STANDARD

TRANSMISSION SERVICE AGREEMENT

FOR

DEVELOPMENT AND OPERATION OF INTRA-STATE TRANSMISSION SYSTEM

FOR TRANSMISSION OF ELECTRICITY THROUGH TARIFF BASED COMPETITIVE BIDDING FOR

CONSTRUCTION OF 400/220 KV, 2X500 MVA GIS SUBSTATION JEWAR, 220/33 KV, 2X60 MVA GIS SUBSTATION CANTT (CHAUKAGHAT) VARANASI, 220/33 KV, 3X60 MVA GIS SUBSTATION VASUNDHARA (GHAZIABAD), 220/132/33 KV, 2X160+2X40 MVA SUBSTATION KHAGA (FATEHPUR) WITH ASSOCIATED LINES

BETWEEN THE

PASCHIMANCHAL VIDYUT VITRAN NIGAM LTD.

MADHYANCHAL VIDYUT VITRAN NIGAM LTD.

PURVANCHAL VIDYUT VITRAN NIGAM LTD.

DAKSHINANCHAL VIDYUT VITRAN NIGAM LTD.

KANPUR ELECTRICITY SUPPLY CO. LTD.

AND

……

[INSERT THE NAME OF TRANSMISISON SERVICE PROVIDER]

May 04, 2023

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THIS TRANSMISISON SERVICE AGREEMENT (hereinafter referred to as "TSA" or "Agreement" or "the Agreement" or "this Agreement") is made on the …… [Insert day] of……. [Insert month] of Two Thousand and…… [Insert Year]

BETWEEN:

Persons whose names, addresses and other details are provided in Schedule 10 of this Agreement (collectively referred to as the "Long Term Transmission Customer(s)" and individually referred to as the "Long Term Transmission Customer", which expression shall unless repugnant to the context or meaning thereof include its successors, and permitted assigns) as Party of the one part;

AND

……. [Insert Name of the SPV], incorporated under the Companies Act, 1956/ Companies Act, 2013 (as the case may be), having its registered office at …….. (herein after referred to as "Transmission Service Provider" or "TSP", which expression shall unless repugnant to the context or meaning thereof include its successors, and permitted assigns) as Party of the other part;

(Each of the "Long Term Transmission Customer" or "Long Term Transmission Customers" and "TSP" are individually referred to as "Party" and collectively as the "Parties")

AND WHEREAS:

A) In accordance with the Bidding Guidelines, the Bid Process Coordinator (hereinafter referred to as BPC) had initiated a competitive e-reverse bidding process through issue of RFP for selecting a Successful Bidder to build, own, operate and transfer the Project comprising of the Elements mentioned in Schedule 1 (hereinafter referred to as the Project)

B) Pursuant to the said e-reverse bidding process, the BPC has identified the Successful Bidder, who will be responsible to set up the Project on build, own, operate and transfer basis to provide Transmission Service in accordance with the terms of this Agreement and the Transmission License.

C) The Selected Bidder have submitted the Contract Performance Guarantee and acquired one hundred percent (100%) of the equity shareholding of **SPV [which is under incorporation]**, along with all its related assets and liabilities in terms of the provisions of the Share Purchase Agreement.

D) The TSP has agreed to make an application for a Transmission License to the State Commission for setting up the Project on build, own, operate and transfer basis.

E) The TSP has further agreed to make an application to the State Commission for the adoption of the Transmission Charges under Section 63 of the Electricity Act, 2003, along with a certification from the Bid Evaluation Committee in accordance with the Bidding Guidelines issued by Ministry of Power, Government of India.

F) The Long Term Transmission Customers agree, on the terms and subject to the conditions of this Agreement, to use the available transmission capacity of the Project and pay to TSP the Transmission Charges as determined in accordance with the terms of this Agreement.

G) The TSP agrees to the terms and conditions of this agreement, for making available the Intra-State Transmission System and charge the Transmission Charges in accordance with the terms and conditions of this agreement.

H) The terms and conditions stipulated in the Transmission License issued by the State Commission to the TSP shall be applicable to this Agreement and the TSP agrees to comply with these terms and conditions. In case of inconsistency between the Transmission License terms & conditions and the conditions of this Agreement, the conditions stipulated in the Transmission License granted by the State Commission shall prevail.

NOW, THEREFORE, IN CONSIDERATION OF THE PREMISES AND MUTUAL AGREEMENTS, COVENANTS AND CONDITIONS SET FORTH HEREIN, IT IS HEREBY AGREED BY AND BETWEEN THE PARTIES HERETO AS FOLLOWS:

ARTICLE: 1

1 DEFINITIONS AND INTERPRETATIONS

1.1 Definitions:

1.1.1 The words / expressions used in this Agreement, unless as defined below or repugnant to the context, shall have the same meaning as assigned to them by the Electricity Act, 2003 and the rules or regulations framed there under including those issued / framed by the State Commission (as defined hereunder), as amended or re-enacted from time to time or the General Clauses Act, failing which it shall bear its ordinary English meaning.

The words/expressions when used in this Agreement shall have the respective meanings as specified below:

"Acquisition Price" shall have the same meaning as defined in the Share Purchase Agreement;

"Act" or **"Electricity Act"** or **"Electricity Act 2003"** shall mean the Electricity Act, 2003 and any amendments made to the same or any succeeding enactment thereof;

"Affiliate" shall mean a company that either directly or indirectly

i. controls or

ii. is controlled by or

iii. is under common control with

a Bidding Company (in the case of a single company) or a Member (in the case of a Consortium) and "**control**" means ownership by one entity of at least twenty six percent (26%) of the voting rights of the other entity;

"Allocated Project Capacity" shall mean, for each Long Term Transmission Customer, the sum of the generating capacities allocated to such Long Term Transmission Customer from the ISGS and the contracted power, if any, as adopted by UPERC from time to time in determining sharing of transmission charges between the Long Term Transmission Customers;

"Availability" in relation to the Project or in relation to any Element of the Project, for a given period shall mean the time in hours during that period the Project is capable to transmit electricity at its Rated Voltage and shall be expressed in percentage of total hours in the given period and shall be calculated as per the procedure contained in **as defined in Uttar Pradesh Electricity Regulatory Commission (Multi Year Tariff for Distribution and Transmission) Regulations, 2019,** as amended from time to time, attached herewith in Schedule 6;

"Bid" shall mean technical bid and financial bid submitted by the Bidder, in response to the RFP, in accordance with the terms and conditions of the RFP;

"Bid Deadline" shall mean the last date and time for submission of the Bid in response to RFP, as specified in the RFP;

"Bidding Company" shall refer to such single company that has made a Response to RFP for the Project;

"Bidding Consortium / Consortium" shall refer to a group of companies that has collectively made a Response to RFP for the Project;

"Bid Documents" or **"Bidding Documents"** shall mean the RFP, along with all attachments thereto or clarifications thereof;

"Bidding Guidelines" shall mean the "Tariff Based Competitive Bidding Guidelines for Transmission Service" and "Guidelines for Encouraging Competition in Development of Transmission Projects" issued by Government of India, Ministry of Power under Section – 63 of the Electricity Act as amended from time to time;

"Bid Process Coordinator" or **"BPC"** shall mean a person or its authorized representative as notified by the Government of India, responsible for carrying out the process for selection of Bidder who will acquire Transmission Service Provider;

"Business Day" shall mean a day other than Sunday or a statutory holiday, on which the banks remain open for business in the State in which the concerned Long Term Transmission Customer's registered office is located and the concerned TSP are located;

"CEA" shall mean the Central Electricity Authority constituted under Section -70 of the Electricity Act;

"Change in law" shall have the meaning ascribed thereto in Article 12;

"Commercial Operation Date" or **"COD"** shall mean the date as per Article 6.2;

"Commission" or **"CERC"** shall mean the Central Electricity Regulatory Commission referred to in sub-section (1) of Section 76 of the Electricity Act, 2003 or its successors and assigns;

"Competent Court of Law" shall mean the Supreme Court or any High Court, or any tribunal or any similar judicial or quasi-judicial body in India that has jurisdiction to adjudicate upon issues relating to the Project;

"Connection Agreement" shall mean the agreement between the CTU or STU or any other concerned parties and the TSP, setting out the terms relating to the connection of the Project to the Inter-connection Facilities and use of the Inter State Transmission System as per the provisions of the IEGC, as the case may be;

"Consultation Period" shall mean the period of sixty (60) days or such longer period as the Parties may agree, commencing from the date of issue of a TSP's Preliminary Notice or a Long Term Transmission Customer's Preliminary Termination Notice, as provided in Article 13 of this Agreement, for consultation between the Parties to mitigate the consequence of the relevant event having regard to all the circumstances;

"Consents, Clearances and Permits" shall mean all authorizations, licenses, approvals, registrations, permits, waivers, privileges, acknowledgements, agreements, or concessions required to be obtained from or provided by any concerned authority for the development, execution and operation of Project including without any limitation for the construction, ownership, operation and maintenance of the Transmission Lines and/or sub-stations;

"Construction Period" shall mean the period from (and including) the Effective Date of the Transmission Service Agreement up to (but not including) the COD of the Element of the Project in relation to an Element and up to (but not including) the COD of the Project in relation to the Project;

"Contractors" shall mean the engineering, procurement, construction, operation & maintenance contractors, surveyors, advisors, consultants, designers,

suppliers to the TSP and each of their respective sub-contractors (and each of their respective successors and permitted assigns) in their respective capacities as such;

"Contract Performance Guarantee" shall mean the irrevocable unconditional bank guarantee, submitted and to be submitted by the TSP or by the Selected Bidder on behalf of the TSP to the Long Term Transmission Customer(s) from a bank mentioned in Annexure 17 of the RFP, in the form attached here to as Schedule 8, in accordance with Article 3 of this Agreement and which shall include the additional bank guarantee furnished by the TSP under this Agreement;

"Contract Year", for the purpose of payment of Transmission Charges, shall mean the period beginning on the COD, and ending on the immediately succeeding March 31 and thereafter each period of 12 months beginning on April 1 and ending on March 31 provided that the last Contract Year shall end on the last day of the term of the TSA;

"CTU" or **"Central Transmission Utility"** shall have same meaning as defined in the Electricity Act, 2003;

"Day" shall mean a day starting at 0000 hours and ending at 2400 hours;

"D/C" shall mean Double Circuit;

"**Designated ISTS Customers**" or "**DICs**" shall have the meaning as ascribed in the Sharing Regulations.

"Dispute" shall mean any dispute or difference of any kind between the Parties, in connection with or arising out of this Agreement including any issue on the interpretation and scope of the terms of this Agreement as provided in Article 16;

"Effective Date" for the purposes of this Agreement, shall have the same meaning as per Article 2.1 of this Agreement;

"Electrical Inspector" shall mean a person appointed as such by the State Government under sub-section (1) of Section 162 of the Electricity Act 2003 and also includes Chief Electrical Inspector;

"Electricity Rules 2005" shall mean the rules framed pursuant to the Electricity Act 2003 and as amended from time to time;

"Element" shall mean each Transmission Line or each circuit of the Transmission Lines (where there are more than one circuit) or each bay of Sub-station or switching station or HVDC terminal or inverter station of the Project, including ICTs, Reactors, SVC, FSC, etc. forming part of the ISTS, which will be owned, operated and maintained by the concerned ISTS Licensee, and which has a separate Scheduled COD as per Schedule 2 of this Agreement and has a separate percentage for recovery of Transmission Charges on achieving COD as per Schedule 5 of this Agreement;

"Event of Default" shall mean the events as defined in Article 13 of this Agreement;

"Expiry Date" shall be the date which is thirty five (35) years from the COD of the Project;

"Financial Closure" shall mean the first Business Day on which funds are made available to the TSP pursuant to the Financing Agreements;

"Financially Evaluated Entity" shall mean the company which has been evaluated for the satisfaction of the financial requirement set forth in the RFP;

"Financing Agreements" shall mean the agreements pursuant to which the TSP is to finance the Project including the loan agreements, security documents, notes, indentures, security agreements, letters of credit and other documents, as may be amended, modified, or replaced from time to time, but without in anyway increasing the liabilities of the Long Term Transmission Customers;

"Financial Year" shall mean a period of twelve months at midnight Indian Standard Time (IST) between 1st April & 31st March;

"Force Majeure" and **"Force Majeure Event"** shall have the meaning assigned thereto in Article 11;

"GOI" shall mean Government of India;

"Grid Code" / "IEGC" or "State Grid Code" shall mean the Grid Code specified by the Central Commission under Clause (h) of sub-section (1) of Section 79 of the Electricity Act and/or the State Grid Code as specified by the concerned

State Commission, referred under Clause (h) of sub-section (1) of Section 86 of the Electricity Act 2003, as applicable;

"Indian Governmental Instrumentality" shall mean Government of India, Government of any State in India or any ministry, department, board, authority, agency, corporation, commission under the direct or indirect control of Government of India or any State Government or both, any political sub-division of any of them including any court or Commission or tribunal or judicial or quasi-judicial body in India but excluding the CTU, TSP, Designated ISTS Customers and the Long Term Transmission Customer's;

"Insurances" shall mean the insurance cover to be obtained and maintained by the TSP in accordance with Article 9 of this Agreement;

"Interconnection Facilities" shall mean the facilities as may be set up for transmission of electricity through the use of the Project, on either one or both side of generating station's / CTU's / STU's / ISTS Licensee's / Designated ISTS Customer's /Long Term Transmission Customer's substations (as the case may be) which shall include, without limitation, all other transmission lines, gantries, sub-stations and associated equipments not forming part of the Project;

"**Invoice**" shall mean a Monthly Transmission Charges Invoice or Monthly Bill comprising the Monthly Transmission Charges, as per Schedule 4 hereof, a Supplementary Invoice or any other Invoice or Bill raised by any of the Parties;

"**Licensee**" shall be the TSP under this Agreement, consequent to having been awarded a Transmission License by the State Commission and shall be referred to as the TSP or the Licensee, as the context may require in this Agreement;

"ISTS Licensee" shall be the TSP under this Agreement, consequent to having been awarded a Transmission License by the CERC and shall be referred to as the TSP or the ISTS Licensee, as the context may require in this Agreement;

"Law" or "Laws" in relation to this Agreement, shall mean all laws including electricity laws in force in India and any statute, ordinance, rule, regulation, notification, order or code, or any interpretation of any of them by an Indian Governmental Instrumentality having force of law and shall include all rules, regulations, decisions and orders of the State Commission;

"Lead Member of the Bidding Consortium" or "Lead Member" shall mean a company who commits at least 26% equity stake in the Project, meets the technical requirement as specified in the RFP and so designated by other Member(s) in Bidding Consortium;

"Lead **Long Term Transmission Customer"** shall have the meaning as ascribed thereto in Article 19.1.1 of this Agreement;

"**Letter of Credit**" or "**LC**" shall mean an unconditional, irrevocable, revolving Letter of Credit opened by the Long Term Transmission Customer in favour of the TSP with any scheduled bank;

"Lenders" means the banks, financial institutions, multilateral funding agencies, non banking financial companies registered with the Reserve Bank of India (RBI), insurance companies registered with the Insurance Regulatory & Development Authority (IRDA), pension funds regulated by the Pension Fund Regulatory & Development Authority (PFRDA),mutual funds registered with Securities & Exchange Board of India (SEBI), etc., including their successors and assigns, who have agreed on or before COD of the Project to provide the TSP with the debt financing described in the capital structure schedule, and any successor banks or financial institutions to whom their interests under the Financing Agreements may be transferred or assigned;

Provided that, such assignment or transfer shall not relieve the TSP of its obligations to the Long Term Transmission Customers under this Agreement in any manner and shall also does not lead to an increase in the liability of any of the Long Term Transmission Customers;

"Lenders Representative" shall mean the person notified by the Lender(s) in writing as being the representative of the Lender(s) or the Security Trustee and such person may from time to time be replaced by the Lender(s) pursuant to the Financing Agreements by written notice to the TSP;

"Letter of Intent" or **"LOI"** shall have the same meaning as in the RFP;

"Long Term Transmission Customer" shall mean a person availing or intending to avail access to the Intra-State Transmission System for a period up to twenty-five years (25) or more, and for the purposes of this Project, or any such other person who executes a supplementary agreement for availing transmission service as per the provisions of the TSA;

"Member in a Bidding Consortium / Member" shall mean each company in the Bidding Consortium;

"Month" shall mean a period of thirty (30) days from (and excluding) the date of the event;

"Monthly Transmission Charges" for any Element of the Project, after COD of the Element till COD of the Project, and for the Project after COD of the Project, shall mean the amount of Transmission Charges as specified in Schedule 5 of this Agreement multiplied by no. of days in the relevant month and divided by no. of days in the year;

"National Load Despatch Centre" shall mean the centre established as per sub-section (1) of Section 26 of the Electricity Act 2003;

"Notification" shall mean any notification, issued in the Gazette of India;

"Operating Period" for any Element of the Project shall mean the period from (and including) the COD of such Element of the Project, up to (and including) the Expiry Date and for the Project, shall mean the period from (and including) the COD of the Project, up to (and including) the Expiry Date;

"Parent Company" shall mean an entity that holds at least twenty six percent (26%) of the paid - up equity capital directly or indirectly in the Bidding Company or in the Member in a Bidding Consortium, as the case may be;

"Preliminary Termination Notice" shall mean a Long Term Transmission Customer's Preliminary Termination Notice as defined in Article 13 of this Agreement;

"Project" shall mean **Construction of 400/220 kV, 2x500 MVA GIS Substation Jewar, 220/33 kV, 2x60 MVA GIS substation Cantt (Chaukaghat) Varanasi, 220/33 kV, 3x60 MVA GIS substation Vasundhara (Ghaziabad), 220/132/33 kV, 2x160+2x40 MVA substation khaga (Fatehpur) with associated lines**, as detailed in Schedule 1 of this Agreement;

"**Project Assets**" shall mean all physical and other assets relating to and forming part of the Project including:

(a) rights over the Site for substations, ROW for transmission lines;

(b) tangible & intangible assets such as civil works and equipment including foundations, embankments, pavements, electrical systems, communication systems, relief centres, administrative offices, Sub-stations, software, tower and sub-stations designs etc;

(c) project facilities situated on the Site;

(d) all rights of the TSP under the project agreements;

(e) financial assets, such as receivables, security deposits etc;

(f) insurance proceeds; and

(g) Applicable Permits and authorisations relating to or in respect of the Transmission System;"

"Project Execution Plan" shall mean the plan referred to in Article 3.1.3(c) hereof;

"Prudent Utility Practices" shall mean the practices, methods and standards that are generally accepted internationally from time to time by electric transmission utilities for the purpose of ensuring the safe, efficient and economic design, construction, commissioning, operation, repair and maintenance of the Project and which practices, methods and standards shall be adjusted as necessary, to take account of:

(i) operation, repair and maintenance guidelines given by the manufacturers to be incorporated in the Project,

(ii) the requirements of Law, and

(iii) the physical conditions at the Site;

(iv) the safety of operating personnel and human beings;

"Rated Voltage" shall mean voltage at which the Transmission System is designed to operate or such lower voltage at which the line is charged, for the time being, in consultation with the Central Transmission Utility;

"Rebate" shall have the meaning as ascribed to in Article 10.3 of this Agreement;

"RFP" shall mean Request For Proposal dated May 04, 2023 along with all schedules, annexures and RFP Project Documents attached thereto, issued by the BPC for tariff based competitive bidding process for selection of Bidder as TSP to execute the Project, including any modifications, amendments or alterations thereto;

"RFP Project Documents" shall mean the following documents to be entered into in respect of the Project, by the Parties to the respective agreements:

a.Transmission Service Agreement,

b. Share Purchase Agreement,

c. Any other agreement as may be required;

"RLDC" shall mean the relevant Regional Load Dispatch Centre as defined in the Electricity Act, 2003, in the region(s) in which the Project is located;

"RPC" shall mean the relevant Regional Power Committee established by the Government of India for the specific Region(s) in accordance with the Electricity Act, 2003 for facilitating integrated operation of the Power System in that Region;

"Scheduled COD" in relation to an Element(s) shall mean the date(s) as mentioned in Schedule 2 as against such Element(s) and in relation to the Project, shall mean the date as mentioned in Schedule 2 as against such Project, subject to the provisions of Article 4.4 of this Agreement, or such date as may be mutually agreed among the Parties;

"Scheduled Outage" shall mean the final outage plan as approved by the RPC as per the provisions of the Grid Code;

"Selected Bid" shall mean the technical Bid and the Final Offer of the Selected Bidder submitted during e-reverse bidding, which shall be downloaded and attached in Schedule 7 on or prior to the Effective Date;

"Share Purchase Agreement" shall mean the agreement amongst PFC Consulting Limited, **SPV [which is under incorporation]** and the Successful Bidder for the purchase of one hundred (100%) per cent of the shareholding of the **SPV [which is under incorporation]** for the Acquisition Price, by the Successful Bidder on the terms and conditions as contained therein;

"Site" in relation to a substation, switching station or HVDC terminal or inverter station, shall mean the land and other places upon which such station / terminal is to be established;

"SLDC" shall mean the State Load Despatch Centre established as per sub-section (1) of Section 31 of the Electricity Act 2003;

"State Commission" or **"Appropriate Commission"** shall mean shall mean the Central Regulatory Commission referred to in sub-section (1) of Section 76 of the Electricity Act, or the State Regulatory Commission referred to in Section 82 of the Electricity Act or the Joint Commission referred to in Section 83 of the Electricity Act, as the case may be. In this case the Appropriate Commission is Uttar Pradesh Electricity Regulatory Commission;

"State Government" shall mean the Government of Uttar Pradesh;

"STU" or **"State Transmission Utility"** shall be the Board or the Government company, specified as such by the State Government under sub-section (1) of Section 39 of the Electricity Act 2003;

"Successful Bidder" or **"Selected Bidder"** shall mean the Bidder selected pursuant to the RFP and who has to acquire one hundred percent (100%) equity shares of **SPV [which is under incorporation]**, along with all its related assets and liabilities, which will be responsible as the TSP to establish the Project on build, own, operate and transfer basis as per the terms of the TSA and other RFP Project Documents;

"**Supplementary Agreement**" shall mean the agreement as annexed hereto in Schedule 11 of this Agreement;

"TSP's Preliminary Notice" shall mean a notice issued by the TSP in pursuant to the provisions of Article 13.3 of this Agreement;

"Target Availability" shall have the meaning as ascribed hereto in Article 8.2 of this Agreement;

"Technically Evaluated Entity" shall mean the company which has been evaluated for the satisfaction of the technical requirement set forth in RFP;

"Termination Notice" shall mean a **Long Term Transmission Customer's** Termination Notice given by the **Long Term Transmission Customer** to the TSP

pursuant to the provisions of Articles 3.3.2, 3.3.4, 4.4.2, 5.8, 13.2 and 13.3 of this Agreement for the termination of this Agreement;

"Term of Agreement" for the purposes of this Agreement shall have the meaning ascribed thereto in Article 2.2 of this Agreement;

"Transmission Charges" shall mean the Final Offer of the Selected Bidder during the e-reverse bidding and adopted by the State Commission, payable to the TSP by the Long Term Transmission Customers as per the provisions of TSA;

"Transmission License" shall mean the license granted by the State Commission in terms of the relevant regulations for grant of such license issued under the Electricity Act;

"Transmission Service" shall mean making the Project available as per the terms and conditions of this Agreement and Sharing Regulations;

"Transmission Licensee" shall mean a licensee authorized to establish and operate Transmission Lines by the Appropriate Commission;

"Unscheduled Outage" shall mean an interruption resulting in reduction of the Availability of the Element(s) / Project (as the case may be) that is not a result of a Scheduled Outage or a Force Majeure Event.

"Ultimate Parent Company" shall mean an entity which owns at least twenty six percent (26%) equity in the Bidding Company or Member of a Consortium, (as the case may be) and in the Technically Evaluated Entity and / or Financially Evaluated Entity (as the case may be) and such Bidding Company or Member of a Consortium, (as the case may be) and the Technically Evaluated Entity and / or Financially Evaluated Entity (as the case may be) shall be under the direct control or indirectly under the common control of such entity;

"**UPERC**" shall mean the Uttar Pradesh Electricity Regulatory Commission or its successors.

1.2 Interpretation:

Save where the contrary is indicated, any reference in this Agreement to:

"Agreement" shall be construed as including a reference to its Schedules, Appendices and Annexures;

"Rupee", **"Rupees"** and **"Rs."** shall denote lawful currency of India;

“crore” shall mean a reference to ten million (10,000,000) and a **“lakh”** shall mean a reference to one tenth of a million (1,00,000);

"encumbrance" shall be construed as a reference to a mortgage, charge, pledge, lien or other encumbrance securing any obligation of any person or any other type of preferential arrangement (including, without limitation, title transfer and retention arrangements) having a similar effect;

"holding company" of a company or corporation shall be construed as a reference to any company or corporation of which the other company or corporation is a subsidiary;

"indebtedness" shall be construed so as to include any obligation (whether incurred as principal or surety) for the payment or repayment of money, whether present or future, actual or contingent;

"person" shall have the meaning as defined in Section 2 (49) of the Act;

"subsidiary" of a company or corporation (the holding company) shall be construed as a reference to any company or corporation:

(i) which is controlled, directly or indirectly, by the holding company, or

(ii) more than half of the issued share capital of which is beneficially owned, directly or indirectly, by the holding company, or

(iii) which is a subsidiary of another subsidiary of the holding company,

for these purposes, a company or corporation shall be treated as being controlled by another if that other company or corporation is able to direct its affairs and/or to control the composition of its board of directors or equivalent body;

"winding-up", **"dissolution"**, **"insolvency"**, or **"reorganization"** in the context of a company or corporation shall have the same meaning as defined in the Companies Act, 1956/ Companies Act, 2013 (as the case may be).

1.2.1 Words importing the singular shall include the plural and vice versa.

1.2.2 This Agreement itself or any other agreement or document shall be construed as a reference to this or to such other agreement or document as it may have been, or may from time to time be, amended, varied, novated, replaced or supplemented.

1.2.3 A Law shall be construed as a reference to such Law including its amendments or re-enactments from time to time.

1.2.4 A time of day shall, save as otherwise provided in any agreement or document be construed as a reference to Indian Standard Time.

1.2.5 Different parts of this Agreement are to be taken as mutually explanatory and supplementary to each other and if there is any inconsistency between or among the parts of this Agreement, they shall be interpreted in a harmonious manner so as to give effect to each part.

1.2.6 The tables of contents and any headings or sub-headings in this Agreement have been inserted for ease of reference only and shall not affect the interpretation of this Agreement.

1.2.7 All interest payable under this Agreement shall accrue from day to day and be calculated on the basis of a year of three hundred and sixty five (365) days.

1.2.8 The words “hereof” or “herein”, if and when used in this Agreement shall mean a reference to this Agreement.

1.2.9 The contents of Schedule 7 shall be referred to for ascertaining accuracy and correctness of the representations made by the Selected Bidder in Article 17.2.1 hereof.

ARTICLE: 2

2 EFFECTIVENESS AND TERM OF AGREEMENT

2.1 Effective Date:

This Agreement shall be effective from later of the dates of the following events:

a. The Selected Bidder, on behalf of the TSP, has provided the Contract Performance Guarantee, as per terms of Article 3.1 of this Agreement; and

b. The Selected Bidder has acquired for the Acquisition Price, one hundred percent (100%) of the equity shareholding of **PFC Consulting Limited** in [Insert Name of the SPV] along with all its related assets and liabilities as per the provisions of the Share Purchase Agreement. and

c. The Agreement is executed and delivered by the Parties;

2.2 Term and Termination:

2.2.1 Subject to Article 2.2.3 and Article 2.4, this Agreement shall continue to be effective in relation to the Project until the Expiry Date, when it shall automatically terminate.

2.2.2 Post the Expiry Date of this Agreement, the TSP shall ensure transfer of Project Assets to STU or its successors or an agency as decided by the State Government at zero cost and free from any encumbrance and liability. The transfer shall be completed within 90 days of expiry of this Agreement failing which STU shall be entitled to take over the Project Assets Suo moto.

2.2.3 This Agreement shall terminate before the Expiry Date in accordance with Article 13 or Article 3.3.2 or Article 3.3.4.

2.3 Conditions prior to the expiry of the Transmission License

2.3.1 In order to continue the Project beyond the expiry of the Transmission License, the TSP shall be obligated to make an application to the State Commission at least two (2) years before the date of expiry of the Transmission License, seeking the Commission's approval for the extension of the term of the Transmission License up to the Expiry Date.

2.3.2 The TSP shall timely comply with all the requirements that may be laid down by the State Commission for extension of the term of the Transmission License beyond the initial term of twenty-five (25) years & upto the Expiry Date and the TSP shall keep the Long Term Transmission Customers fully informed about the progress on its application for extension of the term of the Transmission License.

2.4 Survival:

The expiry or termination of this Agreement shall not affect any accrued rights, obligations/ roles and liabilities of the Parties under this Agreement, including the right to receive liquidated damages as per the terms of this Agreement, nor shall it effect the survival of any continuing obligations/ roles for which this Agreement provides, either expressly or by necessary implication, which are to survive after the Expiry Date or termination including those under Articles 3.3.3, 3.3.5, Article 9.3 (Application of Insurance Proceeds), Article 11 (Force Majeure), Article 13 (Events of Default and Termination), Article 14 (Liability & Indemnification), Article 16 (Governing Law & Dispute Resolution), Article 19 (Miscellaneous).

2.5 Applicability of the provisions of this Agreement

2.5.1 For the purpose of Availability, Target Availability and the computation of Availability, Incentive, Penalty, the provisions provided in this Agreement shall apply and any future modifications in the relevant Rules and Regulations shall not be applicable for this Project.

2.5.2 For the purposes of this Agreement for Intra State systems developed under the tariff based competitive bidding framework, the provisions relating to the definitions (Availability and COD), Article 3 (Contract Performance Guarantee and Conditions Subsequent), Article 5 (Construction of the Project), Article 6

(Connection and Commissioning of the Project), Article 8 (Target Availability and calculation of Availability), Article 11 (Force Majeure), Article 12 (Change in Law), Article 13 (Event of Default), Article 14 (Indemnification), Article 15 (Assignment and Charges), Articles 16.1, 16.2 and 16.4 (Governing Laws and Dispute Resolution) and Article 17 (representation and warranties of the InSTS Licensee) of this agreement shall prevail.

ARTICLE: 3

3 CONDITIONS SUBSEQUENT

3.1 Satisfaction of conditions subsequent by the TSP

3.1.1 Within ten (10) days from the date of issue of Letter of Intent, the Selected Bidder, shall:

a. Provide the Contract Performance Guarantee, and

b. Acquire, for the Acquisition Price, one hundred percent (100%) equity shareholding of **SPV [which is under incorporation]** from **PFC Consulting Limited**, who shall sell to the Selected Bidder, the equity shareholding of **SPV [which is under incorporation]**, along with all its related assets and liabilities.

c. Execute this Agreement;

The TSP shall, within five (5) working days from the date of acquisition of SPV by the Selected Bidder, undertake to apply to the state Commission for the grant of Transmission License and for the adoption of tariff as required under section-63 of the Electricity Act.

The Selected Bidder, on behalf of the TSP, will provide to the Long Term Transmission Customers the Contract Performance Guarantee for an amount of **Rs. 17.10 Crore (Rupees Seventeen Crore Ten Lakh only)**.

3.1.2 The Contract Performance Guarantee shall be initially valid for a period up to three (3) months after the Scheduled COD of the Project and shall be extended from time to time to be valid for a period up to three (3) months after the COD of the Project. In case the validity of the Contract Performance Guarantee is expiring before the validity specified in this Article, the TSP shall, at least thirty (30) days before the expiry of the Contract Performance Guarantee, replace the Contract Performance Guarantee with another Contract Performance Guarantee or extend the validity of the existing Contract Performance Guarantee until the validity period specified in this Article.

3.1.3 The TSP agrees and undertakes to duly perform and complete the following activities within six (6) months from the Effective Date (except for c) below),

unless such completion is affected due to any Force Majeure Event, or if any of the activities is specifically waived in writing by the Majority Long Term Transmission Customers:

a. To obtain the Transmission License for the Project from the State Commission;

b. To obtain the order for adoption of Transmission Charges by the State Commission, as required under Section 63 of the Electricity Act 2003;

c. To submit to the Lead Long Term Transmission Customers and STU, the Project Execution Plan, immediately after award of contract(s) and maximum within one hundred and twenty (120) days from the Effective Date. Also, an approved copy each of Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) would be submitted to Long Term Transmission Customer(s) and STU in the same time period. The TSP's Project Execution Plan should be in conformity with the Scheduled COD as specified in Schedule 2 of this Agreement, and shall bring out clearly the organization structure, time plan and methodology for executing the Project, award of major contracts, designing, engineering, procurement, shipping, construction, testing and commissioning to commercial operation;

d. To submit to the Long Term Transmission Customers & STU a detailed bar (GANTT) chart of the Project outlining each activity (taking longer than one Month), linkages as well as durations;

e. To submit to the Long Term Transmission Customers & STU detailed specifications of conductor meeting the functional specifications specified in RFP;

f. To achieve Financial Closure;

g. To provide an irrevocable letter to the Lenders duly accepting and acknowledging the rights provided to the Lenders under the provisions of Article 15.3 of this Agreement and all other RFP Project Documents;

h. To award the Engineering, Procurement and Construction contract ("EPC contract") for the design and construction of the Project and shall have given to such Contractor an irrevocable notice to proceed; and

3.2 Recognition of Lenders' Rights by the Long Term Transmission Customer

3.2.1 The Long Term Transmission Customer hereby accepts and acknowledges the rights provided to the Lenders as per Article 15.3 of this Agreement and all other RFP Project Documents.

3.3 Consequences of non-fulfilment of conditions subsequent

3.3.1 If any of the conditions specified in Article 3.1.3 is not duly fulfilled by the TSP even within three (3) Months after the time specified therein, then on and from the expiry of such period and until the TSP has satisfied all the conditions specified in Article 3.1.3, the TSP shall, on a monthly basis, be liable to furnish to Long Term Transmission Customers additional Contract Performance Guarantee of **Rs. 1.71 Crore (Rupees One Crore Seventy One Lakh Only)** [additional Contract Performance Guarantee to be computed at ten percent (10%) of the original Contract Performance Guarantee amount as per Article 3.1.1] within two (2) Business Days of expiry of every such Month. Such additional Contract Performance Guarantee shall be provided to Long Term Transmission Customers in the manner provided in Article 3.1.1 and shall become part of the Contract Performance Guarantee and all the provisions of this Agreement shall be construed accordingly. Long Term Transmission Customers shall be entitled to hold and / or invoke the Contract Performance Guarantee, including such additional Contract Performance Guarantee, in accordance with the provisions of this Agreement.

