Maximum capacitance		MicroF/ kM	
46	Volume resistivity			
	a)	Insulation (at 27 deg C)	Ohm-cm	
	b)	Conductor screen (at 90 deg C)	Ohm-m	
	c)	Insulation screen (at 90 deg C)	Ohm-m	
47	Eccentricity of insulation			
48	Ovality of core			

CABLE TERMINATION KIT FOR 400kV and 220kV XLPE INSULATED CABLE

S. No.	Item Description	Unit	Data
			Termination Kit
1.	Manufacturer's Name & Address		
2.	Country of Manufacture		
3.	Type of Cable Termination		
4.	Applicable Standards for manufacturing		
5.	Applicable Standards for testing		
6.	Rated Voltage	kV	
7.	Maximum service voltage	kV	
8.	Type & Material of bushing		
9.	Creepage Distance	mm	
10.	Whether full details of termination and BOQ furnished with offer		
11.	Whether cable sealing end is complete with all accessories		
12.	Whether descriptive pamphlet enclosed		
13.	Whether full details of tests to be carried out furnished with offer		
14.	Copies of type test reports enclosed		

SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Page No.	Clause No.	Deviation	Reason / Justification

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

Date:

Tenderer's Stamp & Signature