3.3.2 Subject to Article 3.3.4, if:

(i) the fulfilment of any of the conditions specified in Article 3.1.3 is delayed beyond nine (9) Months from the Effective Date and the TSP fails to furnish additional Contract Performance Guarantee to the Long Term Transmission Customers in accordance with Article 3.3.1 hereof; or

(ii) the TSP furnishes additional Performance Guarantee to the Long Term Transmission Customers in accordance with Article 3.3.1 hereof but fails to fulfil the conditions specified in Article 3.1.3 within a period of twelve (12) months from the Effective Date,

the Long Term Transmission Customers shall have the right to terminate this

Agreement, by giving a Termination Notice to the TSP, in writing, of at least seven (7) days, with a copy to STU and the Lenders' Representative in order to enable the Lenders to exercise right of substitution in accordance with Article 15.3 of this Agreement.

3.3.3 If the Long Term Transmission Customers elects to terminate this Agreement as per the provisions of Article 3.3.2, the TSP shall be liable to pay to the Long Term Transmission Customers an amount of **Rs. 17.10 Crore (Rupees Seventeen Crore Ten Lakh only)** as liquidated damages. The Long Term Transmission Customers shall be entitled to recover this amount of damages by invoking the Contract Performance Guarantee to the extent of liquidated damages, which shall be required by the Long Term Transmission Customers , and the balance shall be returned to TSP, if any.

It is clarified for removal of doubt that this Article shall survive the termination of this Agreement.

3.3.4 In case of inability of the TSP to fulfil the conditions specified in Article 3.1.3 due to any Force Majeure Event, the time period for fulfilment of the condition subsequent as mentioned in Article 3.1.3, may be extended for a period of such Force Majeure Event. Alternatively, if deemed necessary, this Agreement may be terminated by the Long Term Transmission Customers by giving a Termination Notice to the TSP, in writing, of at least seven (7) days, with a copy to STU and the Lenders' Representative in order to enable the Lenders to exercise right of substitution in accordance with Article 15.3 of this Agreement and the Contract Performance Guarantee shall be returned as per the provisions of Article 6.5.1.

Provided, that due to the provisions of this Article 3.3.4, any increase in the time period for completion of conditions subsequent mentioned under Article 3.1.3, shall lead to an equal increase in the time period for the Scheduled COD. If the Scheduled COD is extended beyond a period of one hundred eighty (180) days due to the provisions of this Article 3.3.4, the TSP will be allowed to recover the interest cost during construction corresponding to the period exceeding one hundred eighty (180) days by adjustment in the Transmission Charges in accordance with Schedule 9.

3.3.5 Upon termination of this Agreement as per Articles 3.3.2 and 3.3.4, the Lead

Long Term Transmission Customer may take steps to bid out the Project again.

3.3.6 The Long Term Transmission Customers, on the failure of the TSP to fulfil its obligations, if it considers that there are sufficient grounds for so doing, apart from invoking the Contract Performance Guarantee under para 3.3.3 may also initiate proceedings for blacklisting the TSP as per provisions of Article 13.2 of TSA.

3.4 Progress Reports

The TSP shall notify the Lead Long Term Transmission Customer and STU in writing at least once a Month on the progress made in satisfying the conditions subsequent in Articles 3.1.3.

ARTICLE: 4

4 DEVELOPMENT OF THE PROJECT

4.1 TSP's obligations in development of the Project:

Subject to the terms and conditions of this Agreement, the TSP at its own cost and expense shall observe, comply with, perform, undertake and be responsible:

a. for procuring and maintaining in full force and effect all Consents, Clearances and Permits, required in accordance with Law for development of the Project;

b. for financing, constructing, owning and commissioning each of the Element of the Project for the scope of work set out in Schedule 1 of this Agreement in accordance with:

i. the Electricity Act and the Rules made thereof;

ii. the Grid Code;

iii. the CEA Regulations applicable, and as amended from time to time, for Transmission Lines and sub-stations:

- the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007;
- Central Electricity Authority (Technical Standards for construction of Electrical Plants and Electric Lines) Regulation, 2010;
- Central Electricity Authority (Grid Standard) Regulations, 2010;
- Central Electricity Authority (Safety requirements for construction, operation and maintenance of Electrical Plants and Electrical Lines) Regulation, 2011;
- Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulation, 2010;
- Central Electricity Authority (Technical Standards for Communication System in Power System Operation) Regulations, 2020.

iv. Safety/ security Guidelines laid down by the Government;

v. Prudent Utility Practices, relevant Indian Standards and the Law;

not later than the Scheduled COD as per Schedule 2 of this Agreement;

c. for entering into a Connection Agreement with the concerned parties in accordance with the Grid Code.

d. for owning the Project throughout the term of this Agreement free and clear of any encumbrances except those expressly permitted under Article 15 of this Agreement;

e. to co-ordinate and liaise with concerned agencies and provide on a timely basis relevant information with regard to the specifications of the Project that may be required for interconnecting the Project with the Interconnection Facilities;

f. for providing all assistance to the Arbitrators as they may require for the performance of their duties and responsibilities;

g. to provide to the Long Term Transmission Customers and STU, on a monthly basis, progress reports with regard to the Project and its execution (in accordance with prescribed form) to enable the CEA to monitor and co-ordinate the development of the Project matching with the Interconnection Facilities;

h. to comply with Ministry of Power order no. 25-11/6/2018 – PG dated 02.07.2020 as well as other Guidelines issued by Govt. of India pertaining to this;

i. to procure the products associated with the Transmission System as per provisions of Public Procurement (Preference to Make in India) orders issued by Ministry of Power vide orders No. 11/5/2018 - Coord. dated 28.07.2020 for transmission sector, as amended from time to time read with Department for Promotion of Industry and Internal Trade (DPIIT) orders in this regard (Procuring Entity as defined in above orders shall deemed to have included Selected Bidder and/ or TSP).

Also, to comply with Department of Expenditure, Ministry of Finance vide Order (Public Procurement No 1) bearing File No. 6/18/2019-PPD dated 23.07.2020, Order (Public Procurement No 2) bearing File No. 6/18/2019-PPD dated 23.07.2020 and Order (Public Procurement No. 3) bearing File No. 6/18/2019-PPD, dated 24.07.2020, as amended from time to time, regarding public procurement from a bidder of a country, which shares land border with India;

j. to submit to Long Term Transmission Customers information in the prescribed format [To be devised by Long Term Transmission Customers] for ensuring compliance to Article 4.1 i) above.

k. to comply with all its obligations undertaken in this Agreement.

4.2 Roles of the Long Term Transmission Customers in implementation of the Project:

4.2.1 Subject to the terms and conditions of this Agreement, the Long Term Transmission Customers shall be the holder and administrator of this Agreement and shall inter alia:

a. provide letters of recommendation to the concerned Indian Governmental Instrumentality, as may be requested by the TSP from time to time, for obtaining the Consents, Clearances and Permits required for the Project;

b. coordinate among TSP and upstream/downstream entities in respect of Interconnection Facilities; and

c. monitor the implementation of the Agreement and take appropriate action for breach thereof including revocation of guarantees, cancellation of Agreement, blacklisting etc

d. provide all assistance to the Arbitrators as required for the performance of their duties and responsibilities; and

e. perform any other responsibility (ies) as specified in this Agreement.

4.3 Time for Commencement and Completion:

a. The TSP shall take all necessary steps to commence work on the Project from the Effective Date of the Agreement and shall achieve Scheduled COD of the Project in accordance with the time schedule specified in Schedule 2 of this Agreement;

b. The COD of each Element of the Project shall occur no later than the Scheduled COD or within such extended time to which the TSP shall be entitled under Article 4.4 hereto.

4.4 Extension of time:

4.4.1 In the event that the TSP is unable to perform its obligations for the reasons solely attributable to the Long Term Transmission Customers, the Scheduled COD shall be extended, by a 'day to day' basis, subject to the provisions of Article 13.

4.4.2 In the event that an Element or the Project cannot be commissioned by its Scheduled COD on account of any Force Majeure Event as per Article 11, the Scheduled COD shall be extended, by a 'day to day' basis for a period of such Force Majeure Event. Alternatively, if deemed necessary, the Long Term Transmission Customers may terminate the Agreement as per the provisions of Article 13.4 by giving a Termination Notice to the TSP, in writing, of at least seven (7) days, with a copy to STU and the Lenders' Representative in order to enable the Lenders to exercise right of substitution in accordance with Article 15.3 of this Agreement.

4.4.3 If the Parties have not agreed, within thirty (30) days after the affected Party's performance has ceased to be affected by the relevant circumstance, on how long the Scheduled COD should be deferred by, any Party may raise the Dispute to be resolved in accordance with Article 16.

4.5 Metering Arrangements:

4.5.1 The TSP shall comply with all the provisions of the IEGC and the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 as amended from time to time, with regard to the metering arrangements for the Project. The TSP shall fully cooperate with the CTU / STU / RLDC and extend all necessary assistance in taking meter readings.

4.6 Interconnection Facilities:

4.6.1 Subject to the terms and conditions of this Agreement, the TSP shall be responsible for connecting the Project with the interconnection point(s) specified in Schedule 1 of this Agreement. The Interconnection Facilities shall be developed as per the scope of work and responsibilities assigned in Schedule 1 of this Agreement. The Long Term Transmission Customers shall be responsible for coordinating to make available the Interconnection Facilities.

4.6.2 In order to remove any doubts, it is made clear that the obligation of the TSP within the scope of the project is to construct the Project as per Schedule-1 of this Agreement and in particular to connect it to the Interconnection Facilities as specified in this Agreement.

ARTICLE: 5

5 CONSTRUCTION OF THE PROJECT

5.1 TSP's Construction Responsibilities:

5.1.1 The TSP, at its own cost and expense, shall be responsible for designing, constructing, erecting, testing and commissioning each Element of the Project by the Scheduled COD in accordance with the Regulations and other applicable Laws specified in Article 4.1 of this Agreement.

5.1.2 The TSP acknowledges and agrees that it shall not be relieved from any of its obligations under this Agreement or be entitled to any extension of time or any compensation whatsoever by reason of the unsuitability of the Site or Transmission Line route(s).

5.1.3 The TSP shall be responsible for obtaining all Consents, Clearances and Permits related but not limited to road / rail / river / canal / power line / crossings, Power and Telecom Coordination Committee (PTCC), defence, civil aviation, right of way / way-leaves and environmental & forest clearances from relevant authorities required for developing, financing, constructing, maintaining/ renewing all such Consents, Clearances and Permits in order to carry out its obligations under this Agreement in general and shall furnish to the the Lead Long Term Transmission Customer such copy/ies of each Consents, Clearances and Permits, on demand. The Long Term Transmission Customers shall provide letters of recommendation to the concerned Indian Governmental Instrumentality, as may be requested by the TSP from time to time, for obtaining the Consents, Clearances and Permits required for the Project.

5.1.4 The TSP shall be responsible for:

(a) acquisition of land for location specific substations, switching stations or HVDC terminal or inverter stations. Also, the actual location of substations, switching stations or HVDC terminal or inverter stations shall not be beyond 3 Km radius of the location proposed by the BPC in the survey report;

(b) final selection of Site including its geo-technical investigation;

(c) survey and geo-technical investigation of line route in order to determine the final route of the Transmission Lines;

(d) seeking access to the Site and other places where the Project is being executed, at its own risk and costs, including payment of any crop, tree compensation or any other compensation as may be required.

5.1.5 In case the Project involves any resettlement and rehabilitation, the resettlement and rehabilitation package will be implemented by the State Government authorities, for which the costs is to be borne by the TSP and no changes would be allowed in the Transmission Charges on account of any variation in the resettlement and rehabilitation cost. The TSP shall provide assistance on best endeavour basis, in implementation of the resettlement and rehabilitation package, if execution of such package is in the interest of expeditious implementation of the Project and is beneficial to the Project affected persons.

5.2 Appointing Contractors:

5.2.1 The TSP shall conform to the requirements as provided in this Agreement while appointing Contractor(s) for procurement of goods & services.

5.2.2 The appointment of such Contractor(s) shall neither relieve the TSP of any of its obligations under this Agreement nor make the Long Term Transmission Customers liable for the performance of such Contractor(s).

5.3 Monthly Progress Reporting:

The TSP shall provide to the STU, and Long Term Transmission Customers on a monthly basis, progress reports along with likely completion date of each Element with regard to the Project and its execution (in accordance with prescribed form). The Long Term Transmission Customers / STU shall monitor the development of the Project for its timely completion for improving and augmenting the electricity system as a part of its statutory responsibility.

5.4 Quality of Workmanship:

The TSP shall ensure that the Project is designed, built and completed in a good workmanship using sound engineering and construction practices, and using

only materials and equipment that are new and manufactured as per the MQP and following approved FQP for erection, testing & commissioning and complying with Indian /International Standards such that, the useful life of the Project will be at least thirty five (35) years from the COD of the Project.

The TSP shall ensure that all major substation equipment / component (e.g. transformers, reactors, Circuit Breakers, Instrument Transformers (IT), Surge Arresters (SA), Protection relays, clamps & connectors etc.), equipment in terminal stations of HVDC installations including Thyristor/ IGBT valves, Converter Transformers, smoothing reactors, Transformer bushings and wall bushings, GIS bus ducts, towers and gantry structures and transmission towers or poles and line materials (conductors, earthwire, OPGW, insulator, accessories for conductors, OPGW & earthwires, hardware fittings for insulators, aviation lights etc), facilities and system shall be designed, constructed and tested (Type test, Routine tests, Factory Acceptance Test (FAT)) in accordance with relevant CEA Regulations and Indian Standards. In case Indian Standards for any particular equipment/ system/ process is not available, IEC/ IEEE or equivalent International Standards and Codes shall be followed.

5.5 Progress Monitoring & Quality Assurance:

5.5.1 The Project Execution Plan submitted by the TSP in accordance with Article 3.1.3 c) shall comprise of detailed schedule of all the equipments/items /materials required for the Project, right from procurement of raw material till the dispatch from works and receipt at the site. Further, it should also include various stages of the construction schedule up to the commissioning of the Project.

5.5.2 Long Term Transmission Customers & STU shall have access at all reasonable times to the Site and to the Manufacturer's works and to all such places where the Project is being executed.

5.5.3 Long Term Transmission Customers shall ensure conformity of the conductor specifications with the functional specifications specified in RFP.

5.5.4 The Long Term Transmission Customers shall monitor the following during construction of the Project:

a) Quality of equipments, material, foundation, structures and workmanship etc. as laid down in Article 5.4 and 6.1.4 of the TSA. Specifically, quality of Sub-

station equipments, transmission line material and workmanship etc. would be checked in accordance with the Article 5.4.

b) Progress in the activities specified in Condition Subsequent

c) Verification of readiness of the elements including the statutory clearances & completion of civil works, fixing of all components and finalisation of punch points (if any) prior to charging of the elements

d) Progress of construction of substation and Transmission Lines

5.5.5 The progress shall be reviewed by the Long Term Transmission Customers against the Project Execution Plan. The Long Term Transmission Customers shall prepare its report on monthly basis and submit the same to Long Term Transmission Customers highlighting the progress achieved till the end of respective month vis-à-vis milestone activities, areas of concern, if any, which may result in delay in the timely completion of the Project. Based on the progress, Long Term Transmission Customers and/ or STU shall issue written instructions to the TSP to take corrective measures, as may be prudent for the timely completion of the Project. In case of any deficiency, the Long Term Transmission Customers would be at liberty to take action in accordance with the procedure of this Agreement.

5.5.6 For any delay in commissioning any critical Element(s), as identified in Schedule 1 & Schedule 2 of this Agreement, beyond a period of 45 days shall lead to a sequestration of 10% of the Contract Performance Guarantee.

5.6 Site regulations and Construction Documents

The TSP shall abide by the Safety Rules and Procedures as mentioned in Schedule 3 of this Agreement

The TSP shall retain at the Site and make available for inspection at all reasonable times, copies of the Consents, Clearances and Permits, construction drawings and other documents related to construction.

5.7 Supervision of work:

The TSP shall provide all necessary superintendence for execution of the Project and its supervisory personnel shall be available to provide full-time

superintendence for execution of the Project. The TSP shall provide skilled personnel who are experienced in their respective fields.

5.8 Remedial Measures:

The TSP shall take all necessary actions for remedying the shortfall in achievement of timely progress in execution of the Project, if any, as intimated by the STU and/ or the Long Term Transmission Customer. However, such intimation by the STU and/ or the Long Term Transmission Customer and the subsequent effect of such remedial measures carried out by the TSP shall not relieve the TSP of its obligations in the Agreement. STU and/ or the Long Term Transmission Customers may carry out random inspections during the Project execution, as and when deemed necessary by it. If the shortfalls as intimated to the TSP are not remedied to the satisfaction of the STU and/ or the Long Term Transmission Customers , this Agreement may be terminated by the Long Term Transmission Customers by giving a Termination Notice to the TSP, in writing, of at least seven (7) days, with a copy to STU and the Lenders' Representative in order to enable the Lenders to exercise right of substitution in accordance with Article 15.3 of this Agreement .

ARTICLE: 6

6 CONNECTION AND COMMISSIONING OF THE PROJECT

6.1 Connection with the Inter-Connection Facilities:

6.1.1 The TSP shall give the RLDC(s), CTU, / STU, as the case may be, and any other agencies as required, at least sixty (60) days advance written notice of the date on which it intends to connect an Element of the Project, which date shall not be earlier than its Scheduled COD or Schedule COD extended as per Article 4.4.1 & 4.4.2 of this Agreement, unless mutually agreed to by Parties. Further, any preponing of COD of any element prior to Scheduled COD must be approved by the Long Term Transmission Customers.

6.1.2 The RLDC / SLDC (as the case may be) or the CTU / STU (as the case may be), for reasonable cause, including non-availability of Interconnection Facilities as per Article 4.2, can defer the connection for up to fifteen (15) days from the date notified by the TSP pursuant to Article 6.1.1, if it notifies to the TSP in writing, before the date of connection, of the reason for the deferral and when the connection is to be rescheduled. However, no such deferment on one or more occasions would be for more than an aggregate period of thirty (30) days. Further, the Scheduled COD would be extended as required, for all such deferments on "day to day" basis.

6.1.3 Subject to Articles 6.1.1 and 6.1.2, any Element of Project may be connected with the Interconnection Facilities when:

a. it has been completed in accordance with this Agreement and the Connection Agreement;

b. it meets the Grid Code, Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 as amended from time to time and all other Indian legal requirements, and

c. The TSP has obtained the approval in writing of the Electrical Inspector certifying that the Element is ready from the point of view of safety of supply and can be connected with the Interconnection Facilities.

d. It has satisfactorily met all the testing requirements as per Articles 6.1.4

6.1.4 Site Acceptance Test (SAT)/ pre-commissioning tests of all major substation equipment, component, system, facilities shall be successfully carried out before commissioning. The Type tests, FAT and SAT reports should be available at the substation / terminal station of HVDC installations for ready reference of operation and maintenance staff and has to be made available to the Long Term Transmission Customers appointed for quality monitoring or their authorised representatives, as and when they wish to examine the same.

6.2 Commercial Operation:

6.2.1 An Element of the Project shall be declared to have achieved COD twenty four (24) hours following the connection of the Element with the Interconnection Facilities pursuant to Article 6.1 or seven (7) days after the date on which it is declared by the TSP to be ready for charging but is not able to be charged for reasons not attributable to the TSP subject to Article 6.1.2.

Provided that an Element shall be declared to have achieved COD only after all the Element(s), if any, which are pre-required to have achieved COD as defined in Schedule 2 of this Agreement, have been declared to have achieved their respective COD.

6.2.2 Once any Element of the Project has been declared to have achieved deemed COD as per Article 6.2.1 above, such Element of the Project shall be deemed to have Availability equal to the Target Availability till the actual charging of the Element and to this extent, TSP shall be eligible for the Monthly Transmission Charges applicable for such Element

6.3 Compensation for Direct Non Natural Force Majeure Event or Indirect Non Natural Force Majeure Event or Natural Force Majeure Event (affecting the Long Term Transmission Customers)

6.3.1 If the TSP is otherwise ready to connect the Element(s) of the Project and has given due notice, as per provisions of Article 6.1.1, to the concerned agencies of the date of intention to connect the Element(s) of the Project, where such date is not before the Scheduled COD, but is not able to connect the Element(s)

of the Project by the said date specified in the notice, due to Direct Non Natural Force Majeure Event or Indirect Non Natural Force Majeure Event or Natural Force Majeure Event affecting the Long Term Transmission Customer(s) , provided such Direct Non Natural Force Majeure Event or Indirect Non Natural Force Majeure Event or Natural Force Majeure Event affecting the Long Term Transmission Customer(s) has continued for a period of more than three (3) continuous or non-continuous Months, the TSP shall, until the effects of the Direct Non Natural Force Majeure Event or of Indirect Non Natural Force Majeure Event or Natural Force Majeure Event affecting the Long Term Transmission Customer(s) no longer prevent the TSP from connecting the Element(s) of the Project, be deemed to have achieved COD relevant to that date and to this extent, be deemed to have been providing Transmission Service with effect from the date notified, and shall be treated as follows:

a. In case of delay due to Direct Non Natural Force Majeure Event, TSP is entitled for Transmission Charges calculated on Target Availability for the period of such events in excess of three (3) continuous or non continuous Months in the manner provided in (c) below.

b. In case of delay due to Indirect Non Natural Force Majeure Event or Natural Force Majeure Event affecting the Long Term Transmission Customer(s), TSP is entitled for payment for debt service which is due under the Financing Agreements, subject to a maximum of Transmission Charges calculated on Target Availability, for the period of such events in excess of three (3) continuous or non continuous Months in the manner provided in (c) below.

c. In case of delay due to Direct Non Natural Force Majeure Event or Indirect Non Natural Force Majeure Event or Natural Force Majeure Event affecting the Long Term Transmission Customer(s), the TSP is entitled for payments mentioned in (a) and (b) above, after commencement of Transmission Service, in the form of an increase in Transmission Charges. These amounts shall be paid from the date, being the later of a) the date of cessation of such Indirect Non Natural Force Majeure Event or Natural Force Majeure Event affecting the Long Term Transmission Customer(s) and b) the completion of sixty (60) days from the receipt of the Financing Agreements by the Long Term Transmission Customer(s) from the TSP.

Provided such increase in Transmission Charges shall be so as to put the TSP in the same economic position as the TSP would have been in case the TSP had been paid amounts mentioned in (a) and (b) above in a situation where the Force Majeure Event had not occurred.

For the avoidance of doubt, it is clarified that the charges payable under this Article 6.3.1 shall be paid by the Long Term Transmission Customer(s) in proportion to their then Allocated Project Capacity.

6.4 Liquidated Damages for Delay in achieving COD of Project:

6.4.1 If the TSP fails to achieve COD of any Element of the Project or the Project, by the Element's / Project's Scheduled COD or such Scheduled COD as extended under Articles 4.4.1 and 4.4.3, then the TSP shall pay to the Long Term Transmission Customer(s) , a sum equivalent to 3.33% of Monthly Transmission Charges applicable for the Element of the Project [in case where no Elements have been defined, to be on the Project as a whole] / Project, for each day of delay up to sixty (60) days of delay and beyond that time limit, at the rate of five percent (5%) of the Monthly Transmission Charges applicable to such Element / Project, as liquidated damages for such delay and not as penalty, without prejudice to any rights of the Long Term Transmission Customer(s) under the Agreement.

6.4.2 The TSP's maximum liability under this Article 6.4 shall be limited to the amount of liquidated damages calculated in accordance with Article 6.4.1 for and up to six (6) months of delay for the Element or the Project.

Provided that, in case of failure of the TSP to achieve COD of the Element of the Project even after the expiry of six (6) months from its Scheduled COD, the provisions of Article 13 shall apply.

6.4.3 The TSP shall make payment to the Long Term Transmission Customer(s) of the liquidated damages calculated pursuant to Article 6.4.1 within ten (10) days of the earlier of:

a. the date on which the applicable Element achieves COD; or

b. the date of termination of this Agreement.

The payment of such damages shall not relieve the TSP from its obligations to

complete the Project or from any other obligation and liabilities under the Agreement.

6.4.4 If the TSP fails to pay the amount of liquidated damages to the Long Term Transmission Customer(s) within the said period of ten (10) days, the Long Term Transmission Customer(s) shall be entitled to recover the said amount of the liquidated damages by invoking the Contract Performance Guarantee. If the then existing Contract Performance Guarantee is for an amount which is less than the amount of the liquidated damages payable by the TSP to the Long Term Transmission Customer(s) under this Article 6.3 and the TSP fails to make payment of the balance amount of the liquidated damages not covered by the Contract Performance Guarantee, then such balance amount shall be deducted from the Transmission Charges payable to the TSP. The right of the Long Term Transmission Customer(s) to encash the Contract Performance Guarantee is without prejudice to the other rights of the Long Term Transmission Customer(s) under this Agreement.

6.4.5 For avoidance of doubt, it is clarified that amount payable by TSP under this Article is over and above the penalty payable by TSP under Article 5.5.6 of this Agreement.

6.5 Return of Contract Performance Guarantee

6.5.1 The Contract Performance Guarantee as submitted by TSP in accordance with Article 3.1.1 shall be released by the Long Term Transmission Customers within three (3) months from the COD of the Project. In the event of delay in achieving Scheduled COD of any of the Elements by the TSP (otherwise than due to reasons as mentioned in Article 3.1.3 or Article 11) and consequent part invocation of the Contract Performance Guarantee by the Long Term Transmission Customers, Long Term Transmission Customers shall release the Contract Performance Guarantee, if any remaining unadjusted, after the satisfactory completion by the TSP of all the requirements regarding achieving the Scheduled COD of the remaining Elements of the Project. It is clarified that the Long Term Transmission Customers shall also return / release the Contract Performance Guarantee in the event of (i) applicability of Article 3.3.2 to the extent the Contract Performance Guarantee is valid for an amount in excess of **Rs. 17.10 Crore (Rupees Seventeen Crore Ten Lakh only)**, or (ii) termination of

this Agreement by the Long Term Transmission Customers as mentioned under Article 3.3.4 of this Agreement.

6.5.2 The release of the Contract Performance Guarantee shall be without prejudice to other rights of the Long Term Transmission Customers under this Agreement.

ARTICLE: 7

7 OPERATION AND MAINTENANCE OF THE PROJECT

7.1 Operation and Maintenance of the Project:

The TSP shall be responsible for ensuring that the Project is operated and maintained in accordance with the regulations made by the state Commission and CEA from time to time and provisions of the Act.

ARTICLE: 8

8 AVAILABILITY OF THE PROJECT

8.1 Calculation of Availability of the Project:

Calculation of Availability for the Elements and for the Project, as the case may be, shall be as per Utter Pradesh Electricity Regulatory Commission (Multi Year Tariff for Distribution and Transmission) Regulations 2019 as amended from time to time, as applicable on the Bid Deadline and as appended in Schedule 6 of this Agreement.

8.2 Target Availability:

The Target Availability of each Element and the Project shall be 98% [The target availability shall be indicated as 98% for AC system and 95% for HVDC system].

Payment of monthly Transmission charges based on actual availability will be calculated as per para 1.2 of Schedule 4 of this Agreement.

If the availability of any Element or the Project is below the Target Availability, for six consecutive months in a Contract Year, the DIC(s) or the Long Term Transmission Customers may issue a show cause notice to the TSP, asking them to show cause as to why the Transmission Service Agreement be not terminated, and if no satisfactory cause is shown it may terminate the Agreement. If the Long Term Transmission Customers is of the opinion that the transmission system is of critical importance, it may carry out or cause to carry the operation and maintenance of transmission system at the risk and cost of TSP.

ARTICLE: 9

9 INSURANCES

9.1 Insurance:

9.1.1 The TSP shall effect and maintain or cause to be effected and maintained during the Construction Period and the Operating Period, adequate Insurances against such risks, with such deductibles including but not limited to any third party liability and endorsements and co-beneficiary/insured, as may be necessary under

a. any of the Financing Agreements,

b. the Laws, and

c. in accordance with Prudent Utility Practices.

The Insurances shall be taken effective from a date prior to the date of the Financial Closure till the Expiry Date.

9.2 Evidence of Insurance cover:

9.2.1 The TSP shall furnish to the Lead Long Term Transmission Customer copies of certificates and policies of the Insurances, as and when the Long Term Transmission Customers may seek from the TSP as per the terms of Article 9.1

9.3 Application of Insurance Proceeds:

9.3.1 Save as expressly provided in this Agreement, the policies of Insurances and the Financing Agreements, the proceeds of any insurance claim made due to loss or damage to the Project or any part of the Project shall be first applied to reinstatement, replacement or renewal of such loss or damage.

9.3.2 If a Natural Force Majeure Event renders the Project no longer economically and technically viable and the insurers under the Insurances make payment on a "total loss" or equivalent basis, the portion of the proceeds of such Insurance available to the TSP (after making admissible payments to the Lenders as per the Financing Agreements) shall be allocated only to the TSP. Long Term Transmission Customers shall have no claim on such proceeds of the

Insurance.

9.3.3 Subject to the requirements of the Lenders under the Financing Agreements, any dispute or difference between the Parties as to whether the Project is no longer economically and technically viable due to a Force Majeure Event or whether that event was adequately covered in accordance with this Agreement by the Insurances shall be determined in accordance with Article 16.

9.4 Effect on liability of the Long Term Transmission Customers

9.4.1 The Long Term Transmission Customers shall have no financial obligations or liability whatsoever towards the TSP in respect of this Article 9.

ARTICLE: 10

10 BILLING AND PAYMENT OF TRANSMISSION CHARGES

10.1 Subject to provisions of this Article 10, the Monthly Transmission Charges shall be paid to the TSP, in Indian Rupees, on monthly basis as per the provisions of this agreement, from the date on which an Element(s) has achieved COD until the Expiry Date of this Agreement, unless terminated earlier and in line with the provisions of Schedule 4 of this Agreement.

10.1.1 Delivery of Invoices:

10.1.1.1 TSP's Invoices:

a. Commencing with the month following the month in which the COD of an Element (which is first Commissioned) occurs, the TSP shall submit to Long Term Transmission Customer by the fifth day of such and each succeeding month (or, if such day is not a Business Day, the immediately following Business Day) an Invoice in the Agreed Form (the "Monthly Transmission Charge Invoice") signed by the authorised signatory of the TSP setting out the computation of the Monthly Transmission Charges to be paid by the Long Term Transmission Customer to the TSP in respect of the immediately preceding month in accordance with this Agreement; and

b. Each Monthly Transmission Charge Invoice shall include detailed calculations of the amounts payable under it, together with such further supporting documentation and information as Long Term Transmission Customer may reasonably require / request, from time to time.

10.1.1.2 Long Term Transmission Customer Invoices:

a. Long Term Transmission Customer shall (as and when any amount becomes due to be paid by TSP), on the fifth day of the month (or, if such day is not a Business Day, the immediately following Business Day) submit to the TSP an Invoice in the Agreed Form (the "Long Term Transmission Customer Invoice") setting out the computation of any amount that may be payable to it by the TSP for the immediately preceding month pursuant to this Agreement.

b. Each Long Term Transmission Customer's Invoice shall include detailed calculations of the amounts payable under it, together with such further supporting documentation as the TSP may reasonably require/request, from time to time.

10.1.2 Payment of Invoices:

10.1.2.1 Any amount payable under an Invoice shall be paid in immediately available and freely transferable clear funds, for value on or before the Due Date, to such account of the TSP or Long Term Transmission Customer as shall have been previously notified to Long Term Transmission Customer or the TSP, as the case may be.

10.1.2.2 Where in respect of any month there is both:

a. an amount payable by the Long Term Transmission Customer to TSP pursuant to a Monthly Transmission Charge Invoice and

b. an amount payable by the TSP to Long Term Transmission Customer pursuant to a Long Term Transmission Customer's Invoice as per provisions of this Agreement,

the two amounts, to the extent agreed to be set off by the TSP may, be set off against each other and the balance, if any, shall be paid by Long Term Transmission Customer to the TSP or by TSP to Long Term Transmission Customer, as the case may be.

10.1.2.3 The Long Term Transmission Customer shall pay the amount payable under the Monthly Transmission Charge Invoice and the Supplementary Bill on the Due Date to such account of the TSP, as shall have been previously notified by the TSP to the Long Term Transmission Customer in accordance with Article 10.1.2.6 below.

10.1.2.4 All payments made by the Long Term Transmission Customer shall be appropriated by the TSP in the following order of priority:

i. towards Late Payment Surcharge, payable to the TSP, if any;

ii. towards earlier unpaid Monthly Transmission Charge Invoice, if any;

iii. towards earlier unpaid Supplementary Bill, if any;

iv. towards the then current Monthly Transmission Charge Invoice, if any; and

v. towards the then current Supplementary Bill.

10.1.2.5 All payments required to be made under this Agreement shall only include any deduction or set off for:

i. deductions required by the Law; and

ii. amounts claimed by the Long Term Transmission Customer from the TSP, through an Invoice duly acknowledged by the TSP, to be payable by the TSP, and not disputed by the TSP within thirty (30) days of receipt of the said Invoice and such deduction or set-off shall be made to the extent of the amounts not disputed. It is clarified that the Long Term Transmission Customer shall be entitled to claim any set off or deduction under this Article, after expiry of the said thirty (30) day period.

Provided further, the maximum amounts that can be deducted or set-off by all the Long Term Transmission Customer taken together under this Article in a Contract Year shall not exceed **Rupees 5.73 Crores (Rupees Five Crore Seventy Three lakh Only)**, except on account of payments under sub Article (i) above.

10.1.2.6 The TSP shall open a bank account at ……. [Insert identified place or account] (the "Designated Account") for all payments to be made by the Long Term Transmission Customer to the TSP, and notify the Long Term Transmission Customer of the details of such account at least ninety (90) days before the Scheduled COD of the first Element to the Long Term Transmission Customer. The Long Term Transmission Customer shall, on the day of payment, notify the TSP of the payment made to the Designated Account. The Long Term Transmission Customer shall also designate a bank account at …… [Insert identified place] for payments to be made by the TSP to Long Term Transmission Customer and notify the TSP of the details of such account ninety (90) days before the Scheduled COD of the first Element.

10.2 Calculation of Monthly Transmission Charges:

The Monthly Transmission Charges for each Contract Year including Incentive & Penalty payment shall be calculated in accordance with the provisions of Schedule 4 of this Agreement.

10.3 Rebate & Late Payment Surcharge:

10.3.1 Rebate: In case the Long Term Transmission Customer pays to the TSP through any mode of payment in respect of a Monthly Transmission Charge Invoice or Supplementary Bill, the following shall apply:

a. For payment of Invoices through any mode of payment, a Rebate of 2% shall be allowed on the Monthly Transmission Charge Invoice or Supplementary Bill for payments made in full within two Business Day of the receipt of the Invoice; or

b. For payment of Invoices subsequently, but within the Due Date, a Rebate of 1% shall be allowed on the payments made in full.

c. Applicable rate of Rebate at (a) and (b) above shall be based on the date on which the payment has been actually credited to the TSP's account. Any delay in transfer of money to the TSP's account, on account of a statutory holiday, public holiday, or any other reasons shall be to the account of the Long Term Transmission Customer provided that the Invoice is not submitted on the day immediately preceding a statutory holiday or public holiday.

d. No Rebate shall be payable on the bills raised on account of Change in Law relating to taxes, duties and cess;

Provided that if any Long Term Transmission Customer fails to pay a Monthly Transmission Charge Invoice/ Supplementary Bill or part thereof within and including the Due Date, the TSP shall recover such amount as per provisions of Article 10.4.3.1 (f).

10.3.2 **Late Payment Surcharge**: Any amount due from one Party to the other, pursuant to this Agreement and remaining unpaid for thirty (30) days after the Due Date, shall bear Late Payment Surcharge @ 1.25% per month on the unpaid amount. Such Late Payment Surcharge shall be calculated on simple rate basis and shall accrue from the Due Date until the amount due is actually received by the payee.

10.4 Disputed Bills, Default in payment by the Long Term Transmission Customers & Annual Reconciliation:

10.4.1 Disputed Invoices:

10.4.1.1 If either Party does not question or dispute an Invoice within thirty (30) days of receiving it, the Invoice shall be considered correct, complete and conclusive between the Parties.

10.4.1.2 If either Party disputes any item or part of an item set out in any Invoice then that Party shall serve a notice (an "Invoice Dispute Notice") on the other Party setting out (i) the item or part of an item which is in dispute, (ii) its estimate of what such item or part of an item should be, (iii) and with all written material in support of its claim.

10.4.1.3 If the invoicing Party agrees to the claim raised in the Invoice Dispute Notice issued pursuant to Article 10.4.1.2, the invoicing Party shall revise such Invoice within seven (7) days of receiving such notice from the disputing Party and if the disputing Party has already made the excess payment, the invoicing Party shall refund to the disputing Party, such

excess amount within fifteen (15) days of receiving such notice. In such a case, the excess amount shall be refunded along with interest at the same rate as the Late Payment Surcharge, which shall be applied from the date on which such excess payment was made to the invoicing Party and up to and including the date on which such payment has been received as refund.

10.4.1.4 If the invoicing Party does not agree to the claim raised in the Invoice Dispute Notice issued pursuant to Article 10.4.1.2, it shall, within fifteen (15) days of receiving the Invoice Dispute Notice, furnish a notice to the disputing Party providing (i) reasons for its disagreement; (ii) its estimate of what the correct amount should be; and (iii) all written material in support of its counter-claim.

10.4.1.5 Upon receipt of notice of disagreement to the Invoice Dispute Notice under Article 10.4.1.4, authorised representative(s) or a director of the board of directors/member of board of each Party shall meet and make best endeavours to amicably resolve such Dispute within fifteen (15) days of receiving such notice of disagreement to the Invoice Dispute Notice.

10.4.1.6 If the Parties do not amicably resolve the dispute within fifteen (15) days of receipt of notice of disagreement to the Invoice Dispute Notice pursuant to Article 10.4.1.4, the matter shall be referred to appropriate Commission for Dispute resolution in accordance with Article 16.

10.4.1.7 If a Dispute regarding a Monthly Transmission Charge Invoice or a Supplementary Invoice is settled by Dispute resolution mechanism provided in this Agreement in favour of the Party that issues the Invoice Dispute Notice, the other Party shall refund the amount, if any incorrectly charged and collected from the disputing Party or pay as required, within five (5) days of the Dispute either being amicably resolved by the Parties pursuant to Article 10.4.1.5 or settled by Dispute resolution mechanism, along with interest (at the same rate as Late Payment Surcharge) or Late Payment Surcharge from the date on which such payment had been made to the invoicing Party or the date on which such payment was originally due, as may be applicable.

10.4.1.8 For the avoidance of doubt, it is clarified that despite a Dispute regarding an Invoice, the concerned Long Term Transmission Customer's shall,

without prejudice to its right to Dispute, be under an obligation to make payment, of the lower of (a) an amount equal to simple average of last three (3) months Invoices (being the undisputed portion of such three months Invoices) and (b) Monthly Invoice which is being disputed, provided such Monthly Invoice has been raised based on the Regional Energy Account the Allocated Project Capacity and in accordance with this Agreement.

10.4.2 Payment of Supplementary Bill:

10.4.2.1 Either Party may raise a bill on the other Party ("Supplementary Bill") for payment on account of:

i. adjustments (if any) required by the Regional Energy Account ; or

ii. quarterly or annual reconciliation as per Article 10.5 ; or

iii. Change in Law as provided in Article 12,

and such Bill shall be paid by the other Party.

10.4.3 Payment Security Mechanism:

10.4.3.1 Establishment of Letter of Credit:

(a) Not later than one (1) Month prior to the Scheduled COD of the first Element of the Project, each Long Term Transmission Customer shall, through a scheduled bank, open a Letter of Credit in favour of the TSP, to be made operative from a date prior to the Due Date of its first Monthly Transmission Charge Invoice under this Agreement and shall be renewed annually.

(b) The draft of the proposed Letter of Credit shall be provided by each Long Term Transmission Customer to the TSP not later than the Financial Closure of the Project and shall be mutually agreed between the Parties.

(c) The Letter of Credit shall have a term of twelve (12) Months and shall be for an amount:

i. for the first Contract Year or for each subsequent Contract Year, equal to one point one (1.1) times the estimated average Monthly Transmission Charges based on Target Availability of the Elements or Project with Scheduled COD in such Contract Year, as the case may be;

ii. Provided that, the TSP shall not make any drawl before the Due Date and shall not make more than one drawal in a month.

Provided further that if at any time, such Letter of Credit amount falls short of the amount specified in Article 10.4.3.1, otherwise than by

reason of drawal of such Letter of Credit by the TSP, the relevant Long Term Transmission Customer shall restore such shortfall within seven (7) days.

(d) Long Term Transmission Customer shall cause the scheduled bank issuing the Letter of Credit to intimate the TSP, in writing regarding establishing of such Letter of Credit.

(e) In case of drawal of the Letter of Credit by the TSP in accordance with the terms of this Article 10.4.3.1, the amount of the Letter of Credit shall be reinstated within seven (7) days from the date of such drawal.

(f) If any Long Term Transmission Customer fails to pay a Monthly Transmission Charge Invoice / Supplementary Bill or part thereof within and including the Due Date, then, unless an Invoice Dispute Notice is received by the TSP as per the provisions of Article 10.4.1.2, the TSP may draw upon the Letter of Credit, and accordingly the bank shall pay without any reference or instructions from the Long Term Transmission Customer, an amount equal to such Monthly Transmission Charge Invoice/Supplementary Bill or part thereof plus Late Payment Surcharge, if applicable, in accordance with Article 10.3.2 above, by presenting to the scheduled bank issuing the Letter of Credit, the following documents:

i. a copy of the Monthly Transmission Charge Invoice/Supplementary Bill which has remained unpaid by such Long Term Transmission Customer;

ii. a certificate from the TSP to the effect that the Invoice at item (i) above, or specified part thereof, is in accordance with the Agreement and has remained unpaid beyond the Due Date; and

iii. calculations of applicable Late Payment Surcharge, if any. Provided that failure on the part of the TSP to present the documents for negotiation of the Letter of Credit shall not attract any Late Payment Surcharge on the Long Term Transmission Customer.

(g) Each Long Term Transmission Customer shall ensure that the Letter of Credit shall be renewed not later than thirty (30) days prior to its expiry.

(h) All costs relating to opening and maintenance of the Letter of Credit shall be borne by the Long Term Transmission Customer. However, the Letter of Credit negotiation charges shall be borne and paid by the TSP.

(i) If a Long Term Transmission Customer fails to pay (with respect to a Monthly Bill or Supplementary Bill) an amount exceeding thirty percent (30%) of the most recent undisputed Monthly Bill, for a period of seven (7) days after the Due Date and the TSP is unable to recover the amount

outstanding to the TSP through the Letter of Credit, the TSP shall issue a notice to such Long Term Transmission Customer within seven (7) days from such period, with a copy to each of the other Long Term Transmission Customer, highlighting the nonpayment of such amount by such Long Term Transmission Customer;

(ii) If such Long Term Transmission Customer still fails to pay such amount within a period of thirty (30) days after the issue of notice by TSP as mentioned in (i) above, the TSP shall approach the RLDC / SLDC (as the case may be) requesting for the alteration of the schedule of dispatch of the lowest cost power of such Long Term Transmission Customer from the Central Generating Stations/ State Generating Stations (as the case may be), and the RLDC / SLDC shall continue to reschedule the lowest cost power till all the dues of the TSP are recovered;

- Provided that in this case, the quantum of electricity and the corresponding period in which it would be rescheduled for dispatch shall be corresponding to the amount of default. This electricity will then be dispatched to other utilities by the concerned RLDC/SLDC, as the case may be, during the peak hours, i.e., 7pm to 10 pm. The price of this electricity will be determined as per the UI rate;

- Provided further that the revenue from such diverted power would be used to pay the dues first of the generating company (which would include the capacity charges as well as the energy charges) and the remainder would be available for covering the default amount and the balance (if any), after recovering both the charges, would be paid to the defaulting Long Term Transmission Customer.

10.4.4 Payment Intimation

Long Term Transmission Customer shall remit all amounts due under an Invoice raised by the TSP to the TSP's account by the Due Date and notify the TSP of such remittance on the same day. Similarly, the TSP shall pay all amounts due under an Invoice raised by Long Term Transmission Customer by the Due Date to concerned Long Term Transmission Customer's account and notify such Long Term Transmission Customer of such payment on the same day.

10.5 Quarterly and Annual Reconciliation:

10.5.1 Parties acknowledge that all payments made against Monthly Bill(s) and Supplementary Bill(s) shall be subject to quarterly reconciliation at the

beginning of the following quarter of each Contract Year and annual reconciliation at the end of each Contract Year to take into account Regional Energy Account, adjustments in Transmission Charges payments, Rebates, Late Payment Surcharge, Incentive, Penalty, or any other reasonable circumstance as may be mutually agreed between the Parties.

10.5.2 The Parties, therefore, agree that as soon as all such data in respect of any quarter of a Contract Year or a full Contract Year, as the case may be, is available and has been finally verified and adjusted, the TSP and Long Term Transmission Customer's shall jointly sign such reconciliation statement. Within fifteen (15) days of signing of a reconciliation statement, the TSP or Long Term Transmission Customer's, as the case may be, shall raise a Supplementary Bill for the payments as may be due as a result of reconciliation for the relevant quarter/ Contract Year and shall make payment of such Supplementary Bill for the adjustments in Transmission Charges payments for the relevant quarter/ContractYear.

10.5.3 Interest / Late Payment Surcharge shall be payable in such a case from the date on which such payment had been made to the invoicing Party or the date on which any payment was originally due, as may be applicable. Any dispute with regard to the above reconciliation shall be dealt with in accordance with the provisions of Article 16.

ARTICLE: 11

11 FORCE MAJEURE

11.1 Definitions

11.1.1 The following terms shall have the meanings given hereunder.

11.2 Affected Party

11.2.1 An Affected Party means any Party whose performance has been affected by an event of Force Majeure.

11.2.2 Any event of Force Majeure shall be deemed to be an event of Force Majeure affecting the TSP only if the Force Majeure event affects and results in, late delivery of machinery and equipment for the Project or construction, completion, commissioning of the Project by Scheduled COD and/or operation thereafter;

11.3 Force Majeure

A 'Force Majeure' means any event or circumstance or combination of events and circumstances including those stated below that wholly or partly prevents or unavoidably delays an Affected Party in the performance of its obligations/ roles under this Agreement, but only if and to the extent that such events or circumstances are not within the reasonable control, directly or indirectly, of the Affected Party and could not have been avoided if the Affected Party had taken reasonable care or complied with Prudent Utility Practices:

(a) **Natural Force Majeure Events:**

i. act of God, including, but not limited to drought, fire and explosion (to the extent originating from a source external to the Site), earthquake, volcanic eruption, landslide, flood, cyclone, typhoon, tornado, or exceptionally adverse weather conditions, which are in excess of the statistical measures for the last hundred (100) years; and

ii. epidemic/ pandemic notified by Indian Governmental Instrumentality.

(b) **Non-Natural Force Majeure Events :**

i. Direct Non–Natural Force Majeure Events

- Nationalization or compulsory acquisition by any Indian Governmental Instrumentality of any material assets or rights of the Affected Party; or

- the unlawful, unreasonable or discriminatory revocation of, or refusal to renew, any Consents, Clearances and Permits required by the Affected Party to perform their obligations/ roles under the RFP Project Documents or any unlawful, unreasonable or discriminatory refusal to grant any other Consents, Clearances and Permits required for the development/ operation of the Project, provided that a Competent Court of Law declares the revocation or refusal to be unlawful, unreasonable and discriminatory and strikes the same down; or

- any other unlawful, unreasonable or discriminatory action on the part of an Indian Governmental Instrumentality which is directed against the Project, provided that a Competent Court of Law declares the action to be unlawful, unreasonable and discriminatory and strikes the same down.

ii. Indirect Non - Natural Force Majeure Events

- act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, revolution, riot, insurrection, terrorist or military action; or

- radio active contamination or ionising radiation originating from a source in India or resulting from any other Indirect Non Natural Force Majeure Event mentioned above, excluding circumstances where the source or cause of contamination or radiation is brought or has been brought into or near the Site by the Affected Party or those employed or engaged by the Affected Party; or

- industry-wide strikes and labour disturbances, having a nationwide impact in India.

11.4 Force Majeure Exclusions

11.4.1 Force Majeure shall not include (i) any event or circumstance which is within the reasonable control of the Parties and (ii) the following conditions, except to the extent that they are consequences of an event of Force Majeure:

(a) Unavailability, late delivery, or changes in cost of the machinery, equipment, materials, spare parts etc. for the Project;

(b) Delay in the performance of any Contractors or their agents;

(c) Non-performance resulting from normal wear and tear typically experienced in transmission materials and equipment;

(d) Strikes or labour disturbance at the facilities of the Affected Party;

(e) Insufficiency of finances or funds or the Agreement becoming onerous to perform; and

(f) Non-performance caused by, or connected with, the Affected Party's:

i. negligent or intentional acts, errors or omissions;

ii. failure to comply with an Indian Law; or

iii. breach of, or default under this Agreement or any Project Documents.

(g) Any error or omission in the survey report provided by BPC during the bidding process.

11.5 Notification of Force Majeure Event

11.5.1 The Affected Party shall give notice to the other Party of any event of Force Majeure as soon as reasonably practicable, but not later than seven (7) days after the date on which such Party knew or should reasonably have known of the commencement of the event of Force Majeure. If an event of Force Majeure results in a breakdown of communications rendering it unreasonable to give notice within the applicable time limit specified herein, then the Party claiming Force Majeure shall give such notice as soon as reasonably practicable after reinstatement of communications, but not later than one (1) day after such reinstatement.

Provided that, such notice shall be a pre-condition to the Affected Party's entitlement to claim relief under this Agreement. Such notice shall include full particulars of the event of Force Majeure, its effects on the Party claiming relief and the remedial measures proposed. The Affected Party shall give the other Party regular reports on the progress of those remedial measures and such other information as the other Party may reasonably request about the Force Majeure.

11.5.2 The Affected Party shall give notice to the other Party of (i) the cessation of the relevant event of Force Majeure; and (ii) the cessation of the effects of such event of Force Majeure on the performance of its rights or obligations/ roles under this Agreement, as soon as practicable after becoming aware of each of these cessations.

11.6 Duty to perform and duty to mitigate

To the extent not prevented by a Force Majeure Event, the Affected Party shall continue to perform its obligations/ roles as provided in this Agreement. The Affected Party shall use its reasonable efforts to mitigate the effect of any event of Force Majeure as soon as practicable.

11.7 Available Relief for a Force Majeure Event

Subject to this Article 11,

(a) no Party shall be in breach of its obligations/ roles pursuant to this Agreement to the extent that the performance of its obligations/ roles was prevented, hindered or delayed due to a Force Majeure Event;

(b) each Party shall be entitled to claim relief for a Force Majeure Event affecting its performance in relation to its obligations/ roles under Articles 3.3.4, 4.4.2 and 6.3.1 of this Agreement.

(c) For the avoidance of doubt, it is clarified that the computation of Availability of the Element(s) under outage due to Force Majeure Event, as per Article 11.3 affecting the TSP shall be as per Uttar Pradesh Electricity Regulatory Commission (Multi Year Tariff for Distribution and Transmission) Regulations, 2019, as on Bid Deadline. For the event(s) for which the Element(s) is/are deemed to be available as per Uttar Pradesh Electricity

Regulatory Commission (Multi Year Tariff for Distribution and Transmission) Regulations, 2019, as amended from time to time, then the Transmission Charges, as applicable to such Element(s), shall be payable as per Schedule 4, for the duration of such event(s).

(d) For so long as the TSP is claiming relief due to any Force Majeure Event under this Agreement, the Lead Long Term Transmission Customer may, if it so desires, from time to time on one (1) day notice, inspect the Project and the TSP shall provide the Lead Long Term Transmission Customer's personnel with access to the Project to carry out such inspections.

(e) For avoidance of doubt, the TSP acknowledges that for extension of Scheduled COD a period up to one hundred eighty (180) days due to Force Majeure event, no compensation on the grounds such as interest cost, incident expenditure, opportunity cost will be made to the TSP. However, if Scheduled COD is extended beyond a period of one hundred eighty (180) days due to Force Majeure event, the TSP will be allowed to recover the interest cost during construction corresponding to the period exceeding one hundred eighty (180) days by adjustment in the Transmission Charges in accordance with Schedule 9.

ARTICLE: 12

12 CHANGE IN LAW

12.1 Change in Law

12.1.1 Change in Law means the occurrence of any of the following after the Bid Deadline resulting into any additional recurring / non-recurring expenditure by the TSP or any savings of the TSP:

- the enactment, coming into effect, adoption, promulgation, amendment, modification or repeal (without re-enactment or consolidation) in India, of any Law, including rules and regulations framed pursuant to such Law, subject to the provisions under Article 12.1.2;
- a change in the interpretation or application of any Law by any Indian Governmental Instrumentality having the legal power to interpret or apply such Law, or any Competent Court of Law;
- the imposition of a requirement for obtaining any Consents, Clearances and Permits which was not required earlier;
- a change in the terms and conditions prescribed for obtaining any Consents, Clearances and Permits or the inclusion of any new terms or conditions for obtaining such Consents, Clearances and Permits;
- any change in the licensing regulations of the State Commission, under which the Transmission License for the Project was granted if made applicable by such State Commission to the TSP;
- change in wind zone; or
- any change in tax or introduction of any tax made applicable for providing Transmission Service by the TSP as per the terms of this Agreement.

12.1.2 Notwithstanding anything contained in this Agreement, Change in Law shall not cover any change:

a) Taxes on corporate income; and

b) Withholding tax on income or dividends distributed to the shareholders of the TSP.

12.2 Relief for Change in Law

12.2.1 During Construction Period, the impact of increase/decrease in the cost of the Project on the Transmission Charges shall be governed by the formula given in Schedule 9 of this Agreement.

12.2.2 During the Operation Period:

During the operation period, if as a result of Change in Law, the TSP suffers or is benefited from a change in costs or revenue, the aggregate financial effect of which exceeds 0.30% (zero point three percent) of the Annual Transmission Charges in aggregate for a Contract Year, the TSP may notify so to the Long Term Transmission Customers and propose amendments to this Agreement so as to place the TSP in the same financial position as it would have enjoyed had there been no such Change in Law resulting in change in costs or revenue as aforesaid.

12.2.3 For any claims made under Articles 12.2.1 and 12.2.2 above, the TSP shall provide to the Long Term Transmission Customers documentary proof of such increase / decrease in cost of the Project / revenue for establishing the impact of such Change in Law.

In cases where Change in Law results in decrease of cost and it comes to the notice of Long Term Transmission Customers that TSP has not informed Long Term Transmission Customers about such decrease in cost, Long Term Transmission Customers may initiate appropriate claim.

12.3 Notification of Change in Law:

12.3.1 If the TSP is affected by a Change in Law in accordance with Article 12.1 and wishes to claim relief for such Change in Law under this Article 12, it shall give notice to Lead Long Term Transmission Customer of such Change in Law as soon as reasonably practicable after becoming aware of the same.

12.3.2 The TSP shall also be obliged to serve a notice to the Lead Long Term Transmission Customer even when it is beneficially affected by a Change in Law.

12.3.3 Any notice served pursuant to Articles 12.3.1 and 12.3.2 shall provide, amongst other things, precise details of the Change in Law and its estimated impact on the TSP.

12.4 Payment on account of Change in Law

12.4.1 The payment for Change in Law shall be through a separate Bill. However, in case of any change in Monthly Transmission Charges by reason of Change in Law, as determined in accordance with this Agreement, the Bills to be raised by the Long Term Transmission Customers after such change in Transmission Charges shall appropriately reflect the changed Monthly Transmission Charges.

ARTICLE: 13

13 EVENTS OF DEFAULT AND TERMINATION

13.1 TSP's Event of Default

The occurrence and continuation of any of the following events shall constitute a TSP Event of Default, unless any such TSP Event of Default occurs as a result of any non-fulfilment of its obligations as prescribed under this Agreement by the Long Term Transmission Customers or a Force Majeure Event:

a. After having taken up the construction of the Project, the abandonment by the TSP or the TSP's Contractors of the construction of the Project for a continuous period of two (2) months and such default is not rectified within thirty (30) days from the receipt of notice from the Lead Long Term Transmission Customer in this regard;

b. The failure to commission any Element of the Project by the date falling six (6) months after its Scheduled COD unless extended by Long Term Transmission Customers as per provisions of this Agreement;

c. If the TSP:

i. assigns, mortgages or charges or purports to assign, mortgage or charge any of its assets or rights related to the Project in contravention of the provisions of this Agreement; or

ii. transfers or novates any of its obligations pursuant to this Agreement, in a manner contrary to the provisions of this Agreement;

Except where such transfer is in pursuance of a Law and

- it does not affect the ability of the transferee to perform, and such transferee has the financial and technical capability to perform, its obligations under this Agreement;

- is to a transferee who assumes such obligations under the Project and this Agreement remains effective with respect to the transferee;

d. If:

i. The TSP becomes voluntarily or involuntarily the subject of any bankruptcy or insolvency or winding up proceedings and such proceedings remain uncontested for a period of thirty (30) days; or

ii. any winding up or bankruptcy or insolvency order is passed against the TSP; or

iii. the TSP goes into liquidation or dissolution or a receiver or any similar officer is appointed over all or substantially all of its assets or official liquidator is appointed to manage its affairs, pursuant to Law,

Provided that a dissolution or liquidation of the TSP will not be a TSP's Event of Default, where such dissolution or liquidation of the TSP is for the purpose of a merger, consolidation or reorganization with the prior approval of the State Commission as per the provisions of Central Electricity Regulatory Commission (Procedure, terms and Conditions for grant of Transmission License and other related matters) Regulations, 2006 or as amended from time to time; or

e. Failure on the part of the TSP to comply with the provisions of Article 19.2 of this Agreement; or

f. the TSP repudiates this Agreement and does not rectify such breach even within a period of thirty (30) days from a notice from the Long Term Transmission Customers in this regard; or

g. after Commercial Operation Date of the Project, the TSP fails to achieve monthly Target Availability of 98% [98% for AC system and 95% for HVDC system], for a period of six (6) consecutive months or within a non-consecutive period of six (6) months within any continuous aggregate period of eighteen(18) months except where

the Availability is affected by Force Majeure Events as per Article 11; or

h. any of the representations and warranties made by the TSP in Article 17 of this Agreement being found to be untrue or inaccurate. Further, in addition to the above, any of the undertakings submitted by the Selected Bidder at the time of submission of the Bid being found to be breached or inaccurate, including but not limited to undertakings from its Parent Company / Affiliates related to the minimum equity obligation; or

i. the TSP fails to complete / fulfil all the activities / conditions within the specified period as per Article 3; or

j. except for the reasons solely attributable to Long Term Transmission Customers , the TSP is in material breach of any of its obligations under this Agreement and such material breach is not rectified by the TSP within thirty (30) days of receipt of notice in this regard from the Lead Long Term Transmission Customer ; or

k. the TSP fails to take the possession of the land required for location specific substations, switching stations or HVDC terminal or inverter stations and / or fails to pay the requisite price to the parties and / or any State Government authority from whom the land is acquired, within twelve (12) months from the Effective Date.

13.2 <u>Termination Procedure for TSP Event of Default</u>

a. Upon the occurrence and continuance of any TSP's Event of Default under Article 13.1 the Long Term Transmission Customers may serve notice on the TSP, with a copy to the CEA and the Lenders' Representative, of their intention to terminate this Agreement (a " Long Term Transmission Customer's Preliminary Termination Notice"), which shall specify in reasonable detail, the circumstances giving rise to such Long Term Transmission Customer's Preliminary Termination Notice.

b. Following the issue of a Long Term Transmission Customer's Preliminary Termination Notice, the Consultation Period shall apply and would be for the Parties to discuss as to what steps shall be taken with a view to

mitigate the consequences of the relevant Event of Default having regard to all the circumstances.

c. During the Consultation Period, the Parties shall, save as otherwise provided in this Agreement, continue to perform their respective obligations/ roles under this Agreement, and the TSP shall not remove any material, equipment or any part of the Project, without prior consent of the Long Term Transmission Customers.

Following the expiry of the Consultation Period, unless the Parties shall have otherwise agreed to the contrary or the circumstances giving rise to Long Term Transmission Customer's Preliminary Termination Notice shall have ceased to exist or shall have been remedied, this Agreement may be terminated by the Long Term Transmission Customers by giving a Termination Notice to the TSP, in writing, of at least seven (7) days, with a copy to STU and the Lenders' Representative in order to enable the Lenders to exercise right of substitution in accordance with Article 15.3 of this Agreement.

Further, the Long Term Transmission Customers may also initiate proceedings to blacklist the TSP & its Affiliates from participation in any RFP issued by BPCs for a period of 5 years.

13.3 Procedure for Long Term Transmission Customers non-fulfilment of Role

a. Upon the Long Term Transmission Customers not being able to fulfil its role under Article 4.2, the TSP may serve notice on the Long Term Transmission Customers, with a copy to STU and the Lenders' Representative (a "TSP's Preliminary Notice"), which notice shall specify in reasonable detail the circumstances giving rise to such non-fulfilment of role by the Long Term Transmission Customers.

b. Following the issue of a TSP's Preliminary Notice, the Consultation Period shall apply.

c. The Consultation Period would be for the Parties to discuss as to what steps shall be taken with a view to mitigate the consequences of the relevant non-fulfilment of role by the Long Term Transmission Customers including giving time extension to TSP, having regard to all the circumstances.

d. During the Consultation Period, both Parties shall, save as otherwise provided in this Agreement, continue to perform their respective obligations/ roles under this Agreement.

13.4 Termination due to Force Majeure

13.4.1 In case the Parties could not reach an agreement pursuant to Articles 3.3.4 and 4.4.2 of this Agreement and the Force Majeure Event or its effects continue to be present, the Long Term Transmission Customers shall have the right to cause termination of the Agreement. In case of such termination, the Contract Performance Guarantee shall be returned to the TSP as per the provisions of Article 6.5.1.

13.4.2 In case of termination of this Agreement, the TSP shall provide to the Long Term Transmission Customers the full names and addresses of its Contractors as well as complete designs, design drawings, manufacturing drawings, material specifications and technical information, as required by the Long Term Transmission Customers within thirty (30) days of Termination Notice.

13.5 Termination or amendment due to non-requirement of any Element or Project during construction

13.5.1 In case any Element or Project, which is under construction, is no longer required due to any reason whatsoever, the Long Term Transmission Customers may issue a notice to this effect to the TSP.

13.5.2 Long Term Transmission Customers may also issue notice to the TSP seeking their response to the proposed termination/ amendment (as the case may be) of the Agreement. The Long Term Transmission Customers shall issue copy of such notice to Lenders. In the notice, Long Term Transmission Customers shall also include an assessment of the physical progress made by TSP in the Element/ Project (as the case may be) that is no longer required.

13.5.3 The TSP shall neither carry out further investment nor carry out any work on the Element/ Project (as the case may be) that is no longer required after delivery of the notice.

13.5.4 After taking into account the comments of the TSP, the Long Term Transmission Customers may terminate the Agreement or amend it if both Parties agree to the amendment.

13.6 Revocation of the Transmission License

13.6.1 The State Commission may, as per the provisions of the Electricity Act, 2003, revoke the Transmission License of the ISTS Licensee. Further, in such a case, the Agreement shall be deemed to have been terminated.

13.7 Termination Payment

13.7.1 If Agreement is terminated on account of Force Majeure Events, non-requirement of any Element or Project during Construction, Long Term Transmission Customer's non-fulfilment of Role & TSP's Event of Default, the TSP shall be entitled for Termination Payment equivalent to valuation of Project Assets. Upon payment, the Long Term Transmission Customer(s) shall take over the Project Assets.

ARTICLE: 14

14 LIABILITY AND INDEMNIFICATION

14.1 Indemnity

14.1.1 The TSP shall indemnify, defend and hold the Long Term Transmission Customers harmless against:

(a) any and all third party claims, actions, suits or proceedings against the Long Term Transmission Customers for any loss of or damage to property of such third party, or death or injury to such third party, arising out of a breach by the TSP of any of its obligations under this Agreement, except to the extent that any such claim, action, suit or proceeding has arisen due to a negligent act or omission, breach of this Agreement or non-fulfilment of statutory duty on the part of Long Term Transmission Customers ; and

(b) any and all losses, damages, costs and expenses including legal costs, fines, penalties and interest actually suffered or incurred by the Long Term Transmission Customers from third party claims arising by reason of:

i. a breach by the TSP of any of its obligations under this Agreement, (provided that this Article 14 shall not apply to such breaches by the TSP, for which specific remedies have been provided for under this Agreement) except to the extent that any such losses, damages, costs and expenses including legal costs, fines, penalties and interest (together to constitute “Indemnifiable Losses”) has arisen due to a negligent act or omission, breach of this Agreement or non-fulfilment of statutory duty on the part of the Long Term Transmission Customers or

ii. any of the representations and warranties of the TSP under this Agreement being found to be inaccurate or untrue.

14.1.2 The Long Term Transmission Customers shall, in accordance with the Regulations framed by UPERC in this regard, indemnify, defend and hold the

TSP harmless against:

(a) any and all third party claims, actions, suits or proceedings against the TSP, for any loss of or damage to property of such third party, or death or injury to such third party, arising out of any material breach by the Long Term Transmission Customers of any of their roles under this Agreement, except to the extent that any such claim, action, suit or proceeding has arisen due to a negligent act or omission, breach of this Agreement or breach of statutory duty on the part of the TSP, its Contractors, servants or agents; and

(b) any and all losses, damages, costs and expenses including legal costs, fines, penalties and interest ('Indemnifiable Losses') actually suffered or incurred by the TSP from third party claims arising by reason of:

i. any material breach by the Long Term Transmission Customers of any of its roles under this Agreement (provided that, this Article 14 shall not apply to such breaches by the Long Term Transmission Customers, for which specific remedies have been provided for under this Agreement), except to the extent that any such Indemnifiable Losses have arisen due to a negligent act or omission, breach of this Agreement or breach of statutory duty on the part of the TSP, its Contractors, servants or agents or

ii. any of the representations and warranties of the Long Term Transmission Customers under this Agreement being found to be inaccurate or untrue.

14.2 Patent Indemnity:

14.2.1

(a) The TSP shall, subject to the Long Term Transmission Customers compliance with Article 14.2.1 (b), indemnify and hold harmless the Long Term Transmission Customers and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Long Term

Transmission Customers may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Agreement by reason of the setting up of the Project by the TSP.

Such indemnity shall not cover any use of the Project or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Agreement, any infringement resulting from the misuse of the Project or any part thereof, or any products produced in association or combination with any other equipment, plant or materials not supplied by the TSP, pursuant to the Agreement.

(b) If any proceedings are brought or any claim is made against the Long Term Transmission Customers arising out of the matters referred to in Article 14.2.1(a), the Lead Long Term Transmission Customer shall promptly give the TSP a notice thereof, and the TSP shall at its own expense take necessary steps and attend such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. The TSP shall promptly notify the Long Term Transmission Customers of all actions taken in such proceedings or claims.

(c) If the TSP fails to notify the Lead Long Term Transmission Customer within twenty-eight (28) days after receipt of such notice from the Long Term Transmission Customers under Article 14.2.1(b) above, that it intends to attend any such proceedings or claim, then the Long Term Transmission Customers shall be free to attend the same on their own behalf at the cost of the TSP. Unless the TSP has so failed to notify the Lead Long Term Transmission Customer within the twenty eight (28) days period, the Long Term Transmission Customers shall make no admission that may be prejudicial to the defence of any such proceedings or claims.

(d) The Lead Long Term Transmission Customer shall, at the TSP's request, afford all available assistance to the TSP in attending to such proceedings or claim, and shall be reimbursed by the TSP for all reasonable expenses incurred in so doing.

14.2.2

(a) The Long Term Transmission Customers, in accordance with the Regulations framed by UPERC in this regard, subject to the TSP's compliance with Article 14.2.2(b) shall indemnify and hold harmless the TSP and its employees, officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs and expenses of whatsoever nature, including attorney's fees and expenses, which the TSP may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Agreement by reason of the setting up of the Project by the TSP.

(b) If any proceedings are brought or any claim is made against the TSP arising out of the matters referred to in Article 14.2.2 (a) the TSP shall promptly give the Lead Long Term Transmission Customer a notice thereof, and the Long Term Transmission Customers shall at its own expense take necessary steps and attend such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. The Lead Long Term Transmission Customer shall promptly notify the TSP of all actions taken in such proceedings or claims.

(c) If the Lead Long Term Transmission Customer fails to notify the TSP within twenty-eight (28) days after receipt of such notice from the TSP under Article 14.2.2(b) above, that it intends to attend any such proceedings or claim, then the TSP shall be free to attend the same on its own behalf at the cost of the Long Term Transmission Customers . Unless the Lead Long Term Transmission Customer has so failed to notify the TSP within the twenty (28) days period, the TSP shall make no admission that may be prejudicial to the defence of any such proceedings or claim.

(d) The TSP shall, at the Long Term Transmission Customers request, afford all available assistance to the Long Term Transmission Customers in attending to such proceedings or claim, and shall be reimbursed by the Long Term Transmission Customers for all reasonable expenses incurred in so doing.

14.3 Monetary Limitation of liability

14.3.1 A Party ("Indemnifying Party") shall be liable to indemnify the other Party ("Indemnified Party") under this Article 14 for any indemnity claims made in a Contract Year only up to an amount of **Rs. 1.14 Crore (Rupees One Crore Fourteen Lakh Only)**.

14.4 Procedure for claiming indemnity

14.4.1 Where the Indemnified Party is entitled to indemnification from the Indemnifying Party pursuant to Articles 14.1 or 14.2 the Indemnified Party shall promptly notify the Indemnifying Party of such claim, proceeding, action or suit referred to in Articles 14.1 or 14.2 in respect of which it is entitled to be indemnified. Such notice shall be given as soon as reasonably practicable after the Indemnified Party becomes aware of such claim, proceeding, action or suit. The Indemnifying Party shall be liable to settle the indemnification claim within thirty (30) days of receipt of the above notice.

Provided however that, if:

i. the Parties choose to contest, defend or litigate such claim, action, suit or proceedings in accordance with Article 14.4.3 below; and

ii. the claim amount is not required to be paid/deposited to such third party pending the resolution of the Dispute,

the Indemnifying Party shall become liable to pay the claim amount to the Indemnified Party or to the third party, as the case may be, promptly following the resolution of the Dispute, if such Dispute is not settled in favour of the Indemnified Party.

14.4.2 The Indemnified Party may contest, defend and litigate a claim, action, suit or proceeding for which it is entitled to be indemnified under Articles 14.1 or 14.2 and the Indemnifying Party shall reimburse to the Indemnified Party all reasonable costs and expenses incurred by the Indemnified Party. However, such Indemnified Party shall not settle or compromise such claim, action, suit or proceedings without first getting the consent of the Indemnifying Party, which consent shall not be unreasonably withheld or delayed.

14.4.3 An Indemnifying Party may, at its own expense, assume control of the defence of any proceedings brought against the Indemnified Party if it acknowledges its

obligation to indemnify such Indemnified Party, gives such Indemnified Party prompt notice of its intention to assume control of the defence, and employs an independent legal counsel at its own cost that is reasonably satisfactory to the Indemnified Party.

14.5 Limitation on Liability

14.5.1 Except as expressly provided in this Agreement, neither the TSP nor the Long Term Transmission Customers nor their respective officers, directors, agents, employees or Affiliates (including, officers, directors, agents or employees of such Affiliates), shall be liable or responsible to the other Party or its Affiliates including its officers, directors, agents, employees, successors, insurers or permitted assigns for incidental, indirect or consequential, punitive or exemplary damages, connected with or resulting from performance or non-performance of this Agreement, or anything done in connection herewith, including claims in the nature of lost revenues, income or profits (other than payments expressly required and properly due under this Agreement), any increased expense of, reduction in or loss of transmission capacity or equipment used therefore, irrespective of whether such claims are based upon breach of warranty, tort (including negligence, whether of the Long Term Transmission Customers , the TSP or others), strict liability, contract, breach of statutory duty, operation of law or otherwise.

14.5.2 The Long Term Transmission Customers shall have no recourse against any officer, director or shareholder of the TSP or any Affiliate of the TSP or any of its officers, directors or shareholders for such claims excluded under this Article. The TSP shall also have no recourse against any officer, director or shareholder of the Long Term Transmission Customers, or any Affiliate of the Long Term Transmission Customers or any of its officers, directors or shareholders for such claims excluded under this Article.

14.6 Duty to Mitigate

The party entitled to the benefit of an indemnity under this Article 14 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.

ARTICLE: 15

15 ASSIGNMENTS AND CHARGES

15.1 Assignments:

15.1.1 This Agreement shall be binding upon, and inure to the benefit of the Parties and their respective successors and permitted assigns. This Agreement shall not be assigned by any Party, except as provided in Article 15.3.

15.2 Permitted Charges:

15.2.1 Neither Party shall create or permit to subsist any encumbrance over all or any of its rights and benefits under this Agreement.

15.2.2 However, the TSP may create any encumbrance over all or part of the receivables, or the Project Assets of the Project in favour of the Lenders or the Lenders' Representative on their behalf, as security for amounts payable under the Financing Agreements and any other amounts agreed by the Parties.

Provided that:

i. the Lenders or the Lenders' Representative on their behalf shall have entered into the Financing Agreements and agreed in writing to the provisions of this Agreement; and

ii. any encumbrance granted by the TSP in accordance with this Article 15.2.2 shall contain provisions pursuant to which the Lenders or the Lender's Representative on their behalf agrees unconditionally with the TSP to release from such encumbrances upon payment by the TSP to the Lenders of all amounts due under the Financing Agreements.

15.2.3 Article 15.2.1 does not apply to:

a. liens arising by operation of law (or by an agreement evidencing the same) in the ordinary course of the TSP developing and operating the Project;

b. pledges of goods, the related documents of title and / or other related documents, arising or created in the ordinary course of the TSP developing and operating the Project; or

c. security arising out of retention of title provisions in relation to goods acquired in the ordinary course of the TSP developing and operating the Project.

15.3 Substitution Rights of the Lenders

15.3.1 The TSP would need to operate and maintain the Project under the provisions of this Agreement and cannot assign the Transmission License or transfer the Project or part thereof to any person by sale, lease, exchange or otherwise, without the prior approval of the Long Term Transmission Customers.

15.3.2 However, in the case of default by the TSP in debt repayments or in the case of default by the TSP as per Article 13 of this Agreement during the debt repayments, the State Commission may, on an application from the Lenders, assign the Transmission License to the nominee of the Lenders subject to the fulfilment of the qualification requirements and provisions of the Central Electricity Regulatory Commission (Procedure, terms and Conditions for grant of Transmission License and other related matters) Regulations, 2006 and as amended from time to time.

ARTICLE: 16

16 GOVERNING LAW AND DISPUTE RESOLUTION

16.1 Governing Law:

This Agreement shall be governed by and construed in accordance with the Laws of India. Any legal proceedings in respect of any matters, claims or disputes under this Agreement shall be under the jurisdiction of appropriate courts in Lucknow.

16.2 Amicable Settlement:

16.2.1 Either Party is entitled to raise any claim, dispute or difference of whatever nature arising under, out of or in connection with this Agreement, including its existence or validity or termination or whether during the execution of the Project or after its completion and whether prior to or after the abandonment of the Project or termination or breach of the Agreement by giving a written notice to the other Party, which shall contain:

(i) a description of the Dispute;

(ii) the grounds for such Dispute; and

(iii) all written material in support of its claim.

16.2.2 The other Party shall, within thirty (30) days of issue of notice issued under Article 16.2.1, furnish:

(i) counter-claim and defences, if any, regarding the Dispute; and

(ii) all written material in support of its defences and counter-claim.

16.2.3 Within thirty (30) days of issue of notice by the Party pursuant to Article 16.2.1, if the other Party does not furnish any counter claim or defense under Article 16.2.2, or thirty (30) days from the date of furnishing counter claims or defence by the other Party, both the Parties to the Dispute shall meet to settle such Dispute amicably. If the Parties fail to resolve the Dispute amicably within thirty (30) days from the later of the dates mentioned in this Article 16.2.3, the Dispute shall be referred for dispute resolution in accordance with Article 16.3.

16.3 Dispute Resolution:

All Disputes shall be adjudicated by the State Commission.

16.4 Parties to Perform Obligations:

Notwithstanding the existence of any Dispute and difference referred to the State Commission as provided in Article 16.3 and save as the State Commission may otherwise direct by a final or interim order, the Parties hereto shall continue to perform their respective obligations/ roles (which are not in dispute) under this Agreement.

ARTICLE: 17

17 REPRESENTATION AND WARRANTIES

17.1 Representation and warranties of the Long Term Transmission Customer

17.1.1 The Long Term Transmission Customers hereby represents and warrants to and agrees with the TSP as follows and acknowledges and confirms that the TSP is relying on such representations and warranties in connection with the transactions described in this Agreement:

a. It has all requisite powers and authority to execute and consummate this Agreement;

b. This Agreement is enforceable against the Long Term Transmission Customers in accordance with its terms;

c. The consummation of the transactions contemplated by this Agreement on the part of Long Term Transmission Customers will not violate any provision of nor constitute a default under, nor give rise to a power to cancel any charter, mortgage, deed of trust or lien, lease, agreement, license, permit, evidence of indebtedness, restriction, or other contract to which the Long Term Transmission Customers is a Party or to which the Long Term Transmission Customers is bound, which violation, default or power has not been waived;

17.2 Representation and Warranties of the TSP:

17.2.1 The TSP hereby represents and warrants to and agrees with the Long Term Transmission Customers as follows and acknowledges and confirms that the Long Term Transmission Customers is relying on such representations and warranties in connection with the transactions described in this Agreement:

a. It has all requisite powers and has been duly authorized to execute and consummate this Agreement;

b. This Agreement is enforceable against it, in accordance with its terms;

c. The consummation of the transactions contemplated by this Agreement on the part of the TSP will not violate any provision of nor constitute a default under, nor give rise to a power to cancel any charter, mortgage, deed of trust or lien, lease, agreement, license, permit, evidence of indebtedness, restriction, or other

contract to which the TSP is a Party or to which the TSP is bound which violation, default or power has not been waived;

d. The TSP is not insolvent and no insolvency proceedings have been instituted, nor threatened or pending by or against the TSP;

e. There are no actions, suits, claims, proceedings or investigations pending or, to the best of the TSP's knowledge, threatened in writing against the TSP at law, in equity, or otherwise, and whether civil or criminal in nature, before or by, any court, commission, arbitrator or governmental agency or authority, and there are no outstanding judgments, decrees or orders of any such courts, commission, arbitrator or governmental agencies or authorities, which materially adversely affect its ability to execute the Project or to comply with its obligations under this Agreement.

17.2.2 The TSP makes all the representations and warranties above to be valid as on the Effective Date of this Agreement.

ARTICLE: 18

18 INDEPENDENT ENGINEER

(Not Applicable for Intra-State transmission system)

ARTICLE: 19

19 MISCELLANEOUS PROVISIONS

19.1 Lead Long Term Transmission Customers

19.1.1 The Long Term Transmission Customers hereby appoint and authorise **"Lead LTTC Name"** (hereinafter referred to as the "Lead Long Term Transmission Customer") to represent all the Long Term Transmission Customers for discharging the rights and obligations of the Long Term Transmission Customers, which are required to be undertaken by all the Long Term Transmission Customers. All the Long Term Transmission Customers shall follow and be bound by the decisions of the Lead Long Term Transmission Customer on all matters specified in this Agreement. Accordingly each Long Term Transmission Customer agrees that any decision, communication, notice, action or inaction of the Lead Long Term Transmission Customer on such matters shall be deemed to have been on its/his behalf and shall be binding on each of the Long Term Transmission Customer. The TSP shall be entitled to rely upon any such action, decision or communication or notice from the Lead Long Term Transmission Customer. It is clarified that provisions under this Article 19.1 are not intended to and shall not render the Lead Long Term Transmission Customer liable to discharge Transmission Charges payments due to TSP from the other Long Term Transmission Customers.

19.1.2 The Long Term Transmission Customers hereby also appoint and authorise "**2nd Lead LTTC Name"** (hereinafter referred to as the "Alternate Lead Long Term Transmission Customer"), to act as Lead Long Term Transmission Customer as per the provisions of this Article 19.1.2, on the occurrence of any Event of Default specified in Article 13 by the Lead Long Term Transmission Customer. In such an event, the TSP may, at its option, within a period of fifteen (15) days from the date of issue of the TSP‟s Preliminary Termination Notice referred to in Article 13 and if the said default by the Lead Long Term Transmission Customer subsists, specify in writing to all the Long Term Transmission Customers that the Alternate Lead Long Term Transmission Customer shall thereafter act as the Lead Long Term Transmission Customer. In such a case, if the TSP so notifies, the Alternate Lead Long Term Transmission Customer shall, thereafter, act as Lead Long Term Transmission Customer for the purposes of this Agreement, and the Lead Long Term Transmission Customer earlier appointed under Article 19.1.1 shall automatically cease to be the Lead Long Term Transmission Customer. It is clarified that all decisions taken by the "**Lead LTTC Name**" appointed under Article 19.1.1, in its capacity as Lead Long Term Transmission Customer before such change, shall continue to be valid, in accordance with this Agreement.

19.1.3 In the event of "**2nd Lead LTTC Name**" becoming the Lead Long Term Transmission Customer as per Article 19.1.2, all the Long Term Transmission Customers shall also appoint any of Long Term Transmission Customers, other than "**Lead LTTC Name**", appointed under Article 19.1.1, as an Alternate Lead Long Term Transmission Customer and thereafter the provisions of Article 19.1.2 shall be applicable.

19.1.4 Notwithstanding anything contained above, any decision which is required to be taken by the Long Term Transmission Customers jointly under the provisions of Article 13, shall be taken by all the Long Term Transmission Customers and in case of difference amongst the Long Term Transmission Customers, the said decision shall be taken by the Majority Long Term Transmission Customers, as defined in Article 19.1.5 below.

19.1.5 Any decision taken by Long Term Transmission Customers, who taken together constitute sixty five percent (65%) of the Allocated Project Capacity and constitute in number at least fifty percent (50%) of the total number of Long Term Transmission Customers (hereinafter referred to as "Majority Long Term Transmission Customers"), shall be binding on the Lead Long Term Transmission Customer and all other Long Term Transmission Customers. Majority Long Term Transmission Customers shall also have the right to replace the Lead Long Term Transmission Customer by any other Long Term Transmission Customer of their choice. All decisions taken by the Majority Long Term Transmission Customers in this Agreement shall be conveyed by the Lead Long Term Transmission Customer.

19.2 Equity Lock-in Commitment:

19.2.1 The aggregate equity share holding of the Selected Bidder in the issued and paid up equity share capital of **SPV [which is under incorporation]** shall not be less than Fifty one percent (51%) up to a period of one (1) year after COD of the Project.

Provided that, in case the Lead Member or Bidding Company is holding equity through Affiliate/s, Ultimate Parent Company or Parent Company, such restriction as specified above shall apply to such entities.

Provided further, that in case the Selected Bidder is a Bidding Consortium, the Lead Member shall continue to hold equity of at least twenty six percent (26%) upto a period of one (1) year after COD of the Project and any Member of such Bidding Consortium shall be allowed to divest its equity as long as the other remaining Members (which shall always include the Lead Member) hold the minimum equity specified above.

19.2.2 If equity is held by the Affiliates, Parent Company or Ultimate Parent Company of the

Selected Bidder, then, subject to the second proviso to Article 19.2.1, such Affiliate, Parent Company or Ultimate Parent Company shall be eligible to transfer its shareholding in **SPV [which is under incorporation]** to another Affiliate or to the Parent Company / Ultimate Parent Company of the Selected Bidder. If any such shareholding entity, qualifying as an Affiliate / Parent Company / Ultimate Parent Company, is likely to cease to meet the criteria to qualify as an Affiliate / Parent Company / Ultimate Parent Company, the shares held by such entity shall be transferred to another Affiliate / Parent Company / Ultimate Parent Company of the Selected Bidder.

19.2.3 Subject to Article 19.2.1, all transfer(s) of shareholding of **SPV [which is under incorporation]** by any of the entities referred to in Article 19.2.1 and 19.2.2 above, shall be after prior written intimation to the Long Term Transmission Customers .

19.2.4 For computation of effective Equity holding, the Equity holding of the Selected Bidder or its Ultimate Parent Company in such Affiliate(s) or Parent Company and the equity holding of such Affiliate(s) or Ultimate Parent Company in **SPV [which is under incorporation]** shall be computed in accordance with the example given below:

If the Parent Company or the Ultimate Parent Company of the Selected Bidder A directly holds thirty percent (30%) of the equity in **SPV [which is under incorporation]**, then holding of Selected Bidder A in **SPV [which is under incorporation]** shall be thirty percent (30%);

If Selected Bidder A holds thirty percent (30%) equity of the Affiliate and the Affiliate holds fifty percent (50%) equity in **SPV [which is under incorporation]**, then, for the purposes of ascertaining the minimum equity/equity lock-in requirements specified above, the effective holding of Bidder A in **SPV [which is under incorporation]** shall be fifteen percent (15%), (i.e., 30% x 50%)

19.2.5 The provisions as contained in this Article 19.2 shall override the terms of the consortium agreement submitted as part of the Bid.

19.2.6 The TSP shall be responsible to report to Long Term Transmission Customers, within thirty (30) days from the occurrence of any event that would result in any change in its equity holding structure from that which existed as on the date of signing of the Share Purchase Agreement. In such cases, the Lead Long Term Transmission Customer would reserve the right to ascertain the equity holding structure and to call for all such required documents / information / clarifications as may be required.

19.3 Commitment of maintaining Qualification Requirement

19.3.1 The Selected Bidder will be required to continue to maintain compliance with the Qualification Requirements, as stipulated in RFP Document, till the COD of the Project. Where the Technically Evaluated Entity and/or the Financially Evaluated Entity is not the Bidding Company or a Member in a Bidding Consortium, as the case may be, the Bidding Company or Member shall continue to be an Affiliate of the Technically Evaluated Entity and/or Financially Evaluated Entity till the COD of the Project.

19.3.2 Failure to comply with the aforesaid provisions shall be dealt in the same manner as TSP's Event of Default as under Article 13 of this Agreement.

19.4 Language:

19.4.1 All agreements, correspondence and communications between the Parties relating to this Agreement and all other documentation to be prepared and supplied under the Agreement shall be written in English, and the Agreement shall be construed and interpreted in accordance with English language.

19.4.2 If any of the agreements, correspondence, communications or documents are prepared in any language other than English, the English translation of such agreements, correspondence, communications or documents shall prevail in matters of interpretation.

19.5 Affirmation

The TSP and the Long Term Transmission Customers, each affirm that:

1. neither it nor its respective directors, employees, or agents has paid or undertaken to pay or shall in the future pay any unlawful commission, bribe, pay-off or kick-back; and

2. it has not in any other manner paid any sums, whether in Indian currency or foreign currency and whether in India or abroad to the other Party to procure this Agreement, and the TSP and the Long Term Transmission Customers hereby undertake not to engage in any similar acts during the Term of Agreement.

19.6 Severability

The invalidity or enforceability, for any reason, of any part of this Agreement shall not prejudice or affect the validity or enforceability of the remainder of this Agreement, unless the part held invalid or unenforceable is fundamental to this Agreement.

19.7 Counterparts

This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which collectively shall be deemed one and the same Agreement.

19.8 Breach of Obligations/ Roles

The Parties acknowledge that a breach of any of the obligations/ roles contained herein would result in injuries. The Parties further acknowledge that the amount of the liquidated damages or the method of calculating the liquidated damages specified in this Agreement is a genuine and reasonable pre-estimate of the damages that may be suffered by the non-defaulting Party in each case specified under this Agreement.

19.9 Restriction of Shareholders / Owners Liability

19.9.1 Parties expressly agree and acknowledge that none of the shareholders of the Parties hereto shall be liable to the other Parties for any of the contractual obligations of the concerned Party under this Agreement.

19.9.2 Further, the financial liabilities of the shareholder(s) of each Party to this Agreement shall be restricted to the extent provided in the Indian Companies Act, 1956 / Companies Act, 2013 (as the case may be).

19.10 Taxes and Duties:

19.10.1 The TSP shall bear and promptly pay all statutory taxes, duties, levies and cess, assessed/levied on the TSP, its Contractors or their employees that are required to be paid by the TSP as per the Law in relation to the execution of the Project and for providing Transmission Service as per the terms of this Agreement.

19.10.2 The Long Term Transmission Customers shall be indemnified and held harmless by the TSP against any claims that may be made against the Long Term Transmission Customers in relation to the matters set out in Article 19.10.1.

19.10.3 The Long Term Transmission Customers shall not be liable for any payment of, taxes, duties, levies, cess whatsoever for discharging any obligation of the TSP by the Long Term Transmission Customers on behalf of TSP or its personnel, provided the TSP has consented in writing to Long Term Transmission Customers for such work, for which consent shall not be unreasonably withheld.

19.11 No Consequential or Indirect Losses

The liability of the TSP shall be limited to that explicitly provided in this Agreement.

Provided that, notwithstanding anything contained in this Agreement, under no event shall the Long Term Transmission Customers or the TSP claim from one another any indirect or consequential losses or damages.

19.12 Discretion:

Except where this Agreement expressly requires a Party to act fairly or reasonably, a Party may exercise any discretion given to it under this Agreement in any way it deems fit.

19.13 Confidentiality

19.13.1 The Parties undertake to hold in confidence this Agreement and RFP Project Documents and not to disclose the terms and conditions of the transaction contemplated hereby to third parties, except:

(a) to their professional advisors;

(b) to their officers, contractors, employees, agents or representatives, financiers, who need to have access to such information for the proper performance of their activities; or

(c) disclosures required under Law,

without the prior written consent of the other Parties.

Provided that, the TSP agrees and acknowledges that the Long Term Transmission Customers, may, at any time, disclose the terms and conditions of the Agreement and the RFP Project Documents to any person, to the extent stipulated under the Law and the Competitive Bidding Guidelines.

19.14 Order of priority in application:

Save as provided in Article 2.5, in case of inconsistencies between the terms and conditions stipulated in Transmission License issued by the Appropriate Commission to the TSP, agreement(s) executed between the Parties, applicable Law including rules and regulations framed thereunder, the order of priority as between them shall be the order in which they are placed below:

- terms and conditions of Transmission License;

- applicable Law, rules and regulations framed thereunder;
- this Agreement;

19.15 Independent Entity:

19.15.1 The TSP shall be an independent entity performing its obligations pursuant to the Agreement.

19.15.2 Subject to the provisions of the Agreement, the TSP shall be solely responsible for the manner in which its obligations under this Agreement are to be performed. All employees and representatives of the TSP or Contractors engaged by the TSP in connection with the performance of the Agreement shall be under the complete control of the TSP and shall not be deemed to be employees, representatives, Contractors of the Long Term Transmission Customers and nothing contained in the Agreement or in any agreement or contract awarded by the TSP shall be construed to create any contractual relationship between any such employees, representatives or Contractors and the Long Term Transmission Customers.

19.16 Amendments:

19.16.1 This Agreement may only be amended or supplemented by a written agreement between the Parties.

19.17 Waiver:

19.17.1 No waiver by either Party of any default or breach by the other Party in the performance of any of the provisions of this Agreement shall be effective unless in writing duly executed by an authorised representative of such Party.

19.17.2 Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement nor time or other indulgence granted by one Party to the other Parties shall act as a waiver of such breach or acceptance of any variation or the relinquishment of any such right or any other right under this Agreement, which shall remain in full force and effect.

19.18 Relationship of the Parties:

This Agreement shall not be interpreted or construed to create an association, joint venture, or partnership or agency or any such other relationship between the Parties or to impose any partnership obligation or liability upon either Party and neither Party shall

have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Party.

19.19 Entirety:

19.19.1 This Agreement along with its sections, schedules and appendices is intended by the Parties as the final expression of their agreement and is intended also as a complete and exclusive statement of the terms of their agreement.

19.19.2 Except as provided in this Agreement, all prior written or oral understandings, offers or other communications of every kind pertaining to this Agreement or the provision of Transmission Service under this Agreement to the Long Term Transmission Customers by the TSP shall stand superseded and abrogated.

19.20 Notices:

19.20.1 All notices or other communications which are required to be given under this Agreement shall be in writing and in the English language

19.20.2 If to the TSP, all notices or communications must be delivered personally or by registered post or facsimile or any other mode duly acknowledged to the addressee below:

Address :

Attention :

Email :

Fax. No. :

Telephone No.:

19.20.3 If to the Long Term Transmission Customer(s), all notices or communications must be delivered personally or by registered post or facsimile or any other mode duly acknowledged to the addresses below:

(i) Paschimanchal Vidyut Vitran Nigam Ltd.

Address :

Attention

Email :

Fax. No. :

Telephone No.:

(ii) Madhyanchal Vidyut Vitran Nigam Ltd.

Address :

Attention

Email :

Fax. No. :

Telephone No.:

(iii) Purvanchal Vidyut Vitran Nigam Ltd.

Address :

Attention

Email :

Fax. No. :

Telephone No.:

(iv) Dakshinanchal Vidyut Vitran Nigam Ltd.

Address :

Attention

Email :

Fax. No. :

Telephone No.:

(v) Kanpur Electricity Supply Co. Ltd.

Address :

Attention

Email :

Fax. No. :

Telephone No.:

19.20.4 All notices or communications given by facsimile shall be confirmed by sending a copy of the same via post office in an envelope properly addressed to the appropriate Party for delivery by registered mail. All notices shall be deemed validly delivered upon receipt evidenced by an acknowledgement of the recipient, unless the Party delivering the notice can prove in case of delivery through the registered post that the recipient refused to acknowledge the receipt of the notice despite efforts of the postal

authorities.

19.20.5 Any Party may by notice of at least fifteen (15) days to the other Party change the address and/or addresses to which such notices and communications to it are to be delivered or mailed.

19.21 Fraudulent and Corrupt Practices

19.21.1 The TSP and its respective officers, employees, agents and advisers shall observe the highest standard of ethics during the subsistence of this Agreement. Notwithstanding anything to the contrary contained in the Agreement, the Long Term Transmission Customers may terminate the Agreement without being liable in any manner whatsoever to the TSP, if it determines that the TSP has, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice in the Bid process. In such an event, the Long Term Transmission Customers shall forfeit the Contract Performance Guarantee of the TSP, without prejudice to any other right or remedy that may be available to the hereunder or subsistence otherwise.

19.21.2 Without prejudice to the rights of the Long Term Transmission Customers under Clause 19.21.1 hereinabove and the rights and remedies which the Long Term Transmission Customers may have under this Agreement, if a TSP is found by the Long Term Transmission Customers to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice during the Bid process, or after the issue of Letter of Intent (hereinafter referred to as LoI) or after the execution of the TSA, the Long Term Transmission Customer(s) may terminate the Agreement without being liable in any manner whatsoever to the TSP. Further, the TSP & its Affiliates shall not be eligible to participate in any tender or RFP issued by any BPC for an indefinite period from the date such TSP is found by the Long Term Transmission Customer(s) to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practices, as the case may be.

19.21.3 For the purposes of this Clause 19.21, the following terms shall have the meaning hereinafter respectively assigned to them:

(a) **"corrupt practice"** means (i) the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the actions of any person connected with the Bid process (for avoidance of doubt, offering of employment to or employing or

engaging in any manner whatsoever, directly or indirectly, any official of the BPC who is or has been associated or dealt in any manner, directly or indirectly with the Bid process or the LoI or has dealt with matters concerning the RFP Project Documents or arising there from, before or after the execution thereof, at any time prior to the expiry of one year from the date such official resigns or retires from or otherwise ceases to be in the service of the BPC, shall be deemed to constitute influencing the actions of a person connected with the Bid Process); or (ii) engaging in any manner whatsoever, whether during the Bid Process or after the issue of the LoI or after the execution of the RFP Project Documents, as the case may be, any person in respect of any matter relating to the Project or the LoI or the RFP Project Documents, who at any time has been or is a legal, financial or technical adviser of the BPC in relation to any matter concerning the Project;

(b)"**fraudulent practice**" means a misrepresentation or omission of facts or suppression of facts or disclosure of incomplete facts, in order to influence the Bid process;

(c) "**coercive practice**" means impairing or harming, or threatening to impair or harm, directly or indirectly, any person or property to influence any person's participation or action in the Bid process;

(d) "**undesirable practice**" means (i) establishing contact with any person connected with or employed or engaged by the BPC with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Bid process; or (ii) having a Conflict of Interest; and

(e) "**restrictive practice**" means forming a cartel or arriving at any understanding or arrangement among Bidders with the objective of restricting or manipulating a full and fair competition in the Bid process;

19.22 Compliance with Law:

Despite anything contained in this Agreement but without prejudice to Article 12, if any provision of this Agreement shall be in deviation or inconsistent with or repugnant to the provisions contained in the Electricity Act, 2003, or any rules and regulations made there under, such provision shall be deemed to be amended to the extent required to bring it into compliance with the aforesaid relevant provisions as amended from time to time.

IN WITNESS WHEREOF, THE PARTIES HAVE CAUSED THIS AGREEMENT TO BE EXECUTED BY THEIR DULY AUTHORISED REPRESENTATIVES AS OF THE DATE AND PLACE SET FORTH ABOVE.

1. For and on behalf of TSP

……..

[Signature, Name, Designation and Address]

2. For and on behalf of Paschimanchal Vidyut Vitran Nigam Ltd.

……..

[Signature, Name, Designation and Address]

3. For and on behalf of Madhyanchal Vidyut Vitran Nigam Ltd.

……..

[Signature, Name, Designation and Address]

4. For and on behalf of Purvanchal Vidyut Vitran Nigam Ltd.

……..

[Signature, Name, Designation and Address]

5. For and on behalf of Dakshinanchal Vidyut Vitran Nigam Ltd.

……..

[Signature, Name, Designation and Address]

6. For and on behalf of Kanpur Electricity Supply Co. Ltd.

……..

[Signature, Name, Designation and Address]

WITNESSES:

1. For and on behalf of

: BPC

……

[Signature]

.....

[Insert, Name, Designation and Address of the Witness]

2. **For and on behalf of**

: STU

……

[Signature]

.....

[Insert Name, Designation and Address of the Witness]

SCHEDULES

Schedule: 1

Project Description and Scope of Project

1. Brief description of Transmission line:

- Data Centers under construction in Noida/Greater Noida has to be supplied power from two separate sources as per the data center policy approved by the Government.
- To provide smooth power supply to the under construction International Airport Jewar.
- Proposed high speed train and industrial activities in the area.
- To strengthen the existing transmission system to provide a strong secondary source to 220 KV sub-stations.
- Constriction of 220 kV GIS S/s Cantt Chaukaghat, Varanasi will provide support to 33 kV substation of the distribution area like Chaukaghat, Kashi Vidyapeeth, Municipal corporation, cultural complex, Chaukaghat (S.T.P.), Pandepur (proposed), Dhel Bairiya (proposed) etc.
- Construction of 200 Kv GIS S/s Vasundhara (Ghaziabad), will provide support to 33 kV sub-stations of the distribution unit like Vasundhara Sector -2, Sector-7, sector-8, Sector-10, Sector-16, sector-19 & sector-16 (old) etc.
- Construction of 220 kV S/s Khaga (Fatehpur) will provide second source to 132 kV Hussainganj S/s and 33kV sub-stations of PuVVNL such as Thariav, Ashothar, Jaroli, Mahichamandir, Haswa, Faridpur, Naraini & Dharampursato etc.

2. Scope of the Project:

S. No.	Name of Transmission Element	Scheduled COD from Effective Date
A.	**Construction of 400/220 kV, 2x500 MVA GIS Substation Jewar (Gautam Budh Nagar) with associated lines**	
A1	Construction of 400/220 kV. 2x500 MVA GIS Substation Jewar (Gautam Budh Nagar) (along with 125 MVAR reactor) • 400 kV GIS feeder bay – 02 Nos. • 400 kV GIS Bus Coupler bay – 01 No.	18 months

S. No.	Name of Transmission Element	Scheduled COD from Effective Date
	• 400 kV GIS Bus reactor bay – 01 No. • 400 kV GIS ICT bay – 02 Nos. • 220 kV GIS feeder bay – 02 Nos. • 220 kV GIS Bus Coupler bay – 01 No. • 220 kV GIS ICT bay – 02 Nos. • 220 kV GIS Interconnecting (220 kV S/S Jewar) bay – 02 Nos. • 220 kV GIS Feeder (220 kV S/S Sector-28 YEIDA) bay – 02 Nos.	
A2	LILO of one ckt. of 400 kV Greater Noida (765 kV) – Sector -148 (400), Noida DC line at 400/220 kV GIS Substation Jewar (Gautam Budh Nagar) (for LILO, twin HTLS conductor and OPGW stringing work on narrow base multi circuit towers)	
B.	**Construction of** 220**/33 kV, 2x60 MVA GIS substation Cantt, (Chaukaghat) Varanasi with associated lines**	
B1	Construction of 220/33 kV, GIS Substation Cantt, (Chaukaghat) Varanasi • 220 kV GIS feeder bay – 02 Nos. • 220 kV GIS Bus Coupler bay – 01 No. • 220 kV GIS ICT bay – 02 Nos. • 33 kV GIS feeder bay – 12 Nos. • 33 kV GIS Transfer Bus Coupler bay – 01 No. • 33 kV GIS ICT bay – 02 Nos.	18 months
B2	LILO of one ckt, of 220 kV Satnath (400)- Gajokhar DC line at Cantt.(Chaukaghat) Varanasi construction of 41.5 Km (37 Km overhead line (Zebra Conductor) on Lattice Tower and construction of 4.5 Km 630 mm2 line with copper XLPE cable	
C.	**Construction of 220/33 kV, 3x60 MVA GIS substation Vasundhara (Ghaziabad) with associated lines**	
C1	Construction of 220/33 kV GIS substation Vasundhara (Ghaziabad)	18 months

S. No.	Name of Transmission Element	Scheduled COD from Effective Date
	• 220 kV GIS feeder bay – 03 Nos. • 220 kV GIS feeder bay (spare) – 01 No. • 220kV GIS Bus Coupler Bay- 01 No. • 220 kV GIS ICT bay – 03 Nos. • 33 kV GIS feeder bay – 10 Nos. • 33 kV GIS Transfer Bus Coupler bay – 01 No. • 33 kV GIS bus sectionalized bay – 02 Nos. • 33 kV capacitor bank bay (1x10 MVAR)– 03 Nos. • 33 kV GIS ICT bay – 03 Nos. • 33/0.4 kV Station transformer bay – 02 Nos.	
C2	LILO of one ckt, of 220 kV Muradnagar(400)- Sahibabad (220) SC line at 220 kV Substation Vasundhara (Ghaziabad) (Multi Ckt. / Monopole Tower)(Zebra conductor)	
C3	220 kV Indirapuram (400) – Vasundhara SC line (Monopole and Narrowbase multi ciruit tower)	
D.	**Construction of 220/132/33 kV, 2x160+2x40 MVA Substation Khaga (Fatehpur) with associated lines**	
D1	Construction of 220/132/33 kV, Substation Khaga (Fatehpur) • 220 kV feeder bay – 02 Nos. • 220 kV spare feeder bay – 02 Nos. • 220 kV bus coupler – 01 No. • 220 kV transfer bus coupler – 01 No • 220 kV ICT bay – 02 Nos. • 132 kV feeder bay – 03 Nos. • 132 kV spare feeder bay – 01 No. • 132 kV bus coupler – 01 No. • 132 kV transfer bus coupler – 01 No • 132 kV ICT bay – 04 Nos. • 33 kV Feeder Bay – 07 Nos. • 33 kV Transfer Bus Coupler bay – 01 No. • 33 kV ICT bay – 02 Nos.	18 months

S. No.	Name of Transmission Element	Scheduled COD from Effective Date
D2	220 kV Fatehpur (765) PG -Khaga DC line (Zebra Conductor)	
D3	132 kV Khaga (220) – Khaga DC line	
D4	132 kV Khaga (220) — Hussainganj SC line	
D5	132 kV Bay 132 kV Substation Khaga	
D6	132 kV Hybrid Bay at 132 kV substation Hussainganj	

Note:

1. *UPPTCL to provide adequate land for construction of 400/220 kV, 2x500 MVA GIS Substation at Jewar (Gautam Budh Nagar) free of cost and shall be handed over to TSP as is where basis.*

2. *UPPTCL to provide adequate land for construction of 220/33 kV, 2x60 MVA GIS substation at Cantt, (Chaukaghat) Varanasi free of cost and shall be handed over to TSP as is where basis.*

3. *UPPTCL to provide adequate land for construction of 220/33 kV, 3x60 MVA GIS substation at Vasundhara (Ghaziabad) free of cost and shall be handed over to TSP as is where basis.*

4. *UPPTCL to provide adequate land for construction of 220/132/33 kV, 2x160+2x40 MVA Substation at Khaga (Fatehpur) free of cost and shall be handed over to TSP as is where basis.*

5. *02 Nos., 220 kV Bay at Fatehpur (765) PG shall be under scope of developer.*

6. *02 Nos., 132 kV Bay at 132 kV S/s Khaga shall be under scope of developer.*

7. *01 No., 132 kV Hybrid Bay at 132 kV S/s Husainganj shall be under scope of developer.*

ANNEXURE C

Technical Specifications of Transmission System

SPECIFIC TECHNICAL REQUIREMENTS FOR 220 KV AND 132 KV TRANSMISSION LINES

1. GENERAL INFORMATION

The transmission line shall be constructed on self supporting 132kV Galvanized Latticed Steel Double circuit towers and Narrow base Double circuit tower. The phase conductor shall be ACSR PANTHER in vertical formation with three phase of one Circuits being on one side of the tower of 132kV lines respectively. The 7/10 or 7/9 SWG Earth wire/OPGW shall be provided above the conductors for effective shielding of 132KV lines respectively.

2. SERVICE CONDITION

i.	Nominal system voltage	132KV
ii.	Rated highest system voltage	145
iii.	System frequency	50 Hz
iv.	No. of phase	3
v.	Phase configuration	Vertical
vi.	Neutral earthling	Effectively earthed
vii.	BIL	550 kV
viii	Power frequency withstand voltage (wet condition)	230 kV
ix.	Variation in system voltage	+10% to -15%
x.	Variation in system frequency	$\pm$ 5%

TECHNICAL CONDITIONS (TOWERS)

STEEL

- Tower members shall be fabricated out of steel conforming to IS:226/1975 or IS: 2062/1999 with the latest revision thereof.
- The tower members shall be fabricated in accordance with IS: 802(Part –II)-1978 with the latest revision thereof.

Tolerance:

- The following fabrication tolerances shall be allowed as per IS : 7215-1974.

- The maximum allowable difference in diameter of the hole on the two sides of plate or angle shall not exceed 0.8 mm i.e. allowable taper in punched hole shall not exceed 0.8 mm on diameter.
- The tolerance cumulative and between consecutive holes shall be within + 0.5mm.
- The tolerance on the overall length of members shall be within +1.6 mm.
- The tolerance on back mark shall be within +0.5 mm.

TECHNICAL REQUIREMENTS FOR BOLTS

- The bolts shall be hot dip galvanized, Hexagon round hexagon head transmission tower bolts of size M16 for use in construction of transmission towers and sub stations. These must confirm to IS: 12477/1988.
- The dimensions of the M16 shall be as per IS: 12427-1988.

3. INSULATORS

The specification covers design, manufacture, testing and supply and delivery of following insulators suitable for hardware fitting of Zebra ACSR Conductor for 220 kV and Panther ACSR for 132 kV transmission lines.

The equipment offered, shall be complete with all components which are necessary or usually used for their efficient performance and satisfactory maintenance

a. DETAILS OF DISC INSULATORS

3.1.1 The insulators of the string shall consist of standard discs for 3 phase 50 Hz effectively earthed system which can be operated at a voltage ten (10) percent higher than the rated system voltage in moderately polluted atmospheric conditions.

3.1.2 The disc insulators shall be made of electro-porcelain. The disc insulators shall be of cap and pin, ball and socket type. porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed.

3.1.3 The disc insulators shall be used on 220 KV /132 KV transmission lines in form of single tension/double tension strings.

3.1.4 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulators shall not lead to deterioration. Special care should be taken in use of very low autoclave expansion cement to curb the unpredictable cement growth which leads to ageing. The limit of autoclave cement expansion should be as mentioned with the details in relevant standard.

3.1.5 The number of Disc Insulators of each Single suspension/ Single Tension and Double Suspension / Tension insulator string in 220 KV line shall be as follow:-

S. N.	Insulators Strings	No. of Disc Insulators per strings 220 KV	No. of Disc Insulators per strings 132 KV
1	Single Suspension	14	9
2	Double Suspension	2X14	2X9
3	Single Tension	16	10
4	Double Tension	2X16	2X10

3.1.6 The size, minimum creepage distance and EM (Electro mechanical) strength of disc insulators shall be as follows:

S N	Type of Disc (B-Type)	Size (mm)	Min. Creepage distance -mm	EM strength - KN
1	70 KN	255x145	292	70
2	120 KN	280/255 x 145	330	120
3	160 KN	280 x 170	330	160

3.2 TECHNICAL PARTICULARS OF INSULATORS

The insulators to be supplied must fulfill the minimum technical particulars as mentioned below:-

S N	Description	70KN	120 KN	160KN
(A)	General			
1.	Type of Insulators (B&S Type)	16 mm	20 mm	20 mm
2.	Outside diameter of disc with tolerance (mm)	255	280/255	280
3.	Distance between centers of disc with tolerance (mm)	145	145	170
4.	Color of glazing of porcelain of Insulators	Brown	Brown	Brown
(B)	Mechanical Values			
1.	Electro-Mechanical Strength of single disc (KN)	70	120	160

S N	Description	70KN	120 KN	160KN
2.	Breaking strength of single disc not less than (KN)	70	120	160
(C)	Electrical Values			
1.	Usual working System voltage (KV)	132/220	132	220
2.	Minimum Creepage distance of single disc (mm)	292	330	330
3.	Power Frequency Puncture Voltage of single Disc (KV) rms.	120	120	125
4.	Power Frequency and minute withstand voltage of single disc (KV) rms. Dry Wet	 70 40	 75 45	 75 45
5.	Impulse withstand voltage (KV) Peak (+ wave)	110	120	122
(D)	Complete string Values (132 KV)			
	Suspension Tension	9(132KV) 10(220KV) -	- 10	- 16
1.	Power frequency withstand voltage (KV)			
	with arcing horn on both side Dry (132 KV/220 KV) Wet(132 KV/220 KV)	 350/490 230/395	 380 250	 550 460
	without arcing horn Dry(132 KV/220 KV) Wet(132 KV/220 KV)	 260/500 240/405	 400 290	 600 500
2.	Power frequency flashover voltage (KV)			
	(a) with arcing horn on both side Dry(132 KV/220 KV) Wet(132 KV/220 KV)	 420/560 300/430	 450 320	 590 520
	(b) without arcing horn Dry(132 KV/220 KV)	 430/560	 480	 650

S N	Description	70KN	120 KN	160KN
	Wet(132 KV/220 KV)	310/440	330	560
3.	Impulse withstand voltage (KV)			
	(a) with arcing horn on both side			
	(i) +ive(132 KV/220 KV)	550/900	570	1050
	(ii) -ive(132 KV/220 KV)	550/900	570	1050
	(b) without arcing horn			
	(i) +ive(132 KV/220 KV)	560/910	650	1150
	(ii) -ive(132 KV/220 KV)	560/910	650	1150
4.	Impulse flashover voltage (KV)			
	(a) with arcing horn on both side			
	(i) +ive(132 KV/220 KV)	600/975	620	1150
	(ii) -ive(132 KV/220 KV)	600/975	620	1150
	(b) without arcing horn			
	(i) +ive(132 KV/220 KV)	610/985	700	1200
	(ii) -ive(132 KV/220 KV)	610/985	700	1200
5.	Maxm. percentage of line to earth voltage distribution of insulator with normal fittings (%)(132 KV/220 KV)	22	20	14.14
6.	Mechanical failing load (kg.)			
	Single Suspension	7000	-	-
	Double Suspension	14000	-	-
	Single Tension	-	16500	16500
	Double Tension	-	33000	33000
7.	No deformation load (kg f)	67% of load at 6 above		

4. CONDUCTOR HARDWARES

4.1 The specification covers design, manufacture, testing & supply and delivery of following hardware fitting suitable for Zebra/Panther ACSR conductor for 220KV/132 KV transmission line. The equipment offered, shall be complete with all components which are necessary or usually used for their efficient performance and satisfactory maintenance.

1- Single Suspension
2- Single Tension
3- Single suspension Pilot fittings

4- Double Suspension
5- Double Tension

4.2 The hardware fittings shall be suitable for three phase, 50 Hz effectively earthed system in moderately polluted atmosphere and for operation at voltage 10% higher than the rated service voltage. The edges, lips etc of all hardware components shall be so rounded as to reduce corona loss and radio interference voltage to a minimum. The hardware fitting shall be complete with all components which are necessary or usually used for their efficient performance and satisfactory maintenance.

5. CONDUCTOR AND INSULATOR PARTICULARS:

5.1 CONDUCTOR

5.1.1 The hardware fitting for 220 KV lines shall be suitable for Zebra & for 132 KV lines shall be suitable for Panther conductor having particulars as hereunder –

	Code Name	**Zebra**	**Panther**
a	Copper Equivalent Area mm sq.	260	130
b	Total area mm sq.	484.5	261.30
c	No. of Strands	61	37
d	Stranding & wire diameter (mm) Aluminium (mm) Steel (mm)	 54/3.18 7/3.18	 30/3.00 7/3.00
e	Overall dia (mm)	28.62	21.00
f	DC Resistance at 20oC (ohm/Km	0.06868	0.3497
g	Ultimate tensile strength (KN)	130.32	89.67
h	Conductor per phase	Single	Single

5.2 DISC INSULATORS PARTICULARS

		Zebra	**Panther**
1	**70 KN**		
a	Size (mm)	255x145	255x145
b	E&M Strength KN	70	70
c	Discs in string (Nos.)	14	9
d	Ball & Socket (mm)	16/16B	16/16B
II	Tension string single or Double		

e	Size (mm)	280x170	255x145
f	E&M Strength mm	160	120
g	Discs in string (Nos.)	16	10
h	Ball & Socket (mm)	20	20

Note – Ball & Socket as per IS: 2486 Part-II

5.3 LENGTH OF FITTINGS WITH INSULATORS

		Zebra	**Panther**
1	Single Suspension		
	(a) Minimum - mm	2055	1330
	(b) Maximum - mm	2415	1650
II	Single Tension		
	(a) Minimum - mm	2860	1620
	(b) Maximum - mm	3260	2000
E	Ruling Span – Meters		
	(a) Single Circuit	380	360
	(b) Double Circuit	365	350
F	Configuration		
	(a) Single Circuit	Delta	Delta
	(b) Double Circuit	Vertical	Vertical
G	Conductor Tension At 32o C	22% of UTS of conductor	22% of UTS of conductor

6. CONDUCTOR ACCESSORIES

The specification covers design, manufacture, testing and supply and delivery of following conductor accessories suitable for Zebra ACSR Conductor for 220 kV transmission line and ACSR Panther Conductor for 132 kV transmission line. The equipment offered, shall be complete with all components which are necessary or usually used for their efficient performance and satisfactory maintenance.

i- Preformed Amour Rods

ii- Vibration Damper

iii- Repair sleeves

iv- Mid span Compression Joints

7. CONDUCTOR AND LINE DATA

The conductor accessories shall be suitable for Zebra/Panther, ACSR. The conductor and line data are as under :-

For Zebra For Panther

S N	Configuration	Vertical/Triangular	Vertical/ Triangular
1.	Number of phases	Three /Six	Three /Six
2.	Size of conductor		
	i) Aluminium	54/3.18 mm	30/3.00 mm
	ii) Steel	7/3.18 mm	7/3.30 mm
3	Over diameter	28.62 mm	21.00 mm
4	Weight per meter	1.621 kg	0.974 kg
5	Ultimate tensile strength	130.32 KN	89.67
6	Normal span (i) Single Circuit (ii) Double Circuit	 380 m 365 m	 365 m 380m
7	Maximum Conductor tension at 320C without external load.		
	i. Initial unloaded tension	35 % of UTS.	35 % of UTS.
	ii. Final unloaded tension	25% of UTS.	25% of UTS.
8	Nature of terrain	Generally flat with cultivated fields	
9	i) No. of performed Armour rods used	12 nos	11 nos
	ii) Dia of each rod	7.87 mm	6.35 mm
	iii) Dia of conductor with Armour rods	44.36 mm	33.70 mm
10	Max. permissible dynamic strain after damping	150 Microns	150 Microns

PREFORMED AMOUR RODS:

Preformed Armour Road shall line conform to IS:2121.The technical particulars are given as here under :-

S N		For Zebra	For Panther
i)	Material (IS: 739-1977)	Aluminium Alloy	Aluminium Alloy
ii)	Number of Rod per set	12	11
ii)	Diameter of each rod (mm)	7.87+0 / -0.1	6.35+0 / -0.1
iii)	Length of each rod (mm)	2540± 25	1950± 25
iv)	Difference between the longest rod and the shortest rod in each set (mm)	16	16
v)	Electrical conductivity at 200C	Not less than 39% of IACS (International Annealed Copper standards	
vi)	Ultimate strength of each rod (kg/mm2)	35 Kg	35 Kg
vii)	Marking	Centre line to be marked with black point	
viii)	Shape of end	Parrot bill ended	

8. **EARTHWIRE ACCESSORIES**

The specification covers design, manufacture, testing and supply of delivery of following earthwire accessories suitable for 7/3.67 mm. Earthwire for 220 KV lines and 7/3.25 mm. Earthwire for 132 KV lines. The equipment offered, shall be complete with all components which are necessary or usually used for their efficient performance and satisfactory maintenance.

i)Suspension clamp (Free centre type)

ii) Tension clamp

iii) Mid span compression joints

iv) Vibration damper

9. SUSPENSION CLAMPS: (FREE CENTER TYPE)

9.1 At all suspension towers suitable suspension clamps shall be used to support the earthwire. The suspension clamps shall hang from U-bolt which is fixed vertically downwards in the ground wire peak of suspension tower. The U-bolt is fixed in the direction of run of the line. This U-bolt is part of tower.

9.2 Necessary arrangement for hanging the suspension clamp form U-bolt shall be supplied along with the suspension clamp and shall be considered as a part of clamp.

9.3 The clamps shall conform to general requirement of IS : 2486 (Part -I) with latest revision thereof.

9.4 The suspension clamps (Complete assembly) shall consist of the following components:

i) Suspension Clamps

ii) Keeper piece

iii) U-bolts

iv) Anchor shackle to be used for suspending the suspension clamp form U-bolt of earthwire peak of the tower.

v) Nuts, bolts, washers and split pins etc.

9.5 The clamping piece and the clamp body shall be clamped by at least two U-bolts of size not less than M-10 diameter having one nut and one 3.5 mm. thick spring lock washer on each of its limbs. Suspension clamps shall be provided with inverted type U-bolts. The limb of one of the U-Bolts shall be long enough to accommodate the lug of the flexible copper bond.

9.6 Total length of suspension clamps assembly between tower peak and axis of earthwire at clamp (including one 65 mm long U-bolt which is already fixed in tower peak) shall be 200 mm.

9.7 The material for the suspension clamps shall be such that it gives the required mechanical strength with specified dimensions. The clamp may be made of either forged steel (as per IS : 2004) or malleable cast iron (as per IS: 2107 and IS: 2108) having good finish. The clamps shall be free from all internal defects like shrinkage inclusion, blow holes etc. and quality of the product shall be uniform throughout.

9.8 There shall be no sharp points in the clamps coming in contact with earthwire.

9.9 All the ferrous parts of compete assembly including bolts, nutsan lock washers shall be hot dip galvanised as per IS: 2633/1972. Spring washer should be electro-galvanised. The female thread of nuts should be oiled only.

9.10 The assembly shall give adequate area of support to the earthwire . The groove of the clamp shall be smooth finished in uniform circular or oval shape and shall slope downwards in a smooth curve in 25 mm length at either end to avoid sharp support for the earthwire and to reduce the intensity of bending moment at the clamp edge due to vertical load. There shallnot be any displacement in the configuration of the earthwire standards nor shall these be unduly stressed in final assembly.

9.11 The suspension assembly shall be guarantied for the following values:-

1. Slip strength : 8-15%of breaking load of earthwire

2. Minimum failing load : Not less than breaking load of earthwire.

10. **TENSION CLAMPS**

10.1 At all the tension towers, suitable compression type tension clamps shall be used to hold 7/9 SWG galvanised steel earth wire in case of 220 KV lines and 7/10 SWG galvanised steel earth wire in case of 132 KV lines.

10.2 The tension assembly shall consist of the following component parts :

i) Dead and End

ii) Jumper tube.

iii) Anchor D-Shackles

iv) Rivet, washer & cotter pins etc.

10.3 The compression tube & Jumper tube shall give adequate area of support without any slip to the earthwire under normal working tension and vibration conditions.

10.4 The dead end tubes and jumper tubes of tension clamps shall be made of Forged steed as per IS : 2004 with latest revision thereof.

10.5 All the forgings shall be of good finish and free from flaws and other defects. There shall be no sharp points in the tube coming in contact with the earthwire. There shall also not be any displacement in the configuration of the earthwirestrands nor shall they be un-duly stressed in the final assembly. The tube shall be such as to give

smooth surface after compression. The complete assembly shall be so designed as to avoid un-due bending in any part of assembly and shall not produce any hindrance to the movement of the clamp in horizontal or vertical directions.

10.6 Suitable lugs for jumper connection shall also be supplied along with necessary bolts and nuts.

10.7 All ferrous parts of complete assembly including bolts, nuts and washers shall be hot dip galvanised as per IS: 2633. Spring washers may be electro galvanised. The female thread of the nuts may be oiled only.

10.8 The assembly shall be connected to horizontal strain plates of the tower body by means of D- Shackle or eye link.

10.9 The jumper terminal plates shall be welded with dead end at an angle of 30^0 from the vertical plane. The jumper shall pass in a vertical plane.

10.10 The assembly shall be supplied complete with dead and jumper tubes, Anchor shokles bolts. nuts and washers .

10.11 The dimensions and the dimensional tolerances of the compressible tube shall be as under :-

(i) Before compression :		**For 7/3.67 mm EW**	**For 7/3.25 mm EW**
(a) Inner dia (mm)	:	11.5 ± 0.2	10.3 ± 0.2
(b) Outer dia (mm)	:	20.0 ± 0.5	18.0 ± 0.2
(ii) After the compression:			
(a) Width (corner to corner) (mm)	:	20.0 ± 0.5	17.4 ± 0.5
(b) Width (flat to flat) (mm)	:	17.5 ± 05	15.1 ± 0.5

10.12 The slip strength of the assembly shall not be less than the 95% of the ultimate tensile strength of the earthwire. The ultimate strengths of clamp shall not be less than that of earthwire. The method of testing shall conform to IS: 2121 (part -3) and IS: 2486 (part -I) or an equivalent standards amended upto -date.

11. MID SPAN COMPRESSION JOINTS

11.1 These joints shall be suitable for joining two length of earthwire.

11.2 These shall be made of high strength of mild steel tubes and shall be easily compressible without any crack or failure with 100 ton capacity hydraulic compressor.

11.3 The minimum failing load (slip strength) of the joint shall not be less than 95% of the ultimate tensile strength of the earthwire.

11.4 The joints shall have the same conductivity as the earthwire.

11.5 The dimensions and the dimensional tolerances of the joints shall be as under :-

(i) Before compression :		**For 7/3.67 mm EW**	**For 7/3.25 mm EW**
(a) Inner dia (mm)	:	11.5 $\pm$ 0.2	10.3 $\pm$ 0.2
(b) Outer dia (mm)	:	20.0 $\pm$ 0.5	18.0 $\pm$ 0.2
(c) Length (mm)	:	230$\pm$ 0.5	203 $\pm$ 0.2
(ii) After the compression:			
(a) Width (corner to corner) (mm)	:	20.0$\pm$ 0.5	17.4 $\pm$ 0.2
(b) Width (flat to flat) (mm)	:	17.5$\pm$ 05	15.1 $\pm$ 0.2
(c) Length (mm)	:	262$\pm$ 0.5	220$\pm$ 0.2

12. <u>VIBRATION DAMPERS</u>

12.1 Stock bridge 4R type vibration damper suitable for 7/3.67 mm earth wire shall be provided at all tension and suspension points on each span (at least one at each end of each earthwire spans of up to 450 meter) to damp out the vibration up to a limit of 150 micro strains on 220 KV lines.. The dampers shall effectively damp out the vibration of the earthwire for the full frequency range experienced in the earthwire for spans from 200 to 450 meter and wind velocity of 0-30 km per hour. Vibration Dampers shall not be installed on 132 KV Lines

12.2 The necessary technical particulars of dampers design are as given below: -

Sl. No.	Particulars	Details
1.	Configuration	Single steel stranded earthwire at the

		peak of tower
2.	Height of cable support under every day condition above	
	a)tower	36.5 m
	b)mid span	27 m
3.	Size of cable	7/9 SWG
4.	Span length in meters	
	i) Ruling Span for design	400 m
	ii) Maximum span	450 m
	iii) Minimum span	250 m
5.	Maximum earthwire tension at 320C without external load.	
	i. Initial unloaded tension	35 % of UTS.
	ii. Final unloaded tension	25% of UTS.
6.	Nature of terrain	Centrally flat with cultivated fields
7.	If armour rods used	No
8.	Maximum permissible dynamics strain after damping	150 micro strains
9..	Minimum no of cycles for fatigue performance	10 million
10.	Amplitude for fatigue test	± 50 mm at the highest resonant frequency
11.	Slip strength of clamp	1. Not less than 250 kg. when an untested vibration demure is installed at the recommended bolt torque on the earthwire. 2. Not less than 200 kg. without retightening the bolts after concocting the Fatigue test.
12.	Max. Wind load	45 kg/m² on full projected area

12.3 The clamp of the vibration damper shall be made of permanent mould cast high strength aluminium alloy. It shall be capable of supporting the damper during installation and to prevent any damage or chafing of the earthwire during fitting

and during continued operation which would produce high electrical and mechanical stresses in normal working. If there are any chances of the clamp chafing the earthwire in service, suitable remedial devices shall be provided by the vendor free of cost.

The clamp shall have sufficient grip to maintain the damper in position on the earthwire without damaging the strands or causing premature fatigue. The groove of the clamp body and clamp cap shall be smooth, free of projections, grit or other material which could cause damage to the earthwire when the clamp is installed. Clamping bolts shall be provided with self locking nuts and designed to prevent corrosion of the threads or loosening during service.

12.4 The messenger cable of the damper shall comprise of high strength steel strength which shall be hot dip galvanised as per IS 4826. The steel strands shall be pre-formed and suitably protected against loosening of its standards in order to prevent subsequent droop of weight in service and to maintain consistent flexural stiffness of the cable while in service. The messenger cable shall be suitably and effectively sealed to prevent corrosion.

12.5 The damper mass shall be made of hot dip galvanised mild steel/ cast iron. All castings shall be free from defects such as cracks, shrinkages, inclusions and blow holes etc. The inside and outside surfaces of the damper masses shall be smooth.

The damper mass shall be fixed permanently to the messenger cable with suitable non ferrous sleeves or compound. The damper mass shall not droop more than 5 degrees from the centre of the damper. Each damper mass shall be designed so as to avoid accumulation of rain waters.

12.6 The vibration damper shall be capable of being installed and removed from energized line by means of hot line technique without completely separating components . In addition, the clamp shall be capable of being removed and reinstalled on the conductor at the design torque without damaging the fasteners and conductor surface. The damper assembly shall be electrically conductive.

12.7 The approved vendor shall give full details of the damping characteristics and energy dissipation curve of the dampers and guarantee their effectiveness for the earthwire for damping design.

12.8 The vibration damper shall also conform to IS : 9708-1980 and technical particular given hereunder:-

i) Type	Stock Bridge type 4R
ii) Materials a) Clamps b) Messenger cable c) Damper masses	 Aluminium Alloy High tensile steel of strength 140 kg/mm² (19 strands wire) H.D.G. cast Iron
iii) Mass pull off strength	500 kg.
iv) Clamp slip strength	250 kg
v) Maximum permissible dynamic strain	Less than 150 micro -strains
vi) Minimum number of cycles for fatigue performance	10 million cycles at highest resonant frequency at $\pm$ 0.5

13. ERECTION

GENERAL

The line shall be constructed on self supporting, latticed steel towers. The phase conductors shall be in triangular formation (right angle or equi-lateral triangle) in case of Single Circuit line(s) and in vertical formation in case of Double circuit lines. Earthwire shall be provided above the conductors for effective shielding. The construction details shall comply in all respects with the specifications given herein.

The towers shall be fully galvanised including stubs and cleats by hot dip galvanising. The tower members shall be fabricated using structural mild steel sections as per IS: 226/2062. Hexagonal round head galvanised M.S. bolts and nuts with flat washers of 5 mm thick shall be used for connections.

13.1 CLASSIFICATION OF TOWERS :

(a) 'A2' Type Suspension Towers:

The suspension type towers are designed with suspension strings and 2^0 line deviation with design span.

(b) 'B30' Type Tension Towers:

To be used for angle of line deviation up to 30^0 with design span and shall also be suitable for section conditions.

(c) 'C60' Type Tension Towers :

To be used for angle of line deviation up to 60^0 with design span.

(d) Dead end Towers :

Normally 'C' type towers are used as dead end towers. However, in exceptional circumstances a dead end tower may be different from 'C' type tower.

132 KV Narrow Base Tower

(a) 'NBDA' Type Suspension Towers :

The suspension type towers are designed with suspension strings and 2^0 line deviation with design span.

(b) 'NBDB' Type Tension Towers :

To be used for angle of line deviation up to 15^0 with design span and shall also be suitable for section conditions.

(c) 'NBDC' Type Tension Towers :

To be used for angle of line deviation up to 30^0 with design span.

(d) 'NBDD' Type Tension Towers :

- To be used for angle of line deviation up to 60^0 with design span.
- To be used Dead End tower.
- These towers can also be used for longer spans with reduced angle of deviation with limitations of ground clearance and wind/weight span as per tower spotting data.

13.2 SPECIAL TOWERS

13.2.1 In addition to standard towers and extensions specified, erection of special structures, if any, required for major river crossings, power line crossings very long spans etc. shall be carried out by the Contractor as a part of this contract. Details of these structures shall be made known at the time of finalisation of survey.

13.2.2 **EXTENSIONS :**

- Extensions in the towers may also be used wherever required.
- Such extension shall be used where ground clearance and inter circuit clearances are found to be inadequate.
- Tower foundations may be suitable with or without extensions depending up[on foundation design.

13.2.3 TOWER LOCATION

13.2.4 SAG TEMPLATES

The TSP shall prepare the sag template for tower spotting

13.2.5 TOWER SPOTTING

With the help of tower spotting data and approved sag templates, tower locations shall be marked on the profiles. While locating the towers on survey charts, the following points shall be borne in mind –

(a) Towers shall be located within its design parameters.

(b) Towers shall be placed at mid bisection of deviation angle.

(c) Dead end tower shall be square to the line side and may have a deviation upto 15^0 on slack span side.

(d) There shall not be any upward force on suspension towers under normal working conditions and the suspension towers shall support at least the minimum weight span as provided in the designs. In case uplift is unavoidable, it will be examined if the same can be over come by adding standard body extensions to the towers, failing which tension towers designed for the purpose shall be employed at such positions.

(e) An individual span shall be as near to the normal design span as possible. In case an individual span becomes too short with normal supports on account of undulations in ground profile, one or both line supports of the span may be extended by inserting standard body extension, designed for the purpose.

(f) The number of consecutive spans between the section points shall not exceed 15 spans. A sectional point shall be taken to comprise a tension point with a B-type or C-type tower.

(g) ROAD CROSSING

At all important road crossings, the tower shall be located in such manner that the ground clearance at the roads under maximum temperature and in still air shall be such that even with a conductor broken in adjacent span the ground clearance of the conductor from the road surface will not be less than that required under Indian Electricity Rules l956. Road crossing span shall not exceed to 250 meter.

(h) RAILWAY CROSSING

Railway crossings shall be constructed in conformity with the specifications laid down by the Railway Authorities. The angle of crossing shall be as near 90^0 as possible. The railway crossing towers shall have double tension insulator strings.

(i) POWER LINE CROSSING

Where the line under construction is to cross over another line of the same voltage or lower voltage, tower with suitable extensions shall be used. Provision to prevent the possibility of its coming into contact with the other overhead lines, shall be made in accordance with the Indian Electricity Rules, 1956.

(j) TELECOMMUNICATION LINES CROSSING

The angle of crossing between telecommunication line and power line shall be as near 90^0 as possible. However, deviation to the extent of 60^0 may be permitted under exceptionally difficult situations. When the angle of crossing has to be below 60^0 the matter will be referred to the authority in charge of the telecommunication system. Also in the crossing span, power line supports will be as near the telecommunication line as possible, to obtain increased vertical clearance between the wires.

(k) TRANSPOSITION

No transposition of the conductors shall be carried out in the line.

(l) RIVER CROSSING

Small rivers shall be crossed with normal A, B & C towers with or without extension. Major rivers may be crossed either with normal A, B, C towers with or without extension or special river crossing towers.

(m) APPROACH SPANS

On approach line towers upto 1.5 Km from the terminal structures on either end of the line, insulator strings suitable for graded insulation with arcing horns on both sides with the number of insulator discs one less then those in the normal line, suspension and tension insulator strings shall be used.

Latitude and longitude of each location of the lines shall be captured and KML file for each line shall also be prepare and submit for ready reference.

14. CONSTRUCTION OF TOWER FOUNDATION, STUB SETTING & EARTHING

Cement concrete footings shall be used for all types of towers, in conformity with the present day practice followed in the country, and specifications laid herein. RCC foundations may be used for locations where cement concrete footings are not possible to be laid. All the footings of the tower shall be similar.

14.1 FOUNDATION DEPTH

The depth of the foundation may vary from 1.5metres to 3.5 meters.

14.1.1 CLASSIFICATION OF FOUNDATION

- Depending on the type of soil, the sub-soil water table and the presence of surface water, four types of foundation will be used for each type of tower locations, classified in the following manner –

(a)	Normal dry type	To be used for location in normal dry cohesive or non-cohesive soils.
(b)	Wet type Or and	To be used for locations – i) Where sub-soil water is met at 1.5m or more below the ground line. ii) Which are in surface water for long periods with water penetration not exceeding one metre below the ground line. iii) In black cotton soils.
(c)	Partially submerged type	To be used on locations where sub-soil water table is met between 0.75 meter to 1.5 meter below the ground line.
(d)	Fully submerged type	To be used at locations where sub-soil water is met at less than 0.75 meter below the ground line.

- In addition to the above, depending on the site conditions other types of foundations may be introduced suitable for –

i) Intermediate conditions under the above classifications to effect more economy, or

ii) for locations in hilly and rocky areas.

14.2 **EARTHING**

The footing resistance of all towers shall be measured by the TSP in dry weather after their erection before the stringing of earth wire. In case the tower footing resistance exceeds 10 ohms, pipe type earthing/counterpoise earthing, wherever required shall be done in accordance with stipulation made in this contract

14.3 **PIPE EARTHING**

The grounding shall be effected by making about 300mm dia 3750mm deep pit at a distance of not less than 3650mm away from the stubs and filling in the pit with finely broken coke having the granule sizes not more than 25mm and salt in such a way that minimum cover of 125mm thick salt-mixed-coke shall be maintained from the pipe on all sides and that the top edge of the pipe shall be at least 600mm below the ground line. The GS strip shall be buried not less than 600mm from the ground line.

14.4 COUNTERPOISE EARTHING

In place of high resistivity soil, special earthing arrangement shall be employed in the form of counterpoise earth to bring down the tower footing resistance to 10 ohms. The counterpoise earth shall be composed of 7/9 SWG galvanized steel wire having suitable GS lugs soldered or compressed at its one end complete with 16mm dia bolts & nuts, required for connecting the earthing to the tower end. The counterpoise shall be buried radially away from the tower base at 600mm below ground level. The lug should preferably be buried in the chimney portion of the foundation to avoid pilferage.

14.5 STRING OF CONDUCTOR & EARTHWIRE :

14.5.1 The stringing of the conductors and earth wire shall be done in a most standard method used for such lines.

14.5.2 On certain 220KV or 132KV lines, UPPTCL may opt to use earthwire in place of OPGW.In that case TSP will be required to lay Earthwire on 132KV or 220kV towers in place of with all related hardwares.

14.5.3 The TSP shall be entirely responsible for any damage to the towers or the conductors during stringing. The damaged items shall be replaced without extra charges to the UPPTCL.

15. OPGW : TECHNICAL SPECIFICATIONS OF OPGWAND ITS ACCESSORIES

15.1 Introduction, General Information and Requirement - This section describes the technical specifications for procurement of overhead fibre optic cable (OPGW) for 220 & 132 kV SC/DC Transmission system.

15.2 Introduction

UPPTCL is constructing 220KV & 132 kV SC/DC transmission lines with ACSR Zebra/Panther. 24/48 Fibre (DWSM, G.652D) Optical Ground Wire (OPGW) cable shall be laid on these lines. The Installation, Erection, Splicing, Termination, Testing and Commissioning of OPGW cable & OFAC upto end to end connectivity shall also be carried out by the TSP.

Specifications and Functional Description

Table 2-1(a): DWSM Optical Fibre Characteristics	
Fibre Description:	Dual-Window Single-Mode
Mode Field Diameter:	8.6 to 9.5 (m (± 0.6(m)
Cladding Diameter:	125.0 (m ± 1 (m
Mode field concentricity error	0.6(m
Cladding non-circularity	
Cable Cut-off Wavelength λcc	1260 nm
1550 nm loss performance	As per G.652 D
Proof Test Level	0.69 Gpa
Attenuation Coefficient:	@ 1310 nm 0.35 dB/km @ 1550 nm 0.21 dB/km
Chromatic Dispersion; Maximum: **Zero Dispersion Wavelength:** **Zero Dispersion Slope:**	18 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339nm 5.3 ps/(nm x km) 1271-1360nm 1300 to 1324nm 0.092 ps/(nm2xkm) maximum
Polarization mode dispersion coefficient	0.2 ps/km^½
Temperature Dependence:	Induced attenuation 0.05 dB (-60C - +85C)
Bend Performance:	@ 1310 nm (75±2 mm dia Mandrel), 100 turns;

	Attenuation Rise 0.05 dB/km @ 1550 nm (75±2 mm dia Mandrel), 100 turns; Attenuation Rise 0.10 dB/km @ 1550 nm (32±0.5 mm dia Mandrel, 1 turn; Attenuation Rise 0.50 dB/km

The size of OPGW shall be selected such that max tension and sag at specified temperature and wind condition remain within the limits indicated below:

S. No.	Parameter	For 47 m/sec Wind Zone
1.	Basic Span	380 m
2.	Wind Pressure	189.64 kg/sq-m
3.	Overall Diameter	0.011010 m
4.	Unit Weight	0.583 kg/m
5.	Ultimate Tensile Strength	7030 kg
6.	Tension at 32° C & Full wind	3200 kg
7.	Sag at 53° C & no wind	9.507 m
8.	Sag at 0° C & no wind	7.745 m

The above cases shall be considered for the spans from 100 m to 600 m in the range of 50 m spans. The full wind load shall be considered as the design wind load for all the specified transmission lines as per relevant IS 802 version and the sag-tension chart shall be submitted considering the transmission lines.

16. <u>Electrical and Mechanical Requirements</u>

Table 2-2(a) provides OPGW Electrical and Mechanical Requirements for the minimum performance characteristics. For the purposes of determining the appropriate Max Working Tension limit for the OPGW cable IS 802:1995 and IS 875: 1987 shall be applied. However the OPGW installation sag & tension charts shall be based on IS 802 version to which the line is originally designed. For the OPGW cable design selection and preparation of sag tension charts, the limits specified in clause 2.1.2.5 shall also be satisfied. The Bidder shall submit sag-tension charts for the above cases with their bids.

Table 2.2(a) : OPGW Electrical and Mechanical Requirements		
(1)	Everyday Tension	20% of UTS of OPGW
(2)	D.C. Resistance at 20C:	< 1.0 ohm/Km
(3)	Short Circuit Current:	6.32 kA for 1.0 second

TECHNICAL PARTICULARS OF CONDUCTOR AND EARTHWIRE

Technical particular of Conductor

S N	Code Name	Zebra	Panther
1	Copper Equivalent Area mm sq.	260	130
2	Total area mm sq.	484.5	261.30
3	No. of Strands	61	37
4	Stranding & wire diameter (mm) Aluminium (mm) Steel (mm)	 54/3.18 7/3.18	 30/3.00 7/3.00
5	Overall dia (mm)	28.62	21.00
6	Ultimate tensile strength (KN)	130.32	89.67
7	Conductor per phase	Single	Single
8	Weight (Kg/km)	1623	974
9	Final modulus of elasticity GN/mm2	69	80
10	Coff. Of linear expansion (0C)	19.3X10-6	17.8X10-6

Technical particular of Earthwire

SN	Code Name	7/9 SWG	7/10 SWG
1	Type (Galvanized steel)	95 kg/mm2	95 kg/mm2
3	No. of Strands	7	7
4	Stranding /diameter (mm) Steel (mm)	 7/3.66	 7/3.25
5	Overall dia (mm)	10.98	9.75
6	Ultimate tensile strength (Kg)	7030	5510
7	Weight (Kg/km)	580.5	460
8	Coff. Of linear expansion (0C)	11.5X10-6	11.5X10-6

TECHNICAL PARTICULARS OF INSULATOR STRING (FOR 132 KV LINES)

SN	String particular	Electro-mech strength(KN)	Weight of each disc (kgs)	Size of brown glazes insulator disc(kgs)
1	9 unit single suspension string	70	5.25	280X145
2	2X9 unit Double suspension string	70	5.25	280X145
3	10 unit single tension string	120	9.00	280X145
4	2X 10 unit double tension string	120	9.00	280X145

SPECIFIC TECHNICAL REQUIREMNETS FOR 220/132/33 kV AIS SUBSTATION

1. GENERAL TECHNICAL REQUIREMENTS OF SPECIFICATIONS

	SYSTEM PARTICULARS			
(i)	Rated System voltage		245KV, 145KV, 36KV	
(ii)	System frequency & Number of phases		50 Hz, This may vary by ± 5% & Three	
(iii)	Neutral		Effectively Earthed	
(iv)	Auxiliary power supply:-		245KV, 145KV, 36KV	
	Auxiliary electrical equipment shall be suitable for operation on the following supply system.			
	(a)	Power device(Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.	
	(b)	Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.	
	(c)	DC alarm, Control and Protective	2wire ungrounded DC supplies	
		Devices from sub station batteries as under		
			220/132KV S/S : 110V DC	
			Communication equipment : 48 V DC	
	The above supply voltage is subject to variation as follows :			
	All devices must be suitable for a continuous operation over the entire range of voltage variations :			
	(i)	AC	Voltage may vary by ± 10%.	
			Frequency by ± 5%	
			Combined Voltage & frequency by ±10%.	
	(ii)	DC		
		a)	220 V may vary between 187& 242 V	
		b)	110 V may vary between 93 & 121 V	
		c)	48 V may vary between 41 & 53 V	
	SYSTEM PARAMETERS: The following system parameters shall prevail.			
	Nominal system voltage	**220KV**	**132 kV**	**33 kV**

	SYSTEM PARTICULARS			
	Nominal system voltage	**220KV**	**132 kV**	**33 kV**
	Highest system & Frequency	245KV & 50Hz	145 Kv & 50Hz	36 kV & 50Hz
	Rated short time current	40KA for 3 Sec.	31.5 kA for 3 sec	25 kA for 3 sec
	Dry and wet one minute power frequency withstand voltage	460KV	275 kV	95 kV
	Dry and wet impulse withstand voltage positive and negative	1050KVp	650 kVp	250 kVp
	System Earthing	Effectively Earthed	Effectively Earthed	Un- effectively

General criteria for using the conductors at 220/132/33 KV substations is as under:

S. No.	**Bus/ Feeder**	**220kV Switch yard**	**132kV Switch yard**	**33kV Switch yard**
1	Main Bus	Tarantulla	Tarantulla	Tarantulla
2	Transfer Bus/Auxiliary bus	Zebra	Zebra	Zebra
3	Jack Bus/Jumpers/Equipment Interconnection for			
A	Feeder	Zebra	zebra	2x Panther
B	160 MVA T/F	zebra	tarantula	
C	60 MVA T/F	Zebra	-	2x Zebra
D	40 MVA T/F		zebra	2x Zebra
E	TBC	Zebra	Zebra	Zebra
Sizes (Diameter in mm) for various conductors are as follows :				
	Moose -	31.775	Panther -	21.00
	Zebra -	28.575	Tarantulla -	36.61

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

All types of boxes, cabinets etc. shall generally conform to in accordance with IS-5039/ IS-8623, IEC-439, as applicable.

Control cabinets, junction boxes, marshalling boxes & terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braces to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box, the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

3. EARTHING

Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire/ strip shall be terminated on to the earthing pad and secured by the use of self etching washer. Earthing of hinged door shall be done by using a separate earth wire.

4. TECHNICAL SPECIFICATION FOR 250 KVA 33/0.4 kV CLASS POWER TRANSFORMERS

The materials shall conform in all respects to the relevant Indian Standard Specifications with latest amendments indicated below:

Indian Standard	Title	International & Internationally Recognized Standard
ISS – 2026	Specification for Power Transformer	IEC 76
ISS – 3347/1967	Specification for Transformer's Porcelain Bushings	DIN 42531,2,3
ISS – 335	Specification for Transformer Oil	BS 148, IEC 296
IS-4237	General requirement for switch-gear & control gear for voltages not exceeding 1000 V.	
ISS-6600/1972	Guide for Loading of Oil immersed transformers	IEC 76
ISS – 1271	Insulating Material	
ISS-2099/1973	Specification for high voltage Porcelain	BS 148

	Bushings.	IEC 36 A
ISS-2393/1980	Cylindrical pins	
ISS-2633/1986	Methods of testing uniformity of zinc coated articles	
ISS – 5	Colours of Ready Mixed Paints.	

Equipment conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would also be acceptable. In case the Bidder who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translations shall be furnished alongwith the offer.

Principal Parameters

The transformer shall be suitable for outdoor installation with three phase, 50 Hz, conventional type copper wound distribution transformer ,Core type, Oil immersed and naturally cooled (Type ON), 33 kV system in which Neutral is effectively earthed and they should be suitable for service under fluctuation in supply voltage from +10% to – 15%. The transformer shall conform to the following specific parameters.

1. Continuous rated capacity	250 kVA
2. Rated Voltage HV	33 kV
3. Rated Voltage LV	0.4 kV
4. Frequency	50 Hz ±5%
5. No. of phase	Three
6. Method of connection HV	Delta
LV	Star
7. Vector Group	Dyll
8. Type of cooling	ONAN
9. Percentage impedance voltage on normal tap on kVA base corresponding to HV/LV rating and applicable tolerance as per ISS .	% impedance
(a) For 250 kVA (Tolerance ± 10%)	4.75%
10. Permissible temperature rise over ambient.	
i. of top oil measured by thermometer.	40 deg. C.

ii. of winding measured by resistance	50 deg. C
11. Tap changing gear	
i. Type	Off Load
ii. Provided on	HV winding
iii. Tap range	-5% to + 10%
iv. Tap steps	2.5%
12. Insulation Levels for windings	33 kV
a) 1.2/50 micro second wave shape impulse withstand (kVp)	170
b) Power frequency withstand voltage (kV rms)	70
c) Maximum continuous operating system voltage (kV rms)	36
13. Bushings	
(i) Voltage rating (amps)	36
(ii) Current rating (amps)	As per required
(iii) Insulation Level	
(a) Lightening impulse withstand (kVp)	170
(b) One minute power frequency withstand voltage (kV rms)	70

5. TECHNICAL SPECIFICATION OF 245KV &145 KV SF6 CIRCUIT BREAKERS

Standard	Title
IEC 62271-100 and IS-13118	Specification for alternating current circuit Breakers.
IEC – 376	Specification for acceptance of new supply of SF6.
IEC – 137	Bushing for A.C. Voltage.
IEC – 71	Electrical Clearances.
IEC – 694	Common clause for high voltage switch gear and control gear standard.
IS – 2147	Degree of Protection Provided for enclosures for low voltage switch gear and control gear.
IS – 2516	Specification for circuit Breaker

IS – 5578 & 11353	Making and arrangement for switch gear bus bar, Main Connections and auxiliary wiring.
IS – 2629	Recommended Practice for hot dip galvanizing of iron and steel.
IS – 2099	High voltage Porcelain bushings.
IS – 4379	Identification of the contents of Industrial Gas Cylinders.
IS – 7285	Seamless high carbon steel cylinders for permanent and high pressure liquefiable gas.

PRINCIPAL PARAMETERS

FOR 245 kV SF6 Circuit Breakers	
Rated nominal system voltage	220KV
Rated voltage	245KV
Rating of C.B.	MVA
Rated frequency	50 Hz
System neutral earthing	Effectively earthed
Type of C.B.	SF 6
No. of poles	3 – (pole operated)
Installation	Outdoor
Rated normal current	3150 Amp.
Rated short circuit breaking	RMS value of A.C. component current of the rated short circuit breaking current 40 kA for 3 Sec.
	D.C. component as per IEC-62210
Rated duration of short circuit	3 Sec.
Transient frequency voltage	The rated transient recovery voltage of the breaker shall be used on 4 parameter method as defined in IEC 62210
Terminal faults	1st pole of clear factor 1.3 value of 4 parameter as per IEC62210
Short line fault	As per IEC
Rated short circuit making capacity (peak)	100 kA
Operation duly cycle	0-t-co-t1 -co

FOR 245 kV SF6 Circuit Breakers	
	t = 0.3 Sec.
	t1 = 3 min.
Total breaking time	3 cycles
1.2/50 microsecond lightning impulse withstand voltage to earth	1050 KV (min.)
One minute power frequency dry withstand voltage to earth	460 KV (RMS)
Temperature rise	Final Steady State Temperature rise of current carrying part shall not exceed the limits specified in IEC 62210 with a site reference ambient temperature of 500C
Operating mechanism	Spring/Electro pneumatic.
Type of tripping	Trip free
Number of auxiliary contacts	12 Nos NO. and 12 Nos NC
No. of trip coils	2 Nos.
No. of closing coils	1 No.
Breaking line charging current	125 Amps. at 245KV
Interrupting capacity in KA for kilometric faults	40 KA (RMS)
Arcing time (at 100% interruption capacity)	25 milliseconds.
Minimum dead time	300 milliseconds.
No. of break per phase	One
Tripping and closing control circuit voltage	110 V.DC
First pole to clear factor	1.3
FOR 145 kV SF6 Circuit Breakers	
Rated nominal system voltage	132KV
Rated voltage	145KV
Rating of C.B.	7900 MVA
Rated frequency	50 Hz
System neutral earthing	Effectively earthed

FOR 245 kV SF6 Circuit Breakers	
Type of C.B.	SF 6
No. of poles	3 – (gang operated)
Installation	Outdoor
Rated normal current	1250 Amp.
Rated short circuit breaking	RMS value of A.C. component current of the rated short circuit breaking current 31.5KV for 3 Sec.
	D.C.component as per IEC-62271 – 100
Rated duration of short circuit	3 Sec.
Transient frequency voltage	The rated transient recovery voltage of the breaker shall be used on 4 parameters method as defined in IEC 62271-100
Terminal faults	1st pole of clear factor 1.5 value of 4 parameter as per IEC62210
Short line fault	As per IEC
Rated short circuit making capacity (peak)	80 KA
Operation duly cycle	0-t-co-t1 -co
	t = 0.3 Sec.
	t1 = 3 min.
Total breaking time	3 cycles
1.2/50 microsecond lightning impulse withstand voltage to earth	650 KV (min.)
One minute power frequency dry withstand voltage to earth	275 KV (RMS)
Temperature rise	Final Steady State Temperature rise of current carrying part shall not exceed the limits specified in IEC 62271-100 with a site reference ambient temperature of 500C
Operating mechanism	Mechanical spring/Electro pneumatic.

FOR 245 kV SF6 Circuit Breakers	
Type of tripping	Trip free
Number of auxiliary contacts	12 Nos NO. and 12 Nos NC
No. of trip coils	2 Nos.
No. of closing coils	1 No.
Breaking line charging current	50 Amps. at 145KV
Interrupting capacity in KA for kilometric faults	31.5 KA (RMS)
Arcing time (at 100% interruption capacity)	25 milliseconds.
Minimum dead time	300 milliseconds.
No. of break per phase	One
Tripping and closing control circuit voltage	110 V.DC
AUTOMATIC RAPID RECLOSING	
The operating duty of the circuit breaker shall be "O-Dead Time-CO-Re-closing Time-CO" in accordance with latest edition of IEC-62271-100. The values of dead time and reclaiming time shall be 0.3 second and 3 min. respectively.	

6. TECHNICAL SPECIFICATIONS OF 36 KV VACUUM CIRCUIT BREAKERS

STANDARD

The 36KV Vacuum circuit breaker shall comply with the requirements of latest issue of **IEC-62210** except where specified otherwise in this specification. Equipment having better quality than the standards mentioned may also be considered provided documentary evidences are furnished.

	PRINCIPLE PARAMETERS	
	The 36KV Vacuum circuit breaker shall be suitable for outdoor operation in solidly grounded system under climatic conditions specified and should have the following ratings:-	
i)	Nominal system voltage	33 KV
ii)	Highest system voltage	36 KV

iii)	Rates voltage	36 KV
iv)	Interrupting capacity	1000 KVA
v)	Rated normal current	1250 A
vi)	Rated frequency	50 c/s
vii)	Rated basic insulation level	170 KV
viii)	Rated short circuit current	25 KA
ix)	Rated short circuit making current	35 KA
x)	Rated operating sequence	0-0. 3 Sec.-Co-3 min-Co
xi)	Total break time for any current up to the rated breaking current	5-6 c/s
xii)	Control circuit voltage	110 VDC

GENERAL

The Vacuum circuit breakers shall provide for rapid and smooth interruption of current under all conditions, completely suppressing all undesirable phenomenons, even under the most severe conditions or while interrupting small currents, loading or logging reactive currents. The rate of rise of restriking voltage across the circuit breaker, switching on inductive or capacitive load, should not exceed 2,5 times the normal phase to neutral voltage. The total break time for the circuit breaker throughout the range of their operating duly shall be stated in the Bid and guaranteed particulars of the breaker.

7. **TECHNICAL SPECIFICATION OF 245 KV/145KV/36KV CURRENT TRANSFORMERS**

1.0	STANDARDS :		
1.1	Except as modified in this specification, the Current Transformers and accessories shall be in accordance with the latest editions of the following standards :-		
1.	IEC Publication 185		Current Transformers
2.	Draft Supplement to IEC publication 185 (1966)		CTs for protection system for which transient performance is significant.
3.	IS:2705 (Part-I to IV) 1991 & IEC 60444-1		Specification for CTs.

4.	IS : 2099		High voltage porcelain bushing.
5.	IS : 3347		Dimension for porcelain T/F
6.	IEC : 60-1973		High voltage test techniques.
7.	IS : 335		Insulating oil for T/F and switchgear.
8.	IS : 3202		Code of practice : climate proofing of electrical equipment.
9.	IEC-270-1968		Partial discharge measure-ment.
10.	IEC-44(4)-1980		Instrument transformers measurement of partial discharge.

TYPE & RATING :

The CTs should be of the outdoor type, single phase, 50 c/s, oil immersed, self cooled, hermetically sealed, suitable for operation in humid atmosphere in the tropical sun with climatic conditions as indicated in Clause 4.0 of General Technical Requirements. The CTs should also be suitable for use in area subject to heavy lightning storms.

The CTs shall comply with requirements indicted below :-

S. No.	Particulars	245 KV CTs	145 KV CTs	36 KV CTs
1.	Nominal system voltage	220 KV (r.m.s.)	132 KV (r.m.s.)	33 KV(r.m.s.)
2.	Highest system voltage	245 KV (r.m.s.)	145 KV (r.m.s.)	36 KV(r.m.s.)
3.	Frequency	50 Hz	50 Hz	50 Hz
4.	Earthing of system	Effective	Effective	Effective
5.	Insulation level (BIL)	1050 KV (peak)	650 KV (peak)	170 KV (peak)
6.	Transformation ratio	1000/800/500/ 300/1A	800- 500/1A (For160MVA T/F) 400-200-100/1A (For 40 MVA T/F) 800-400-200/1A (For Feeders)	400-200/1A (For Feeders) Two cores. 800-400/1A(For T/F) Three cores.

S. No.	Particulars	245 KV CTs	145 KV CTs	36 KV CTs
7.	No. of cores	Five	Three	Two /Three
8.	Short time current rating (Corresponding to 6500 MVA-fault level)	40 KA for 3 sec.	31.5 KA for 3 sec.	25 KA for 3 sec.
9.	Creepage distance of bushing.	6125 mm (min.)	3625 mm (min.)	900 mm (min)
10.	Ratio selection	Primary reconnection & Secondary tapings.	Primary reconnection & secondary tapings	Primary reconnection & secondary tapings.
11.	Continuous primary current	120% of rated primary current.	125% of rated Primary current.	120% of rated primary current.
12.	Short time primary current.	Twice rated current.	Twice the rated current.	Twice the rated current.
13.	Continuous secondary current rating.	120%	2 Amps.	2 Amps. (min.)
14.	Rated withstand dynamic current (2.5) times of short time current rating.	100 KA (peak)	78.5 KA (peak)	62.5 KA (Peak)
15.	One minute power frequency withstand voltage (KV)	460 KV	275 KV	70 KV

245 KV C.T. REQUIREMENT

Core No.	Application	Current Ratio (A/A)	Output Burden (VA)	Accuracy Class	Values at Maximum Tap		
					Min. Knee point Voltage (Volts)	Max. Exciting current (mA)	Max. CT Secondary winding Resistance (Ohms)
1	2	3	4	5	6	7	8
I	Transformer Diff. I/ Distance Protection Main-I	1000-800-500-300/1	-	PS	1100	80	5 Ω
II	Transformer Diff.II /Distance protection Main-II	- do -	-	PS	1100	80	5 Ω
III	Metering*	- do -	30 VA	0.2	-	-	-
IV	Bus Bar Diff. Main	- do -	-	PS	1100	80	5 Ω
V	Bus Bar Diff.	- do -	-	PS	1100	80	5 Ω

**** Instrument Security Factor for Metering Core should not exceed 5.***

145 KV C.Ts REQUIREMENTS

TYPE- A (For 132 kV Feeders)

Core No.	Application	Current Ratio (A/A)	Output Burden (VA)	Accuracy Class as per IEC-185	Minimum Knee point Voltage (Volts)	Max.Exciting current at half knee point voltage (mA)	Maximum CT secondary winding Resistance at 75 deg C (Ohms)
	Distance Protection	800/1	-	PS	1100	20 at VK/2	5 Ω
		400 /1	-	PS	1100	20 at VK/2	5 Ω

		200/1	-	PS	550	40 at VK/2	2.5Ω
	Over Current & E/F Protection	800/1	-	PS	1100	20 at VK/2	5 Ω
		400 /1	-	PS	1100	20 at VK/2	5 Ω
		200/1	-	PS	550	40 at VK/2	2.5Ω
	Metering*	800/1	20	0.2	-	-	-
		400/1	20	0.2	-	-	-
		200/ 1	20	0.2	-	-	-

* Instrument Security Factor for Metering Core should not exceed 5.

TYPE- B (For 132 kV side of 160 MVA 220/132 kV Transformers)

1	2	3	4	5	6	7	8
I	Differential Protection	800-500/1	-	PS	1100	20 at VK	5 Ω
II	Over Current & E/F	800-500/1	-	PS	1100	20 at VK	5 Ω
III	Metering*	800-500/1	20 VA	0.2	-	-	-

TYPE- C (For 132 kV side of 40 MVA 132/33kV kV Transformers)

	2	3		5	6	7	8
I	Differential Protection	400/1	-	PS	1100	20 at VK/2	5 Ω
		200 /1	-	PS	550	40 at VK/2	2.5 Ω
		100/1	-	PS	550	40 at VK/2	2.5Ω
II	Over Current & E/F Protn.	400/1	-	PS	1100	20 VK/2	5 Ω
		200 /1	-	PS	550	40 VK/2	2.5 Ω
		100/1	-	PS	550	40 VK/2	2.5 Ω
III	Metering*	400/1	20	0.2	-	-	-
		200/1	20	0.2	-	-	-
		100/ 1	20	0.2	-	-	-

* *Instrument Security Factor for Metering Core should not exceed 5.*

36 KV C.T. REQUIREMENTS

TYPE- A (For 40 MVA Transformers)

1	2	3	4	5	6	7	8
I	Metering*	800/1	10	0.2	-	-	-
		400/1	10	0.2	-	-	-
II	Protection	800/1	-	PS	400	30	4 Ω
		400 /1	-	PS	400	30	4 Ω
III	Protection	800/1	-	PS	400	30	4 Ω
		400 /1	-	PS	400	30	4 Ω

TYPE- B (For 33 kV Feeders)

1	2	3	4	5	6	7	8
I	Metering*	400/1	10	0.2	-	-	-
		200/1	10	0.2	-	-	-
II	Protection	400/1	20	5P10	-	-	-
		200 /1	20	5P10	-	-	-

* *Instrument Security Factor for Metering Core should not exceed 5.*

8. TECHNICAL SPECIFICATION OF 245 KV CAPACITOR VOLTAGE TRANSFORMERS

STANDARDS:

Unless otherwise specified elsewhere in this specification, the rating as well as performance and testing of the 245 KV Capacitor Voltage Transformers along with associated accessories shall conform but not limited to the latest issues/amendments of standards available at the time of placement of order of all the relevant standards as listed hereunder.

Sl. No.	**Standard No.**	**Title**
1.	IS: 3156 (part IV)	Capacitor Voltage Transformers
2.	IS: 2099	High voltage porcelain Bushings
3.	IS: 2071	Method of High voltage testing

Sl. No.	Standard No.	Title
4.	IS: 335	Insulating oil for transformers and switching
5.	IS: 2165	Insulation Co-ordination for equipment of 100 kV and above.
6.	IEC-186	Voltage Transformers:Chapter-III Capacitor Voltage Transformers: Chapter-IV
7.	IEC-186A	First supplement to IEC Publication:186
8.	IEC-270	Partial Discharge Measurement.
9.	IEC-171	Insulation co-ordination
10.	IEC-358	Coupling capacitor divider.
11.	IEC-60	High Voltage Testing Techniques.
12.	IS: 9348	Coupling capacitors and capacitor dividers.

PRINCIPAL TECHNICAL PARAMETERS

8.1 The Voltage Transformers shall conform to the following specific parameters:

S. No	Parameters	Specification
1	2	3
1.	Type of installation	Single Phase, Oil filled hermetically sealed and outdoor types
2.	Type of mounting	Pedestal type
3.	Suitable for system frequency	50 Hz ± 5%
4.	Highest system Voltage	245 Kv
	Transformation ratio on all windings	$\frac{220,000}{\sqrt{3}} / \frac{110}{\sqrt{3}}$
6.	Method of earthing	Effectively earthed
7.	1.2/50 micro second lightning impulse withstand voltage kV (peak)	1050
8.	1 minute dry power frequency withstand voltage kV (rms)	460
9.	Min. Creepage Distance mm.	6125
10.	Radio interference Voltage at 266 kV	Not exceeding 500 micro volts

9. REQUIREMENT OF 245 KV CVT

S. No.	DETAILS	PARTICULARS		
1.	Transformation ratio on all windings	220,000 / 110 √3 √3 (No. of secondary windings 3)		
2.	Supply frequency	50 Hz.		
3.	Type	Capacitor voltage type.		
4.	Rated voltage factor	1.2 continuous 1.5 for 30 seconds.		
5.	Application	Winding I Protection	Winding II Protection	Winding III Metering/Synchro.
6.	Accuracy	3P	3P	0.2
7.	Phase angle error	--------- As per IS ----------		
8.	Output burden	150 VA	150 VA	50 VA
9.	Rated capacitance	4400 + 10% - 5%		
10.	Rated total thermal burden	750 VA		
11.	Standard reference range of frequency for which the accuracies are valid.	97% to 103% for protection & 99% to 101% for measurement.		
12. a)	One minute power frequency test on secondary winding.	3 KV (r.m.s.)		
b)	Withstand voltage between low voltage terminal and earth terminal	4 KV (r.m.s.)		
(Note : This test voltage shall be 10 KV (r.m.s.) in the low voltage terminal exposed to weather).				
c)	Radio interference voltage of 266 KV (r.m.s.)	Not exceeding 500 microvolts.		
13.	Corona extinction voltage.	320 KV (r.m.s.)		

S. No.	DETAILS	PARTICULARS
15.	Partial discharge level at rated voltage for capacitor divider.	Less than 10 pico coulombs

10. TECHNICAL SPECIFICATION OF 145 KV POTENTIAL TRANSFORMERS

STANDARDS :

Unless otherwise specified elsewhere in this specification, the rating as well as performance and testing of the 145 KV Potential Transformers along with associated accessories shall conform but not limited to the latest issues/ amendments of standards available at the time of placement of order of all the relevant standards as listed hereunder.

Standard No.	**Title**
IS:3156:1992) Transformers	Specification for Voltage (Part I to III) & IEC 186: 1987
IS:2099	Specification for High Voltage porcelain bushing
IS:335	Specification for Insulating oil for T/F & Switchgear
IS:3202	Code of practice: climate proofing of Electrical equipment
IS:4146: 1983	Application Guide for Voltage Transformers.
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel.

PRINCIPAL TECHNICAL PARAMETERS

The Potential Transformers shall conform to the following specific parameters:

Parameters	Specification 145 kV
Type of installation	Single phase, Oil immersed, self cooled, Hermetically sealed, Outdoor type.
Type of mounting	Mounting on steel structures
Suitable for system frequency	50 Hz ± 5%
Highest system voltage	145 kV
Transformation ratio on all windings	132,000 / 110 √3 / √3
Method of earthing	Solidly Grounded

Parameters	Specification 145 kV
1.2/50 micro second lightning impulse withstand voltage kV (peak)	650
1 minute dry power frequency withstand voltage kV (rms)	275
One minute power frequency withstand voltage on secondary	3 kV
Min. Creepage Distance mm.	3625
Voltage ratios and other requirements of the Voltage Transformers shall comply with the requirement indicated in Annexure-I (B) for 145kV PTs respectively.	
Maximum permissible temperature rise of windings of voltage transformers shall be 45 ^{0}C over an ambient of 50^{0}C.	

REQUIREMENT OF 145 KV PT

S. No.	DETAILS	PARTICULARS		
1.	Transformation ratio on all windings	132,000 / 110 √3 √3 (No. of secondary windings 3)		
2.	Supply frequency	50 Hz.		
3.	Type	Single phase, Oil immersed, self cooled, Hermetically sealed, Outdoor type.		
4.	Rated voltage factor	1.2 continuous and 1.5 for 30 seconds.		
5.	Application	Winding I Protection	Winding II Protection	Winding III Metering
6.	Accuracy	3P	3P	0.2 Note : Acc. of 0.2 to be maintained up to and including a total simultaneous burden of 100 VA on all the windings.
7.	Phase angle error	As per relevant IS		

S. No.	DETAILS	PARTICULARS		
8.	Output burden	50 VA	50 VA	50 VA
9.	Creepage distance of bushing	3625 mm (minimum).		
10.	Total simultaneous burden	100 VA		
11.	One minute power frequency withstand voltage on secondary.	3 KV (r.m.s.)		
12.	Rated Power Factor	0.8		
13.	Class of insulation in windings	A		

11. TECHNICAL SPECIFICATION OF 36KV POTENTIAL TRANSFORMERS

SCOPE :

This Specification covers the design, manufacture, assembling, testing at manufacturers' works, supply and delivery of single phase Potential Transformers with terminal connectors and junction boxes for service in 33 KV, three phase system.

Type & Rating :

The potential transformers shall be outdoor type, single phase, oil immersed, self cooled, suitable for operation on three phase, 50 c/s, 33 KV Solidly Grounded system where the short circuit level of the system is of the order of 1000 MVA under the tropical climate conditions specified under General Requirement of Specification.

The potential transformers should have the following ratings:-

1. Rated Voltage	33 KV
2. Nominal System Voltage	33 KV
3. Highest System Voltage	36 KV
4. Type of Supply	3- Phase A.C.
5. Frequency	50 Cycles/sec.
6. Earthing	Solidly Grounded
7. No. of Secondary Windings	Two
8. Transformation Ratio:	Winding – I & II 33 KV/√3 / 110 Volt/√3
9. Rated Burden:	

Winding – I	50 VA each
Winding –II	50 VA each
10. Accuracy Class:	
Winding – I	0.2 for metering
Winding – II	3P for protection
11. Basic Insulation Level (Impulse)	170 KV (Peak)
12. Creepage distance	900 mm (minimum)
13. Rated Voltage Factor:	
	(a) Continuous 1.1
	(b) 30 seconds 1.5
14. Service Conditions	Outdoor, direct in Sun service.
STANDARDS:	
The potential transformers should confirm in all respects to latest edition of ISS: 3156/1965 except wherein specified otherwise.	
1. Rated Voltage	33 KV
2. Nominal System Voltage	33 KV
3. Highest System Voltage	36 KV
4. Type of Supply	3- Phase A.C.
5. Frequency	50 Cycles/sec.
6. Earthing	Solidly Grounded
7. No. of Secondary Windings	Two
8. Transformation Ratio:	Winding – I & II 33 KV/√3 / 110 Volt/√3

REQUIREMENT OF 36 KV PT

S. No.	DETAILS	PARTICULARS	
1.	Transformation ratio on all windings	33,000 / 110 √3 √3 (No. of secondary windings 2)	
2.	Supply frequency	50 Hz.	
3.	Type	Single Phase wound electromagnetic type PT	
4.	Rated voltage factor	1.1 continuous 1.5 for 30 seconds.	
5.	Application	Winding I Metering	Winding II Protection
6.	Accuracy	0.20 Note : Acc of 0.2 to be maintained up to and including a total simultaneous burden of	3P

		75 VA on all the three windings.	
7.	Phase angle error	As per relevant IS	
8.	Output burden	50 VA	50 VA
9.	Total simultaneous burden	75 VA	
10.	One minute power frequency withstand voltage on secondary.	3 KV (r.m.s.)	
11.	Rated Power Factor	0.8	
12.	Class of insulation in windings	A	
13.	Method connection which will be adopted		
	-Primary winding	Star/earthed	
	-Secondary winding I	Star/earthed	
	-Secondary winding II	Open delta	

12. TECHNICAL SPECIFICATION FOR 245 AND 145 KV MOTOR OPERATED ISOLATORS

STANDARDS

The Isolators shall conform to the latest revisions with amendments available of relevant standards, rules and codes, some of which are listed herein for ready reference.

Sl. No.	Standard	Title
1.	IEC-168	Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 100
2.	IEC-129	Alternating Current disconnectors and earthing switches.
3.	IS-1818	Specification for alternating current isolators (disconnectors) and earthing switches.
4.	IS-9921	Specification for outdoor air break isolators and earthing switches for voltages up to 220 kV.
5.	IS-5561	Electrical power connectors
6.	IS-325	Specification for three phase induction motors.
7.	IS-3202	Code of practice for climate proofing of electrical equipment
8.	IS-2544	Specification for porcelain post insulators (3.3 kV and above)

TECHNICAL SPECIFICATIONS FOR 36 kV ISOLATORS

1.0	**TYPE OF ISOLATORS**	
	a) Three phase, 1250 A, 36 kV manually operated, Standard isolators without earth switch.	
	b) Three phase, 1250 A, 36 kV manually operated, Standard isolators with one earth switch.	
2.0	**PRINCIPAL PARAMETERS**	
Sl. No.	**DETAILS**	**36 kV Isolator**
1	Rated Voltage	36 kV
2	System frequency	50 Hz
3	System Earthing	Effectively earthed
4	Type of Isolator	Outdoor, Horizontal air break suitable for upright mounting
5	Continuous current rating	1250 A
6	Operating mechanism	Manual
7	Phase to phase spacing	1500 mm
8	Rated short time withstand current	25 kA (rms)
9	Rated peak short circuit current	62.5 kA (peak)
10	Temperature rise	As per IEC-129 derated for an ambient of 500C
11	Seismic co-efficient	0.3 g.
12.	1.2/50 microsecond full wave positive and negative impulse withstand voltage to earth	70 kV (peak)
13.	One minute power frequency withstand voltage dry & wet to earth	70 kV (rms)
14.	Auxiliary Contacts	4 normally open and 4 normally closed.
15	Insulation level of insulators	
	i) Impulse voltage withstand test (1.2/50 micro second full wave)	170 kV (peak)

	ii) Power frequency withstand voltage to earth (dry & wet)	70 kV (rms)
16	Creepage distance of insulators :	
	i) Total	900 mm
	ii) Protected	450 mm
17	Minimum strength :	Suitable to withstand wind, short circuit and operating forces
	i) Torsional	
	ii) Cantilever	
18	Interlocks with circuit breaker	1 set of electrical and castel type interlocks.
19	Type of contacts	Hard drawn electrolytic copper with silver plating
20	Conductor take off	Horizontal/vertical according to actual requirement.
21.	Phase-to phase clearance	1500 mm

TECHNICAL SPECIFICATION FOR 245/145/36KV SOLID CORE POST INSULATORS

STANDARDS `

Insulators should conform to the latest publications of IS 2544 & IEC in all respects except BIL which should be 1050Kvpfor 245 kV, and 650 kVp for 145 kV withstand. Equipment meeting any other authoritative standards which ensures equal or better quality than the IS mentioned above, is also acceptable.

REQUIREMENT FOR INSULATORS

FOR 245 AND 145 KV POST INSULATORS			
Nominal voltage		245 KV	145 kV
Highest system voltage		245 KV	145 kV
Sytem frequency		50Hz.	50 Hz.
Number of phases		3 (Three)	3 (Three)
Neutral		Effectively earthed	Effectively earthed
Short circuit current		40.0 KA	31.5 KA

Phase to phase spacing		4.5 meters	3.0 meters
Height of the insulator support structure.	:	2750 mm.	2750 mm
PCD of Top Flange	:	127 mm.	127 mm
PCD of Bottom Flange	:	184 + .2 mm.	184+ .2 mm
BIL	:	1050 KV	650 mm
Height of insulator	:	2300.00mm	1500 mm
FOR 36 KV POST INSULATORS			
Nominal voltage	:	36 KV	
Highest system voltage	:	36 KV	
Sytem frequency	:	50Hz.	
Number of phases	:	3 (Three)	
Neutral	:	Effectively earthed.	
Short circuit current	:	25.0 KA	
Phase to phase spacing	:	1.5 meters	
Height of the insulator support structure.	:	2750 mm.	
PCD of Top Flange	:	127 mm.	
BIL	:	250 KV	
Height of insulator	:	508.00 mm	

13. TECHNICAL SPECIFICATIONS OF 198 KV/120 KV/30 KV 10KA METAL OXIDE GAPLESS SURGE ARRESTERS

STANDARDS

The Lightning Arrester shall conform to the latest revision with amendments available of the relevant standards, rules and codes some of which are listed herein for ready reference:

Sl. No.	**Standard**	**Title**
1.	IEC 99 – 4	Specification Part – 4 for Lightning Arrester without gap for AC system
2.	IS: 3070	Specification for lightning Arrester for alternating current

Sl. No.	Standard	Title		
		system Part		
3.	IS: 2629	Recommended Practice for hot dip galvanizing of iron and steel		
4.	IS: 2633	Method for testing uniformity of coating on Zinc coated articles		
5.	IS: 5621	Specification for large hollow porcelain for use in electrical installation		
6.	IS: 2174	Degree of protection provided by enclosure for low voltage switch-gear and control		
7.	IEC: 71	Electrical Clearances		
8.	IS: 12063	Classification of degree of protection provided by enclosure of electrical equipment.		
	PRINCIPAL PARAMETERS			
•	Rated system voltage	245 KV	145 KV	36 KV
•	System neutral earthing	Effectively earthed		
•	Installation	Outdoor		
•	Rated arrester voltage	198 KV	120 KV	30 KV
•	Max. continuous operating voltage (MCOV) at 500C	168 KV	102 KV	24 KV
•	Nominal discharge current	10 KA (8/20 microwave)		
•	Rated frequency	50 Hz		
•	Minimum line discharge capacity	2 KJ / KV		
•	Power frequency reference voltage	Not less than MCOV		
•	Max. Residual voltage at nominal discharge current of 10 KA and 8/20 Micro Sec.	550 KVP	400 KVP	100 KVP
•	Peak & value of high current (4/10 Microwave)	100 KA		
•	Creepage distance	25 mm/KV		
•	Partial discharge test on 1.05 MCOV	Net more than 50 Pico coulombs		
•	One minute power frequency voltage of arrester housing	460 KV	275 KV	70 KV
•	Impulse withstand voltage of arrester housing with 1.2/50 micro second wave.	1050 KVP	650 KVP	170 KVP
•	Minimum prospective fault current.	40 KA		
•	Radio interference voltage	Not more than 500 micro volts.		

Sl. No.	Standard	Title		
•	Pressure relief class		Class-A	
•	Current for pressure relief.		40 KA	
•	Seismic acceleration		0.3 g.	
•	Long duration discharge class		Class 3 (as per IEC)	
The details of the equipments to be protected by these surge arresters are as under :-				
Equipment		Basic Insulation level		
		220 KV	132 KV	33 KV
Transformer 220 KV side		950 KVP	550 KVP	170 KVP
Switchgears, CTs and CVTs		1050 KVP	650 KVP	170 KVP

RELAYS:

All relays shall conform to the requirements of IS: 3231 or other applicable approved standards. Relays shall be suitable for flush or semi-flush mounting on the front with connections from the rear. Relays shall be rectangular in shape and shall have dust tight, dull black or egg shell black enamel painted cases with transparent cover removable from the front.

TRANSMISSION LINE PROTECTION:

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 primary & back up protection having equal performance requirement specially in respect of time as provided by Main protection called Main and Backup Protection.

APPLICABLE STANDARDS

IS 14697: 1999	Specification for A.C Static Transformer operated Watt Hour & VAR – Hour meters, class 0.2S & 0.5S
CBIP Technical Report No. 88 (Revised July 1996 and Amendments & Errata issued in April - 1999 and September'99)	Specification for A.C. Static Electrical Energy Meters.
IEC – 687	Alternating current static watt-hour meters for measurement of active energy, class 0.2
IS- 3202	Climatic proofing of electrical equipment.

STANDARDS:

The design, manufacture and performance of all the equipment and material provided under this specification shall generally conform to the latest issues of the following:-

Indian Standard	Title	International & Internationally Recognized standards
IS: 3231	Electrical Relays for Power system Protection	IEC-255 Part 1 to 3, BS:142
IS: 1248 & IS: 419	Indicating Instruments	BS: 89
IS: 6236	Recorders	BS: 90
IS: 722 (Part-I to IX)	Energy Meters	BS: 37/IEC-521
IS: 6875	Control Switches (LV switching devices for Control and Auxiliary circuits)	IEC: 337 & 337-1
IS: 1885 (Part-I & II)	Electro-Technical Vocabulary, Electrical Relays & Electrical Power System Protection	
IS: 2705	Current Transformers	IEC: 185
IS: 3156	Voltage Transformers	IEC-186
IS: 375	Marking & Arrangements for Switchgear, Busbar, Main connection and Auxiliary wiring	
IS: 5	Colours for ready mixed paints and channels stability tests	BS: 142
IS: 1554 (Part)	PVC insulated cables upto and including 1000 Volts.	
IS: 3842 (Part-I to VIII)	Application guide for Protective Relays	
IS: 4483 (Part-I & II)	Preferred Panel Controls and Dimensions	
IS: 9224 (Part-II)	HRC Cartridge fuse links	
IS: 2147	Degrees of Protection provided by enclosures for LV switchgear and	

Indian Standard	Title	International & Internationally Recognized standards
	control gear	
IS: 6005	Code of Practice for Phosphating Iron and Steel	
IS: 8686	Specification for static protective relays & tests	IEC-255 Part-V & VI, IEC-801-4
IS: 4237	General requirement of switchgear and control gear for voltages not excluding 1.1 kV	
IS: 5578	Guide for marking of insulated conductors	
IS: 11353	Guide for uniform system of marking and identification of conductor & apparatus terminals	
IS: 13010	Energy Meters	
CBIP Pub No.274	Manual on Protection of Generators, Generator Transformers and 220kV & 400kV network	
CBIP Pub No: 296	Manual on Reliable fault clearance and Back up protection of EHV & UHV Transmission Networks	
IEC 60870	Communication Protocol	IEC 60870
IEC 61850	Substation Automation Protocol	IEC 61850

PLCC

Power line carrier communication (PLCC) equipment complete for speech transmission line, tele-protection commands and data channels shall be provided on each 220 kV and 132 kV transmission lines. The protection for transmission line and the line compensated equipment shall have 100% backup communication channels. The PLCC equipments shall in brief include the following :-

Coupling Device, line traps, carrier terminals, protection couplers, HF cables, PABX and maintains and testing instruments.

A telephone exchange (PABX) of 24 lines shall be provided at new substation as means of effective communication among various buildings of the substation, remote end substation and with controls centres (RLDC/SLDC) etc.

Coupling Devices shall be suitable for 220 kV and 132 kV. Phase to Phase coupling for 220 kV and 132 kV single circuit line shall be provide. For Double circuit line inter circuit coupling can be provided. The pass band of coupling devices shall have sufficient margin for adding communication channel in future if required. Necessary protection devices for safety of personal and low voltage part against power frequency voltages and transient voltage shall also be provided.

The line traps shall be broad band turned suitable for blocking the complete range of carrier frequencies. Line trap shall have the necessary protective devices such as lighting arresters for the protection of tuning device and shall be equipped with corona rings. Decoupling network consisting of line traps and coupling capacitors may also be required at certain substation in case of extreme frequency congestion.

Wherever Fiber Optic/OPGW based telecommunication terminal equipment (i.e. SDH/MUX) are being provided, the same shall be utilized for Data, Voice and line protection applications. For protection purposes, both end Digital Protection Couplers (DPCs) shall be included at both ends. However, for line protection application, back up communication channel/link may be considered as per requirement so as to take care of OPGW/ telecommunication equipment outage.

Addition/Modification/Shifting/Re-commissioning etc. as required of PLCC due to LILO of transmission lines shall be covered under the scope according to element wise detailed given below:-

S. No.	Details of element (line)	Coverage under the scope
1	LILO of one ckt. of 220 kV Sarnath (400) – Gajokhar DC line at Cantt. (Chaukaghat) Varanasi. Construction of 41.5 Km (37 Km overhead line (Zebra Conductor) on Lattice Tower and construction of 4.5 Km 630 mm2 line with copper XLPE cable	Addition/Modification/Shifting/Re- commissioning of PLCC shall be covered under the scope

S. No.	Details of element (line)	Coverage under the scope
2	LILO of one ckt. of 220 kV Muradnagar (400) – Sahibabad (220) SC line at 220 kV substation Vasundhara (Ghaziabad) (Multi Ckt./Monopole Tower) (Zebra conductor)	Addition/Modification/Shifting/Re-commissioning of PLCC shall be covered under the scope

PLCC equipment for the transmission lines at serial 01 & 02 covered under the package (Consisting of one set of analog PLCC channel along with circuit protection coupler and one set of Digital Protection Coupler for both ends of one line segment due to LILO of existing line) shall be provided by the bidder. All other associated equipment for ends cabling, coupling device and HF cable shall be provided by the bidder. 48 kV DC Power supply for PLCC panels shall be provided by the respective substation bay owner. The wave traps, CVTs required for communications from PLCC shall be provided by respective substation owner.

Fire Fighting System

Fire Fighting System is general conforms to fire insurance regulations of India. The fire fighting system is proposed with both AC motor & diesel engine driven pumps housed in a fire fighting pump house building along with water storage tank of adequate capacity. Automatic heat actuated mulsifying system us proposed for transformers & reactors. In addition for alarm system based on heat/smoke detectors are proposed to be installed at sensitive points in a substation e.g. Cable Vault, Control Room building and other building etc. further, adequate water hydrants and portable fire extinguishers shall be provided in the substations. At existing substations the fire fighting system if already available, would be extended for meeting the additional requirements.

Illumination

Adequate normal & emergency AC & DC illumination shall be provided in the control room, GIS hall & other building of the substation. The switchyard shall also be provided with adequate illumination. The entire control room building, fire fighting pump house lighting shall be done by LED based low power consumption luminaries.

Control Room

Substation control room would be provided to house substation work station for station level control along with its peripheral and recording equipment, AC & DC distribution boards, DC batteries & associated battery chargers, Fire Protection panels, Telecommunication panels & other panels as per requirements. Air conditioning will be provided in the building as functional requirements.

SPECIFIC TECHNICAL REQUIREMENT FOR COMMUNICATION FOR 220 KV AND 132 KV LINES

In order to meet the requirement for grid management and operation of substations, Transmission Service Provider (TSP) shall conform to the following requirements.

On 220 kV and 132 kV D/C lines one OPGW containing 24 fibers is to be installed in place of conventional earth wire for grid management and substation operation purpose by STU/CTU and 48 fibers to be installed on LILO lines.

220 kV, 132 kV, 66 kV, 33 kV & 11 kV System

SL No	Description of parameters	220 kV System	132 kV System	66 kV System	33 kV System	11kV System
1.	System operating voltage	220 kV	132 kV	66 kV	33 kV	11 kV
2.	Maximum operating voltage of the system (rms)	245 kV	145 kV	72.5 kV	36 kV	12 kV
3.	Rated frequency	50	50 Hz	50 Hz	50 Hz	50 Hz
4.	No. of phase	3	3	3	3	3
5.	Rated Insulation levels					
	i. Full wave impulsewithstand voltage (1.2/50 micro sec.)	1050 kVp	650 kVp	325 kVp	170 kVp	75 kVp
	ii. One minute power frequencydry a wet withstand voltage (rms)	-	275 kV	140 kV	70 kV	28 kV
6.	Corona extinction voltage	156 kV	105 kV	-	-	-
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 92 kV rms for132 kV system	1000 micro-volts	500 micro-volts	-	-	-
8.	Minimum creepage distance (25mm/kV)	6125mm	3625mm	1813mm	900mm	300mm
9.	Min. Clearances					

SL No	Description of parameters	220 kV System	132 kV System	66 kV System	33 kV System	11kV System
	i. Phase to phase	2100mm	1300mm	750mm	320mm	280mm
	ii. Phase to earth	2100mm	1300mm	630mm	320mm	140mm
	iii. Sectional clearances	5000mm	4000mm	3000mm	3000mm	3000mm
10.	Rated short circuit current for 1 sec. Duration	40kA/50kA (as applicable)	31.5 kA	31.5 kA	25 kA	25 kA
11.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed	Effectively earthed	Effectively earthed

TECHNICAL SPECIFICATION OF 220/33 kV SUBSTATION CANTT (CHAUKAGHAT), VARANASI & VASUNDHARA (GHAZIABAD)

SYSTEM PARTICULARS

(i) Rated System voltage	245kV, 36kV
(ii) System frequency	50 Hz, This may vary by ± 5%
(iii) Number of phases	Three
(iv) Neutral	Effectively Earthed

(v) **Auxiliary power supply:-**

Auxiliary electrical equipment shall be suitable for operation on the following supply system:

(a) Power device (Like drive motors)	400V, 3Phase, 4Wire 50Hz Effectively earthed AC system.
(b) Lighting fixtures, space heaters, fractional Horse Power motors and control devices.	250V, 2wire, 50Hz, AC supply with one point grounded.
(c) DC alarm, Control and Protective Devices	2wire ungrounded DC supplies from sub station batteries as under
(i) 220/132kV S/S :	110V DC
(ii) Communication : equipment	48 V DC

The above supply voltage is subject to variation as follows:

All devices must be suitable for a continuous operation over the entire range of voltage variations :

(i) AC Voltage may vary by ± 10%.

Frequency by ± 5%

Combined Voltage & frequency by ±10%.

(ii) DC

a) 220 V may vary between 187 & 242 V

b) 110 V may vary between 93 & 121 V

c) 48 V may vary between 41 & 53 V

SYSTEM PARAMETERS

The following system parameters shall prevail:

Sl. No.	Description of Parameters	220 kV System	33 kV System
1	Nominal system voltage	220kV	33kV
2	Maximum operating voltage of the system(rms)	245kV	36kV
3	Rated frequency	50Hz	50Hz
4	No. of phase	3	3
5	Rated short time current	40 kA for 3 Sec	25 kA for 3 sec
6	Dry and wet one minute power frequency withstand voltage	460 kV	95kV
7	Dry and wet impulse withstand voltage positive and negative	1050 kVp	250 kVp
8	Corona extinction voltage	156 kV	-
9	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, 320kV rms for 400kV system and 156kV rms for 220kV system & 92kV rms for 132kV system	1000 microvolt	-
10	Minimum total creepage	25mm /kV (6125 mm)	25mm/kV (1300 mm)
11	Min. clearances i. Phase to phase ii. Phase to earth iii) Sectional clearances	 2100 mm 2100 mm 5000 mm	 320 mm 320 mm 3000 mm
12	System neutral earthing	Effectively Earthed	Effectively Earthed

Major technical parameters of bushings/ hollow column/ support insulators are given below:

Sl. No.	Description of Parameters	220 kV System	33 kV System
1	Max. System voltage Um (kV)	245kV	36kV
2	Impulse withstand voltage (dry & wet) (kVp)	± 1050	± 170
3	Switching surge withstand voltage (dry & wet) (kVp)	-	-
4	Power frequency withstand voltage (dry and wet) (kV rms)	460	75
5	Total creepage distance(min) (mm)	6125	900

Insulator shall also meet requirement of IEC- 815 for 245kV, 145kV and 36kV systems, as applicable having alternate long and short sheds.

CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

All types of boxes, cabinets etc. shall generally conform to in accordance with IS- 5039/ IS-8623, IEC-60439, as applicable.

All doors, removable covers and plates shall be provided gasket all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. The quality of gasket shall be such that it does not get damaged/cracked during ten years of operation of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters, the screen shall be fine wire mesh made of brass.

BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS

Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC-60137 while hollow column insulators shall be manufactured and tested in accordance with IEC- 62155/IS:5621. The support insulators shall be manufactured and tested as per IS:2544/IEC- 60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable.

TECHNICAL SPECIFICATION FOR SF6 GAS INSULATED METAL ENCLOSED SWITCHGEARS (GIS)

The GIS shall be double bus bar arrangement and each module shall be complete with SF6 breaker, disconnectors, current and voltage transformers, earthing swithes and all necessary components as detailed in this specification. All parts of the switchgear should be single phase/

three phases (segregated) enclosed for 220 kV GIS and single phase/ three phases encapsulated for 33 kV GIS.

REFERENCE STANDARDS

The metal-enclosed gas-insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be in accordance with the following International Electro-technical Commission (IEC) Publications including their parts and supplements as amended or revised to date:

IEC 62271-203	Gas Insulated metal-enclosed switchgear for rated voltages
	above 52kV
IEC 60376	New sulphur hexafluoride
IEC 62271- 100	High voltage alternating current Circuit breakers
IEC 60694	Common clauses for high voltage Switchgear and control-
	gear standards
IEC 62271-102	Alternating current disconnectors(isolators) and earthing
	switches
IEC 61128	Alternating current disconnectors. Bus-transfer current
	switching by disconnectors.
IEC 61129	Alternating current earthing switches. Induced current
	switching
IEC 66044-1	Current transformers
IEC 66044-2	Voltage transformers
IEC 60137	Bushings for alternating voltages above 1000 V
IEC 60859	Cable connections for gas-insulated switchgear
IEC 60480	Guide to checking of sulphur hexafluoride taken from
	electrical equipment
IEC 60099 -1/4	Non-linear resistor type arresters for AC systems
IEC 60439	Factory-built assemblies of low-voltage switchgear and
	control Gear.
IEC 60427	Report on synthetic testing of high-voltage alternating-
	current breaker.
IEEE 80 (2000)	IEEE Guide for Safety in AC Substation grounding.
CIGRE-44	Earthing of GIS- an application guide. (Electra no.151,Dec'93).
IEC 61639	Direct connection between Power Transformers and gas insulated metal
	enclosed switchgear for rated voltage 72.5 kV and above.

The components and devices which are not covered by the above standards shall conform to, and comply with, the latest applicable standards, rules, codes and regulations of the internationally recognized standardizing bodies.

PRINCIPAL PARAMETERS

The SF6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch of any of it's live constituent parts. It should be designed for indoor/outdoor (as specified) application with meteorological conditions at site.

The metal-enclosed gas insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be in accordance with the IEC-62271-203 with latest amendments publications including their parts and supplements as amended or revised to date.

The required overall parameters of GIS are as follows:-

Sl. No. I	**Technical particulars GIS**	**220 kV System**	**132 kV System**	**33 kV System**
1.	Type of GIS encapsulation	Single Phase /Three Phase encapsulated	Single Phase /Three Phase encapsulated	Single/ Phase Three Phase encapsulated
2.	Location	Indoor	Indoor	Indoor
3.	Rated voltage	245kV rms	145kV rms	36 kV (rms)
4.	Rated frequency	50 HZ	50 HZ	50 HZ
5.	Number of Phases	3	3	3
6.	Grounding	Effectively Earthed	Effectively Earthed	Effectively Earthed
7.	Rated continuous current rating at design ambient temperature i.e. 50 ^{0}C			
	i) Busbar and Bus coupler Bay	2000 Amp.	1600 Amp.	2500 Amp.
	ii) Feeder and Transformer Bay	1600 Amp.	800 Amp.	1250/2500 Amp. (Feeder)/Transf
8.	Rated burn through time of enclosure due to internal arc to short circuit	According to IEC	According to IEC	According to IEC

	Current			
9.	Rated lightning impulse (1.2/50 micro sec.) withstand voltage	± 1050 kV peak	± 650 kV peak	±170 kVp
10.	One minute power frequency withstand voltage	460 kV rms	275 kV rms	70 kV rms
11.	Rated short time withstand current (3 sec)	40 kA rms (As applicable)	40 kA rms (As applicable)	31.5 kA rms
12.	Rated peak withstand current	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	80 kA peak
13.	Material of enclosure	Aluminium alloy	Aluminium alloy	Aluminium alloy
14.	Minimum thickness of enclosure (mm)	As per IEC/CENELEC Standard	As per IEC/CENELEC Standard	As per IEC/CENELEC Standard
15.	Material of busbar conductor	Aluminium and/or Copper	Aluminium and/or Copper	Aluminium and/or Copper
16.	Guaranteed maximum gas losses for complete installation as well as for all individual sections in %.	Less than 0.5% as per IEC-62271-203	Less than 0.5% as per IEC-62271-203	Less than 0.5% as per IEC- 62271-200
17.	Seismic level	Zone- IV, as per IS-1893, Year-2002	Zone- IV, as per IS-1893, Year-2002	Zone- IV, as per IS-1893, Year- 2002
II	**Circuit Breaker (CB)**			
1.	Rated voltage	245kV rms	145kV rms	36 kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type of Circuit Breaker	SF6 insulated	SF6 insulated	SF6 insulated
4.	System neutral	Effectively earthed	Effectively earthed	Effectively earthed

	Earthing			
5.	Rated continuous current rating at design ambient temperature i.e. 50 ^{0}C			
	-Feeder Bay	1600 Amp.	800 Amp.	1250 Amp.
	-Transformer Bay	1600 Amp.	800 Amp.	2500 Amp.
	-Bus coupler Bay	2000 Amp.	1600 Amp.	2500 Amp.
6.	No. of poles	3	3	3
7.	Type of operation	Single Phase Operation	Three Phase Gang Operation	Three Phase Gang Operation
8.	Operating Mechanism	Hydro-Mechanical spring drive/Hydraulic/Spring drive	Hydro-Mechanical spring drive/Hydraulic/Spring drive	Hydro-Mechanical spring drive/Hydraulic/Spring drive
	Auto re-closing duty	Three Phase/ Single Phase	Three Phase	
	Rated operating duty cycle	O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO	O-0.3sec-CO-3 min-CO
	First pole to clear Factor	1.3	1.3	1.5
	Maximum closing time	Not more than 120 ms	Not more than 120 ms	Not more than 120 ms
	Maximum breaking time at rated breaking capacity	65 ms	65 ms	80 ms
	Rated lighting impulse withstand			

voltage			
-between line terminals and ground	±1050 kV peak	± 650 kV peak	±170 kV peak
-between terminals with circuit breaker open	±1050 kV peak	± 650 kV peak	±195 kV peak
One minute power frequency phase to earth voltage (kv rms)			
- between line terminals and ground	460 kV rms	275 kV rms	As per IEC
- betwwen terminals with circuit breaker open	530 kV rms	315 kV rms	As per IEC
Rated breaking current capacity			
i) Rated short circuit current withstand capacity (3 sec)	40 kA (As applicable)	40 kA (As applicable)	31.5 kA
ii) Line charging current	50 A rms/ As per IEC	50 A rms/ As per IEC	As per IEC
iii) Cable charging current	120 A rms	120 A rms	
iv) Small indutive breaking current	10 A rms	10 A rms	
Rated short time making current	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	80 kA peak

	capacity			
	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 156kV	1000 Micro volts	500 Micro volts	___
19.	Max. difference in the instants of closing/opening of contacts (ms) between poles	As per IEC	As per IEC	As per IEC
20.	Trip coil and closing coil voltage	110 V DC with variation as specified in GTR	110 V DC with variation as specified in GTR	110 V DC with variation as specified in GTR
21.	Auxiliary Contacts Auxiliary switch shall also comply with requirements as given, independent single pole reversible contacts (from NO to NC & vice versa)	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for use in future.	Each circuit breaker pole shall be provided with an auxiliary switch with 20% of spare – NO and 20% spare NC contact for
	Rating of auxliary contacts	10A at 110V DC	10A at 110V DC	10A at 110V DC
	Breaking capacity of Aux. Contacts less than 20 ms	2A DC with the circuit time constant of not less than 20 ms	2A DC with the circuit time constant of not less than 20 ms	2A DC with the circuit time constant of not less than 20 ms
III	**Disconnectors (DS)**			

1.	Rated voltage	245kV rms	145kV rms	36 kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type	SF6 insulated	SF6 insulated	SF6 insulated
4.	System Earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed
5.	Rated short time withstand current (3 sec)	40 kA rms (As applicable)	40 kA rms (As applicable)	31.5 kA rms
6.	Rated short time making current capacity	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	80 kA peak
7.	No. of poles	3	3	3
8.	Rated continuous current rating at design ambient temperature i.e. 50 ^{0}C			
	Feeder Bay	1600 Amp.	800 Amp.	1250 Amp.
	Transformer Bay	1600 Amp.	800 Amp.	2500 Amp.
	Bus coupler Bay	2000 Amp.	1600 Amp.	2500 Amp.
9.	OperatingMechanism	Motor	Motor	Motor
10.	Operating time	Less than 12 sec.	Less than 12 sec.	Less than 12 sec.
11.	Rated lightning impulse withstand voltage			
	- Phase to earth	±1050 kV peak	±650 kV peak	±170 kV peak
	- Across the open contacts	±1200 kV peak	±750 kV peak	±195 kV peak
12.	One minute power frequency withstand voltage			
	- Phase to earth	460 kV rms	275 kV rms	As per IEC
	- Across the open contacts	530 kV rms	315 kV rms	As per IEC
13.	Rated mechanical terminal load	As per IEC	As per IEC	As per IEC
14.	Rating of auxiliary contacts	10A at 110V DC	10A at 110V DC	10A at 110V DC

15.	Breaking capacity of auxiliary contacts	2 A	2 A	2 A
16.	No. of auxiliary contacts on each isolator	6 NO and 6 NC	6 NO and 6 NC	6 NO and 6 NC
17.	No. of auxiliary contacts on each earthing switch	6 NO and 6 NC	6 NO and 6 NC	6 NO and 6 NC
IV	**Earthig Switches (ES)**			
1.	Rated voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated short time withstand current (3 sec)	40 kA rms (As applicable)	40 kA rms (As applicable)	31.5 kA rms
4.	Rated short time making current capacity -For high speed earthing switch	125/100 kA peak (As applicable)	125/100 kA peak (As applicable)	80 kA peak
5.	Rated lightning impulse withstand voltage	±1050 kV peak	±650 kV peak	±170 kV peak
6.	One minute power frequency withstand voltage	460 kV rms	275 kV rms	70 kV rms
	Operating Mechanism			
	- For maintenance earthing switch	Motor	Motor	Motor
	-For high speed earthing switch	Motor	Motor	Motor
8.	Operating time			
	-For maintenance earthing switch	Less than 12 sec.	Less than 12 sec.	Less than 12 sec.
	-For high speed earthing switch	Less than 300 m sec	Less than 300 m sec	Less than 300 m sec

V	**Current Transformer (CT)**			
1.	Rated voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
4.	Maximum temperature rise over an ambient temperature of 50^0C	As per IEC 60044-1	As per IEC 60044-1	As per IEC 60044-1
5.	Radio interference voltage at 1.1 Un/√3 and frequency range 0.5 to 2 MHz	≤ 1000 micro-volts	≤ 500 micro-volts	-
6.	One minute power frequency withstand voltage between sec. Terminal & earth	5 kV (rms)	5 kV (rms)	5 kV (rms)
7.	Partial discharge level	≤ 10 pico coulombs	≤ 10 pico coulombs	-
8.	Rated insulation level			
	i) 1.2/50 micro second impulse voltage	±1050 kVp	± 650 kVp	± 170 kVp
	ii) 1 Minute power frequency withstand voltage	460 kV (rms)	275 kV (rms)	70 kV (rms)

9.	Current Ratio For Feeders	1000-800-500-300/1A	800-400-200/1A	400-200/1A
	For Transformer	1000-800-500-300/1A	160MVA (800-400/1A), 100MVA (500/1A),	2000-1250/1A
	For bus coupler	1000-800-500-300/1A	800-400-200/1A	2000-1250/1A
10.	Ratio taps	On secondary side	On secondary side	On secondary side
11.	Accuracy Class			
	-For protection	PS	PS	PS
	-For metering	0.2	0.2	0.2
	Burden			
	-For protection	20 VA	20 VA	20 VA
	-For metering	20 VA	20 VA	10 VA
13.	Rated short time withstand current	40 kA rms (As applicable) for 3 Second.	40 kA rms (As applicable) for 3Second.	31.5 kA rms for 3 Second.
14.	Rated dynamic withstand current	125/100 kA peak (As applicable)) for 1 Second.	125/100 kA peak (As applicable) for 1 Second.	80 kA peak for 1 Second.
15.	Safety factor for metering	< 5	< 5	< 5
16.	Parameters/ Approval Finalization	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by purchaser as per	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by	Burden, Knee Point Voltage Rct, Excitation Current and other parameters shall be got approved by

		protection co-ordination/ scheme requirements during detailed engineering based on details/ calculations to be submitted by successful bidder	purchaser as per protection co-ordination/ scheme requirements during detailed engineering based on details/ calculations to be submitted by successful bidder	purchaser as per protection co-ordination/ scheme requirements during detailed engineering based on details/ calculations to be submitted by successful bidder
VI	**Voltage Transformers**			
1.	Rated System voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Type	Electromagnetic	Electromagnetic	Electromagnetic
4.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
5.	System fault level	40 kAp. (As applicable) for 3 Second.	40 kAp. (As applicable) for 3 Second.	31.5 kAp for 3 Second.
6.	Rated lightning impulse withstand voltage	± 1050 kV peak	± 650 kV peak	± 170 kV peak
7.	One minute power frequency withstand voltage	460 kV rms	275 kV rms	70 kV rms
8.	One minute power frequency withstand voltage for secondary winding	3 kV rms	3 kV rms	3 kV rms
9.	Radio interference voltage at 1.1 Un/√3 and	≤ 1000 micro volts	≤ 500 micro volts	-

	frequency range 0.5 to 2 MHz										
10.	Rated total thermal burden	400 VA			100 VA			75 VA			
11.	Partial discharge level	≤ 10 pico coulombs			≤ 10 pico coulombs			-			
12.	Voltage Ratio	245/√3 :110 V/√3			145/√3 :110 V/√3			36/√3 :110 V/√3			
13.	Number of secondary winding	3			3			2 or 3			
14.	Rated voltage factor	1.5 for 30 seconds			1.5	for 30 seconds		1.5	for 30 seconds		
		1.2	con tinu ous		1.2	continuo us		1.2	continuous		
15.	Phase angle error	± 10 min (for metering core)			± 10 min (for metering core)			± 20 min (for metering core)			
16.	Rated voltage	Sec-I	Sec-II	Sec-III	Sec-I	Sec- II	Sec-III	Sec-I			
			110/√3	110/√3	110/√3	110/√3	110/√3	110/√3			
		Prot.	Prot.	Meteri ng	Prot.	Prot.	Meteri ng	Metering			

	Accuracy	3P	3P	0.2	3P	3P	0.2	0.2
	Output Burden (Min.) VA	50	50	50	50	50	50	10
VII	**Lightning Arresters (LA)**							
1.	Highest system voltage	245 kV rms			145 kV rms			36 kV rms
2.	Rated arrester voltage	198 kV rms			120 kV rms			30 kV rms
3.	Continuous operating voltage at 50 ^{0}C	168 kV			102 kV			25 kV
4.	Type (Tank Type)	Gapless type/ Metal Zinc Oxide type			Gapless type/ Metal Zinc Oxide type			Gapless type/ Metal Zinc Oxide type
5.	Long duration Discharge Class	3			Class 3			Class 3
6.	Nominal discharge current corresponding to 8/20 microsec wave shape	10 kA rms			10 kA rms			10 kA rms
7.	Rated frequency	50 HZ			50 HZ			50 HZ
8.	Minimum discharge capability voltage corresponding to minimum discharge characterstic	5 kJ/kV (referred to rated arrester)			5 kJ/kV (referred to rated arrester)			5 kJ/kV (referred to rated arrester)

9.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
10.	Max. switching surge residual voltage(1 kA)	500 kVp	280 kVp	-
11.	Max. residual voltage at			
	i) 5 kA	560 kVp	310 kVp	-
	ii) 10 kA nominal discharge current	600 kVp	330 kVp	100 kVp
	iii) 20 kA nominal discharge current	-	-	-
12.	High current short duration test value (4/10 micro second wave)	100 kVp	100 kVp	100 kVp
13.	Current for pressure relief test	40 kA rms	40 kA rms	40 kA rms
14.	Prospective symmetrical fault current	40 kA rms for 0.2 Sec	40 kA rms for 0.2 Sec	40 kA rms
15.	Pressure relief class	A	A	A
16.	RIV at 1.1 Un/√3 kV rms	Less than 500 (micro volts)	Less than 500 (micro volts)	-
17.	Partial discharge at 1.05 COV	Not more than 50 pc	Not more than 50 pc	Not more than 50 pc
18.	Low current long duration test value (2000 micro sec.)	As per IEC	As per IEC	As per IEC
19.	Discharge counter and leakage current meter to be provided	Yes	Yes	Yes

VIII	**Busbar**			
1.	Rated voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	2000 A rms	1600 A rms	2500 A rms
4.	Rated short time withstand current	40.0 kA rms/3sec	40.0 kA rms/3sec	31.5 kA rms
5.	Temperature rise			
	-For enclosure	According to IEC	According to IEC	According to IEC
	-For conductor	According to IEC	According to IEC	According to IEC
6.	Rated lightning impulse withstand voltage	±1050 kV peak	±650 kV peak	±170 kVp
7.	One minute power frequency withstand voltage	460 kV (rms)	275 kV (rms)	70 kV (rms)
IX	**Bus Coupler**			
1.	Rated voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	2000 A rms	1600 A rms	2500 A rms
4.	Rated short time withstand current	40.0 kA rms/3sec	40.0 kA rms/3sec	31.5 kA rms
5.	Temperature rise			
	-For enclosure	According to IEC	According to IEC	According to IEC
	-For conductor	According to IEC	According to IEC	According to IEC
6.	Rated lightning impulse withstand voltage	±1050 kV peak	±650 kV peak	±170 kV peak
7.	One minute power frequency withstand voltage	460 kV (rms)	275 kV (rms)	70 kV (rms)
X	**Cable Head (CHD)**			
1.	Rated voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	2000 A rms	1600 A rms	2500 A rms
4.	Rated short time withstand current	40.0 kA rms	40.0 kA rms	31.5 kA rms

5.	Rated lightning impulse withstand voltage	±1050 kV peak	±650 kV peak	±170 kV peak
6.	One minute power frequency withstand voltage	460 kV (rms)	275 kV (rms)	70 kV (rms)
7.	Interface with power cable sealing end	According to IEC	According to IEC	According to IEC
XI	**SF6 Bus Interconnection Duct Termination Head**			
1.	Rated voltage	245kV rms	145kV rms	36kV rms
2.	Rated frequency	50 HZ	50 HZ	50 HZ
3.	Rated current	2000 A rms	1600 A rms	2500 A rms
4.	Rated short time withstand current	40.0 kA rms	40.0 kA rms	31.5 kA rms
5.	Rated lightning impulse withstand voltage	±1050 kV peak	±650 kV peak	±170 kV peak
6.	One minute power frequency withstand voltage	460 kV (rms)	275 kV (rms)	70 kV (rms)
7.	Interface with SF6 Duct end	According to IEC	According to IEC	According to IEC
XII	**Bus Sectionalizers**			
1.	Rated voltage	-	-	36kV rms
2.	Rated frequency	-	-	50
3.	Rated current	-	-	2500 A rms
4.	Rated short time withstand current	-	-	31.5 kA rms
	Temperature rise -For enclosure -For conductor	-	-	According to IEC

Rated lightning impulse withstand voltage	-	-	±170 kV peak
One minute power frequency withstand voltage	-	-	70 kV (rms)

CIRCUIT BREAKERS

GENERAL

The circuit breakers and accessories shall conform to IEC: 62271-100, IEC: 62271-01 and other relevant IEC standards.

245/145/36 kV circuit breakers offered would be of sulphur hexafluoride (SF6) type only and of class C2-M2 as per IEC.

The support structure of circuit breaker as well as that of control cabinet shall be hot dip galvanised. All other parts shall be painted as per shade 697 of IS-5.

DISCONNECTORS (ISOLATORS)

General

Disconnectors shall be of the single-pole, group operated type, installed in the switchgear to provide electrical isolation of the circuit breakers, the transformers, double bus and transmission lines. The disconnectors shall conform to IEC-62271-102.

INSTRUMENT TRANSFORMERS

Current Transformers

The current transformers and accessories shall conform to IEC : 60044-1 and other relevant standards.

Voltage Transformers

The voltage transformers shall conform to IEC- 60044-2 and other relevant standards.

SURGE ARRESTERS

The surge arresters shall confirm in general to latest IEC –60099-4.

a) The surge arresters are being provided to protect the followings whose insulation levels are indicated in the table given below:-

Equipment to be protected	Lightning impulse (kVp) for 245 kV system	Lightning impulse (kVp) for 145 kV system	Lightning impulse (kVp) for 36 kV system

Power Transformer	± 950	± 550	± 170
Instrument Transformer	± 1050	± 650	± 170
CB/Isolator Phase to ground	± 1050	± 650	± 170
Across open contacts	± 1200	± 750	± 195

220/132/33KV GIS BUILDING

The buildings shall house 220kV, 132kV and 33kV Gas Insulated Switchgear (GIS) separately and other associated equipments inside in each of the GIS building. The building shall have arrangement to maintain pressurised air in order to prevent the ingress of dust in the GIS Hall.

The GIS hall shall have an independent ventilation system. Each ventilation system shall consist of two 100% capacity systems, one operating and one stand-by.

To ensure that the air being supplied to the GIS hall is free from dust particles, a minimum **two** stage dust filtration process shall be supplied. This shall consist of at least the following:

3.3.2 **Pre Filters:** To remove dust particles down to10 micron in sizewith at least95% efficiency.

3.3.3 **Fine Filters:** To remove dust particles down to5 microns in sizewith at least99% efficiency.

QUALITY OF SF6 GAS

a) The SF6 gas insulated metal-clad switchgear shall be designed for use with SF6 gas complying with the recommendations of IEC 376, 376A & 376B, at the time of the first charging with gas. All SF6 gas supplied as part of the contract shall comply with the requirements of IEC as above as a minimum & should be suitable in all respects for use in the switchgear under all operating conditions.

b) The high pressure cylinders in which SF6 gas is supplied & stored at site shall comply with the requirements of following standards & regulations:

IS: 4379	Identification of the contents of industrial gas cylinders.
IS: 7311	Seamless high carbon steel cylinders for permanent & high pressure liquefiable gases. The cylinders shall also meet Indian Boilers Regulations. (Mandatory)

CIRCUIT BREAKERS

The circuit breakers and accessories shall conform to IEC: 62271-100, IEC: 62271-01 and other relevant IEC standards.

SULPHUR HEXAFLUORIDE GAS (SF6 GAS)

a) The SF6 gas shall comply with IEC 60376, 60376A and 60376B and shall be suitable in all respects for use in the switchgear under the operating conditions.

b) The high pressure cylinders in which the SF6 gas is shipped and stored at site shall comply with requirements of the relevant standards and regulations.

INSULATORS

All hollow insulators shall conform to IEC-62155.

INTERPOLE CABLING

All cables to be used shall be armoured and shall be as per IS – 1554/ IEC-502 (1100 Volts Grade).

TECHNICAL PARAMETERS

I. 245 kV CIRCUIT BREAKER

1.	Rated continuous current(A) at design ambient temperature.	1600 (as applicable) -2000 for bus coupler bay.
2.	Rated short circuit current breaking capacity at rated voltage	40 kA (as applicable) with percentage DC component as per IEC: 62271-100 corresponding to minimum opening time under operating conditions specified.
3.	Symmetrical interrupting capability (kArms)	40 (as applicable)

4.	Rated short circuit making current (kAp)	125/ 100 (as applicable)
5.	Short time current carrying capability for 3 second (kArms)	40 (as applicable)
6.	Rated operating duty	O-0.3sec-CO-3min-CO cycle
7.	Reclosing	Single phase & three phase autoreclosing
8.	First pole to clear factor	1.3
9.	Rated line/cable charging interrupting current at 90 deg. leading power factor angle (A. rms) (The breaker shall be able to interrupt the rated line/cable charging current with test voltage immediately before opening equal to the product of U/√3 & 1.4 as per IEC: 62271-100)	As per IEC
10.	Temperature rise over the design ambient temperature	As per IEC: 62271-100
11.	i) Total break time as per Cl.3.0 of this specification (ms)	65
	ii) Rated break time as per IEC (ms)	60
12.	Total closing time (ms)	Not more than 120
13.	Operating mechanism	spring/hydraulic or a combination of these

14. Max. difference in the instants of

	closing/ opening of contacts (ms)		
	i)	Between poles (opening)	3.3
	ii)	Between poles (closing)	5.0
	The above shall be at rated control voltage and rated operating and quenching media pressures.		
15.	Trip coil and closing coil voltage		110V DCwith variation as specified
16.	Noise level at base and upto 50 m (distance from base of breaker)		140 dB (Max.)
17.	Rated terminal load		As per IEC or as per the value calculated by GTR, whichever is higher.
18.	Auxiliary contacts		Besides requirement of specification, the bidder shall wire up 5 NO+5 NC contacts for future use of Purchaser.
19.	No of Terminals in common Control cabinet		All Contacts & control circuits to be wired out upto common control cabinet plus 24 terminals exclusively for Purchaser's use.
20.	Maximum allowable switching overvoltage under any switching condition	As per IEC	(Auxiliary switch shall also comply with requirements stipulated under GTR).

DISCONNECTORS (ISOLATORS)

Disconnectors shall be of the single-pole, group operated type, installed in the switchgear to provide electrical isolation of the circuit breakers, the transformers, double bus and transmission lines/cables. The disconnectors shall conform to IEC: 62271-102 (or IS: 9921).

SAFETY GROUNDING SWITCHES

Three-pole, group operated, safety grounding switches shall be operated by electric motor for use on 110V DC ungrounded system and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over-current and short circuit.

The safety grounding switches shall conform to the requirements of IEC- 62271-102

HIGH SPEED MAKE PROOF GROUNDING SWITCHES

Grounding switches located at the beginning of the feeder bay modules shall be of the high speed, make proof type and will be used to discharge the respective charging currents, in addition to their safety grounding function. These grounding switches shall be capable of interrupting the inductive currents and to withstand the associated TRV.

Single phase switches shall be provided with operating mechanism suitable for operation from a 110V DC.

The short circuit making current rating of each ground switch shall be at least equal to its peak withstand current rating. The switches shall have inductive/ capacitive current switching capacity as per IEC-62271-102.

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

INSULATOR

The insulator shall conform to IS: 2544 and/or IEC-60168.

TECHNICAL PARAMETERS

2. 245 kV ISOLATORS

1.	Type	SF6 insulated
2.	Rated current at 50ºC	1600/2000 (As applicable).

	ambient temperature	-1600 for line and Transformer bays. - 2000 bus coupler bay.
1.	Rated short time withstand current of isolator and earth switch (for 3 Sec.)	40 kA / 50 kA (as applicable)
2	Rated dynamic short circuit withstand current of isolator and earth switch	IEC-694.
	100 kAp / 125 kAp (as applicable)	IEC-62271-102
3	Temperature rise over design ambient temperature	
4	Rated mechanical terminal load	A.C. Motor operated
5	Operating mechanism of isolator/earth switch	12 sec. or less
6	Operating time	

INSTRUMENT TRANSFORMERS

The instrument transformers and accessories shall conform to the latest version of the standards specified below:-

Current transformers IEC: 60044-1 (or IS: 2705) Inductive Voltage Transformers IEC: 60044-

Insulating Oil

a) Insulating oil to be used for instrument transformers shall be of EHV grade and shall conform to IS-335/ IEC-60296 (required for first filling).

b) The SF6 gas shall comply with IEC-60376, 60376A and 60376B and shall be suitable in all respects for use in the switchgear under operating conditions. Suitable valve shall be provided for SF6 gas filling in the instrument transformers in live condition. A suitable Rupture Disc shall be provided on the SF6 filled instrument transformers to prevent any chance of explosion.

TECHNICAL PARAMETERS

A.	**245 kV CURRENT TRANSFORMERS**	
1.	Rated Primary current	
2.	Rated short time thermal current	1000A (as applicable)
3.	Rated dynamic current kA (peak)	40 kA for 3 sec./50 kA for 3 sec. (as applicable)
4.	Maximum temperature rise over design ambient temperature	100 / 125 (as applicable)
5.	One minute power frequency withstand voltage sec. terminal & earth	As per IEC:60044-1
6.	Number of terminals	All terminals of control circuits are to be wired upto marshaling box plus 20% spare terminals evenly distributed on all TBs.

7.	Type of insulation	Class A
B.	**245 KV INDUCTIVE VOLTAGE TRANSFORMERS**	
1.	System fault level(for 3 second)	40 kA / 50 kA (as applicable)
2.	Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement
3.	One minute power frequency withstand voltage :	
	i) For secondary winding	3 kV (rms)
4.	Maximum temperature rise over design ambient temperature	As per IEC:60044-2
5.	Number of terminals	All terminals of are wired upto marshaling box plus 12 terminals exclusively for Purchaser's use.
6.	Rated Total Thermal burden (VA)	300 (100VA/winding)

SURGE ARRESTERS

The Surge Arresters shall conform to IEC: 60099-4.

The surge arresters are being provided to protect the following equipment whose insulation levels are indicated in the table given below:-

Equipment to be protected	*Lightning Impulse (kVp) for 245 kV system*	*Lightning Impulse (kVp) for 145 kV system*	*Lightning Impulse (kVp) for 36 kV system*
Power transformer	*± 950*	*± 550*	*± 170*
Instrument Transformer	*± 1050*	*± 650*	*± 170*
CB/Isolator Phase to ground	*± 1050*	*± 650*	*± 170*
CB/Isolator Across open contacts	*±1050 (for CB) ± 1200 (for Isolator)*	*± 750*	*± 195*

TECHNICAL PARAMETERS:

A. 245 kV CLASS SURGE ARRESTER

(a)	Rated arrester voltage	198 kV
(b)	Nominal discharge current	10 kA of 8/20 microsecond wave
(c)	Minimum discharge capability	5kJ/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.
(d)	Continuous operating voltage at 50 deg.C	168 kV rms
(e)	Max. switching surge residual voltage (1kA)	500 kVp
(f)	Max. residual voltage at	
	5 kA	560 kVp
	10 kA nominal discharge current	600 kVp
(g)	Max. steep current impulse residual voltage at 10 kA.	650 kVp
(h)	Long duration discharge Class	3
(i)	High current short duration test value (4/10 micro second wave)	100 kAp
(j)	Current for pressure relief test	40 kA rms / 50 kA rms (as applicable)
(k)	Low current long duration	As per IEC.

test value (2400 micro sec)

Pressure relief class 40 kA / 50 kA (as applicable)

B. 36 kV and 11 kV CLASS SURGE ARRESTER

		36 KV	**11 kV**
	Rated arrester voltage	30 kV	9 kV
	Nominal discharge Current	---10 kA of 8/20 microsecond wave ---	
	Minimum discharge capability	5kJ/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics.)	
	Continuous operating voltage at 50 deg.C	25 kV rms	7.2 kV rms
	Max. switching surge residual voltage (1kA)	72 kVp	22.4 kVp
(f)	Max. residual voltage at		
	i) 5 kA	85 kVp	26 kVp
	ii) 10 kA nominal discharge current	90 kVp	28 kVp
	Long duration discharge	2	2

Class

Pressure relief class 25kA 25 kA

TECHNICAL SPECIFICATION FOR 220 kV XLPE CABLE

STANDARDS

IEC-60228 Conductor for insulated cable. IEC-60229 Tests on cable over sheaths.
IEC-60230 Impulse tests on cables and their accessories.
IEC-60270 Partial discharge measurements.
IEC-60287-1-1 Calculation of continuous current carrying capacity.
IEC-60502 Power Cables with extruded insulation and their accessories.

IEC-60067 Tests for Power cables with extruded insulation for rated voltage

upto 500 kV.

BIS: 7098 XLPE Cable specification for working voltages from 66 kV upto

and including 220 kV.

IEEE:48 Tests procedures and requirements for high voltage cable

terminations.

DESIRED TECHNICAL PARTICULARS OF XLPE CABLE

S.NO.	PARTICULARS	TECHNICAL DETAILS
1.	Cable Applicable Standard	Single Core, Copper Conductor XLPE cable. Conforming to IEC 60502 – 2 and IEC 60840: 2004-04 or IS 7098 (Part - 3) amended up to date.

2.	System voltage & frequency	220 ± 10% kV, 50Hz ± 3%
3.	Rated & Highest System Voltage	245 kV
4.	Suitable for earthed system	Yes
5.	**CONDUCTOR**	
(i)	Material	Annealed Plain Copper wires Conforming to IEC 60228/ IS 8130 with latest amendments
(ii)	Nominal cross-sectional area	800 Sq. mm
(iii)	Construction of conductor / flexibility class	Class -2, IEC 228/ IS: 8130 with latest amendments
(iv)	Shape and formation	Circular, stranded & very well compacted
(v)	Approx. overall diameter of conductor	To be indicated
6.	**CONDUCTOR SCREENING**	
(i) (ii)	Material & Type Grade	Extruded, semi conducting compound layer As per IEC/ IS
(iii)	Thickness	1.0 mm
7.	**INSULATION**	
(i)	Material	Cross linked polyethylene (XLPE)
(ii)	Special Super clean grade Normal thickness of insulation	As per IEC 6207/ IS 7098 (Part-3) with latest amendments
8.	**INSULATION SCREENING**	
A.	Non-metallic part (extruded)	
(i)	Material	Extruded semi conducting compound layer
(ii)	Grade	As per IEC/ IS 7098 (Part-3) with latest amendments
(iii)	Min. Thickness	0.8 mm
B (i)	Non-metallic part (taped) longitudinal water barrier over insulation screen Material	 Synthetic Non-woven semi conducting Water swell-able tape

(ii)	Min thickness	As per standard
C	**METALLIC SHEATH**	
(i)	Material	Corrugated Aluminium/ Lead alloy "E" sheath IS 692 with latest amendments
(ii)	Min. Thickness(mm)	Conforming to IEC 60502-2/ IS 7098
(iii)	Short Circuit Current Withstand (Metallic sheath, together with copper screen (if required)	40 kA for three second
(D)	Bedding over lead sheath	Semi conducting tape(s)
(E)	**CONCENTRIC COPPER WIRE SCREEN (IF REQUIRED)**	
(i)	Material and type	Annealed plain copper wires applied helically with gap followed by open helix of copper tape binder.
(ii)	Min. area (sq. mm.)	This and lead alloy E sheath shall meet earth fault current of 40 kA for a duration of 3 second
9.	**OUTER SHEATH**	
(i)	Material	Extruded Layer of Black PE or PVC type ST-2 as per IEC 62067/ IS 7098 (Part-3)
(ii)	Min. thickness of outer sheath	As per standard
10.	Conducting layer over outer sheath	Graphite coating
11.	Approx. weight overall diameter of cable (mm)	To be indicated
12.	Approx. weight per meter of cable (kg/m)	To be indicated
13.	Recommended minimum installation radius.	To be indicated
14.	Maximum D.C. Resistance of conductor at 90°C in ohm/km	As per standard
15.	Minimum continuous current	**1100 / 843 Amps. As applicable after all**

	rating for each circuit when laid in ground in trefoil formation and other condition given in specification.	**de-rated factors**.
16.	Maximum allowable temperature for cable and accessories.	
(i)	At rated full load and at site conditions.	90° C
(ii)	The conductor temperature after a short circuit for one second shall not exceed (with conductor temperature at start of short circuit as 90°C).	250°C
17.	Basic impulse insulation level (1.2 / 50 micro second wave)	650 kV
18.	Power frequency withstand voltage	As per standard
19.	Symmetrical Short circuit rating for one second duration for lead sheath and copper screened combined	40 kA for 3 sec.
20.	Drum Length	500-600 mtr. / As per requirement.
21.	Expected cable life.	35 years.

TECHNICAL SPECIFICATION FOR 245kV CABLE TERMINATION AND

JOINTINGKITS FOR 1 x 800 SQ. MM& 1x1000SQ.MM. XLPE CABLE

STANDARDS

IEC: 62067	Tests for power cables with extruded insulation for rated voltage above 150kV upto 500kV.
IEC: TS 60859	Cable connection for Gas insulated metal enclosed switchgear for rated voltages of 72.5 kV and above.
IEC: 62271-203	Gas-insulated metal enclosed switchgear for rated voltages of 72.5 kV and above.
IEC: 60228	Conductor for insulated cable
IEC: 60229	Tests on cable over sheaths
IEC: 60230	Impulse tests on cables and their accessories
IEC: 60270	Partial discharge measurements
IEC: 60287	Calculation of continuous current carrying capacity
IEC: 60502	Power Cables with extruded insulation and their accessories.
BIS: 7098 (Part-3)	XLPE cable specification for working voltages from 66 kV up to and including 220 kV.
IEEE 48- 1990	IEEE Standard Test, Procedure & requirement for high voltage alternating current cable terminations.

SYSTEM CONFIGURATION

The 220kV systems will be solidly grounded. Cables will be protected from over voltages caused by lighting strikes or switching surges by means of station type lighting arrestors located at terminal point/ substations. The terminal substation yard equipment and all overhead 220kV transmission lines will be shielded against direct lighting strokes by overhead ground wires.

EARTHING

Earthing of sheath/ screen at both of termination ends of 245kV cable using insulation sheath bonding (earthing) cable of required size through Link box with/ without surge limiter at terminations.

Earthing shall be as per relevant standards.

The sheath/ screen shall bound in the earth station through disconnecting type link boxes.

DESIRED TECHNICAL PARTICULARS OF XLPE CABLES KITS AND ACCESSORIES

	OUTDOOR CABLE END TERMINATION	
1.	Nominal System Voltage	220 kV (rms)
2.	Rated/ Highest System Voltage Um	245 kV (rms)
3.	Rated frequency & No. of phase	50 Hz ± 3%, Three (3)
4.	Installation	Outdoor
5.	Name and address of manufacturer of end termination	
6.	Nomenclature of kit	To be indicated
7.	Type of kit	Pre-molded
8.	Suitable for Single Core Copper Conductor XLPE cable Conforming to IEC 62067/ IS 7098 (pert-3) amendedupto date and as per specification.	Yes
9.	Maximum conductor size	To be indicated
10.	Rated continuous current	Maximum current of the cable
11.	Applicable standard for testing	IEC 62067
12.	Maximum allowable Pd-level	As per IEC
13.	Type of Insulator	Silicone/ Composite
14.	Creepage distance	25 mm/KV
15.	Colour	Brown
16.	Maximum allowable temperature for cable and accessories i) At rated full load and at site condition ii) The conductor temperature after a short circuit for one second shall not exceed (with conductor temperature at start of short circuits as 90°C).	 90°C 250°C
17.	Basic impulse insulation level (1.2/50 micro second	1050 kV

	wave)	
18.	Power frequency withstand voltage	As per standard
19.	Symmetrical Short circuit rating	40 kA for 3 sec.
20.	Power frequency withstand voltage (a) Dry (kV rms.) (b) Wet (kV rms.)	To be indicated
21.	Flashover voltage: (a) Dry (kV rms.) (b) Wet (kV rms.)	To be indicated
22.	Stress relief cone made of	Silicone rubber
23.	Net dimensions of kit (Length x Breadth x Width and Weight)	To be indicated
24.	Craft sensitivity and reliability	To be indicated
25.	Time required for energisation after completing the joint (curing period)	To be indicated
26.	Special storage condition. If any, upto an ambient temperature of 50 degree C and period.	To be indicated
27.	Whether provision made for: a) Stress relief b) Track resistance c) Sealing	Yes
28.	Whether any additional support is required for kit?	If so, give details
29.	Make, Type and Material of lugs provided with kits.	Details to be given by bidder.
30.	Class of Kits.	Details to be given by bidder
31.	Sectional Drawing Showing constructional details along with each item material, description enclosed.	Yes.
32.	Expected life of cable joint and cable.	35 years
33.	(a) Shelf life of the kit (years) (b) Design life of the kit (years)	To be indicated To be indicated
34.	Guarantee of kit.	Five (5) years from date of commissioning
35.	Details of terminal connector	
B.	**SF6 SWITCHGEAR TYPE CABLE END TERMINATION**	
1.	Nominal System Voltage U	220 kV (rms.)

2.	Rated/ Highest System Voltage Um	245 kV (rms.)
3.	Rated frequency & No. of phase	50 Hz ±3%, Three (3)
4.	Installation	Indoor/ Outdoor
5.	Name and address of manufacturer of end termination	
6.	Nomenclature of kit	To be indicated
7.	Type of kit	Premoulded, Plug in type
8.	Suitable for Single Core Copper Conductor XLPE cable Conforming to IEC 62067/ IS 7098 (Part-3) amendedupto date and as per specification.	Yes
9.	Maximum conductor size	To be indicated
10.	Rated continuous current	Maximum current of the cable
11.	Applicable standard for testing	IEC 62067
12.	Maximum allowable Pd-level	As per IEC
13.	Type of Insulator	Silicone/ Composite
14.	Creepage distance	25 mm/KV
15.	Colour	Brown
16.	Maximum allowable temperature for cable and accessories (i) At rated full load and at site condition (ii) The conductor temperature after a short circuit for one second shall not exceed (with conductor temperature at start of short circuits as 90°C).	 90°C 250°C
17.	Basic impulse insulation level (1.2 / 50 micro second wave)	1050 kV
18.	Power frequency withstand voltage	As per standard
19.	Symmetrical Short circuit rating	40 KA for 3 sec.
	Power frequency withstand voltage (a) Dry (kV rms.) (b) Wet (kV rms.)	To be indicated
21.	Flashover voltage: (a) Dry (kV rms.)	To be indicated

	(b) Wet (kV rms.)	
22.	Stress relief cone made of	Silicon rubber
23.	Details of terminal connector	As applicable
24.	Net dimensions of kit (Length x Breadth x Width and Weight)	To be indicated
25.	Craft sensitivity and reliability	To be indicated
26.	Time required for energisation after completing the joint (curing period)	To be indicated
27.	Special storage condition. If any, upto an ambient temperature of 50°C and period.	To be indicated
28.	Whether provision made for: Stress relief Track resistance Sealing	Yes
29.	Whether any additional support is required for kit?	If so, give derails.
30.	Make, Type and Material of lugs provided with kits.	Details to be given by bidder.
31.	Class of Kits.	Details to be given by bidder.
32.	Sectional Drawing Showing constructional details along with each item material, description enclosed.	Yes
33.	Expected life od Cable joint and cable.	30 years
34.	(a) Shelf life of the kit (years) (b) Design life of the kit (years)	To be indicated To be indicated
35.	Details of terminal connector	
36.	Guarantee of kit	Five (5) years from date of commissioning.
C.	**LINK BOX ROR EARTHING CABLE WITH PVC INSULATION**	
1.	Make	
2.	Type	
3.	Detailed dimension and internal arrangement of Single/ Three phase Link boxes with direct grounding	To be submitted
4.	Detailed dimension and internal arrangement of Three Phase Link boxes for cross bonding with SVL	To be submitted

5.	Earthing of sheath/ screen at cross bonding points and termination ends	Yes
6.	PVC insulated single core/ concentric/ coaxial cable to be used for sheath bonding (earthing) suitable for 40 kA for 3 second	Size, Type to be indicated
7.	Insulation of above a earthing cable	To be indicated (3 kV / 6 kV)
8.	Voltage rise of the insulation sheath controlled within voltage	65 Volts.
9.	Surge voltage limiter	Required (3 kV / 6 kV)
D.	**SUPPORTING STRUCTURE & ANGLE BRACKET SUPPORTS FOR CABLE**	
1.	Detail drawing enclosed	Yes
2.	Overall height of structure	Shall be as per approved drawing.

33KV XLPE CABLE & ACCESSORIES

33 KV XLPE Cable

33KV XLPE cable shall be in accordance with the Internationally accepted standard and also conform to the requirement of IEC Publication 502.

TECHNICAL SPECIFICATION FOR 60 MVA 220/33 KV 3 PHASE POWER TRANSFORMER

STANDARDS

The transformer should conform in all respect to latest addition of IS:2026 & CBIP.

PRINCIPAL PARAMETERS

The transformers shall be of core type constructions, three phase, oil immersed for outdoor service as both step up and step down transformers, with types of cooling mentioned below. The rating and electrical characteristics of transformers shall be as below :-

(i)	Maximum continuous capacity	60MVA
(ii)	Frequency	50 Hz
(iii)	No. of Phase	Three
(iv)	Rated Voltage of HV winding	220KV

(v) Rated Voltage of LV winding	33KV
(vi) Rated Voltage of Tertiary winding	11KV
(vii) Percentage impedance	
(viii) HV to LV at Normal tap No. 13 at 100% rating	12.5%
(ix) HV to Tertiary at Normal tap	12.5% (min.)
(x) LV to Tertiary at Normal tap	12.5% (min.)
(xi) a. No load loss at rated voltage and frequency at Principal Tap (KW)	25 (max)
No load loss at voltage corresponding to the highest tap (KW)	35 (max)
Tolerance if any on the above value	No tolerance
(xii) a. Load loss at rated output, rated frequency and corrected for 75 Deg C winding temperature at -Principal Tap (KW) - Highest Tap (KW) -Lower Tap (KW)	 150 KW (max) at 220/33 KV 126 KW (approx.) at 220/37.95 KV 161 KW (approx.) at 220/31.35 KV
Tolerance, if any, on the above value	No tolerance
(xiii) a. Auxiliary losses at rated output, normal, rated voltage, rated frequency and ambient temperature (KW)	3.0 KW (max)
b. Tolerance, if any, on the above value	NIL
(xix) Total Loss at normal ratio inclusive of auxiliary component losses (KW)	178 KW (Max.) at 220/33 KV@60MVA Base

NOTE : No reactor either inside or outside the tank shall be used to achieve above percentage impedance value.

(xx) Connections for :-	
a) HV Winding /LV Winding	Star / Star
b) Tertiary winding	Delta

(xxi) Reference Voltage group and terminal markings	HV/LV/Tertiary -YNynOd11
(xxii) On load tap on HV side neutral	- 5% to +15% in equal steps. of 1.25 % each for IV variations.
(xxiii) Type of cooling	ONAN/ONAF/OFAF.
(xxiv) Rating corresponding to cooling system :-	
a) ONAN Cooling	30 MVA
b) ONAF Cooling	42 MVA
c) OFAF Cooling	60 MVA
(xxv) Rated capacity of tertiary winding	18 MVA
(xxvi) D.C. Voltage for relays etc.	110V
(xxvii) Maximum Noise Level	75 dB

INSULATION

The di-electric strength of winding insulation and of the bushing shall conform to the value given in IS:2026-1977.

For rated system, Voltage of 245 KV, 36 KV and 11 KV following test voltage shall be provided.

SYSTEM VOLTAGE	IMPULSE TEST VOLTAGE	ONE MINUTE POWER FREQUENCY TESTS
245 KV	950 KV	395 KV
36 KV	170 KV	70 KV
11 KV	95 KV	38 KV

The HV and LV windings of transformers shall have graded insulation. The insulation class of the neutral of the winding shall be graded to 95 KV impulse and 38 KV Power frequency withstand.

FREQUENCY

The normal frequency of the system is 50 Hz. It may vary ±5%. The transformers shall be suitable for continuous operation at rated capacity without exceeding the specified temperature rise within this frequency range.

PARALLEL OPERATION

The transformer shall operate satisfactorily in parallel with similar units of different make having following parallel operation details:-

Sl. No.	Variable	Details
1	HV to IV %impedance of tap No.1(ëxtreme) of 100% rating	12.5%
2	HV to IV %impedance of tap No.13(Normal) of 100% rating	12.5%
3	HV to IV %impedance of tap No.17(2nd ëxtreme) of 100% rating	12.5%
4	Location of Tap Changer	HV side neutral
5	Voltage variation	-5% to + 15%
6	Step Voltage	1.25%
7	Vector group	YNyn0d11

CONSTRUCTION DETAILS

The features and construction details of power transformers shall be in accordance with the requirements stated hereunder:-

TANK AND TANK ACCESSORIES

TANK :-

Tank shall be of welded construction and fabricated from tested quality low carbon steel of adequate thickness.

All seams and those joints not required to be opened at site shall be factory welded and wherever possible, they shall be double welded. After completion of tank construction and before painting, dye penetration test shall be carried out on welded parts of jacking bosses, lifting lugs and all load bearing members.

Tank stiffeners shall be provided for general rigidity and these shall be designed to prevent retention of water.

The tanks shall be designed to withstand :

i) Mechanical shocks during transportation.

ii) Vacuum filling of oil.

iii) Continuous internal pressured of 35 kN/m² over normal hydrostatic pressured of oil.

iv) Short circuit forces.

Wherever possible, the transformer tank and its accessories shall be designed without pockets, wherein, gas may collect. Where pockets can not be avoided, pipes shall be provided to vent the gas in to the main expansion pipes.

Adequate space shall be provided at the bottom of the tank for collection of sediments.

Lifting lug & eye bolts shall be so located that a safe clearance is obtained between slings and transformer bushings without use of spreader.

When transformers are provided with separately mounted radiators, flexible joints shall be provided on the main oil pipes connecting the transformer tank to the radiator banks to reduce vibration and facilitate erection and dismantling.

Transformer tank shall be of bell shape construction with an oil tight bolted flange joint near the base, such that during inspection or maintenance, it is possible to lift the upper portion of the tank to provide access to the core and coils.

The transformer tank shall be equipped with the following valves :-

One drain and lower filter valve located on low voltage side of transformer and placed to completely drain the tank.

One value at the top and one at the bottom of the tank mounted diagonally opposite to each other for filtration purpose.

One relief valve to operate at the pressure below the test pressure for the tank.

One oil filling valve (inlet).

One oil sampling valve with plug.

Two nos. stop valves for each pump.

TANK COVER :-

- The tank cover shall be sloped to prevent retention of rain water and shall not distort when lifted.
- At least two adequately sized inspection openings, one at each end of the tank shall be provided for easy access to bushings and earth connections. The inspection covers shall not weigh more that 25 Kg. The inspection covers shall be provided with two handles.
- The tank covers shall be fitted with pockets at the position of maximum oil temperature of MCR (Maximum Continuous Rating) for bulbs of oil and winding temperature indicators. It shall be possible to remove these bulbs without lowering the oil in the tank.
- Bushings, turrets, covers of inspection openings, thermometer, pockets, etc. shall be designed to prevent ingress of water into or leakages of oil from the tank.
- All bolted connections shall be fitted with weather proof, hot oil resistant gasket in between, for complete oil tightness. If gasket is compressible, metallic stops shall be provided to prevent over compression.

AXELS AND WHEELS

- Transformer shall be provided with flanged bi-directional wheels for moving the transformer on rail tracks in directions parallel (X-X) and perpendicular (Y-Y) to the axis of HV bushings. Rail gauge for movement along the axis of HV bushing (i.e., X-X) shall be 1676.4 mm. The movement in direction perpendicular to transformer HV bushing (i.e., Y-Y axis) direction of rail gauge is 3048 mm.
- The transformer shall be rigidly mounted on wheels resting on rails in concrete foundations. The complete transformers shall be rigidly anchored through wheel assemblies to the foundation using anti-earthquake clamping and locking devices. Rails would be mounted flush with top surface of the foundations.
- Ladders with suitable locking arrangement shall be provided on the side of each transformer for purpose of maintenance.

ANTI EARTQUAKE CLAMPING DEVICE

- To prevent transformer movement during earthquake, clamping device shall be provided for fixing transformer to the foundation. The Supplier shall supply necessary bolts for embedding in the concrete foundation. The arrangements shall be such that the transformer can be fixed to or unfastened from these bolts as desired. The fixing of the transformers to

the foundations shall be designed to withstand seismic events to the extent that a static co-efficient of 0.3 g., applied in the direction of least resistance to that loading will not cause the transformer or clamping devices as well as bolts to be over stressed.

- The details of the device used and its adequacy shall be brought out in the additional information schedule.

CONSERVATOR TANK

- The conservator tank shall have adequate capacity between highest and lowest visible level to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment from minimum ambient temperature to 90 deg.C.

  a) The conservator tank shall be bolted into position, so that it can be removed for cleaning purposes.
  b) The conservator shall be fitted with magnetic oil level gauge with low level electrically alarm contact..
  c) Conservator shall be provided in such a position as not to obstruct the electrical connections of the transformer.
  d) Separate conservator shall be provided for OLTC.

PRESSURE RELIEF DEVICE

02Nos. of pressure relief devices may be provided at suitable locations, which shall be of sufficient size for rapid release of any pressure that may be generated in the tank and which may result in damage to the equipment. The device shall operate at a static pressure of less than the hydraulic test pressure of transformer tank, it shall be mounted direct on the tank. One set of electrically insulated contact shall be provided for alarm / tripping. Separate contact for N2 fire prevention system shall also be provided.

BUCHHOLZ RELAY

A double float type Buchholz relay shall be provided. All the gases evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for flexible pipe connection for checking its operation and taking gas sample. A copper or stainless steel tube, shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling, with the transformer in service. The device shall be provided with two electrically independent ungrounded contacts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure. Separate contact for N2 fire prevention system shall also be provided.

TEMPERATURE INDICATOR

a) Oil Temperature Indicator (OTI)

Transformer shall be provided with a 150mm dial type thermometer for top oil temperature indication. The thermometer shall have adjustable, electrically independent ungrounded alarm and trip contacts, maximum reading pointer and resetting device mounted in the cooler control cabinet. A temperature sensing element suitably located in a pocket on top oil shall be furnished. This shall be connected to the OTI by means of capillary tubing. Accuracy class of OTI shall be plus or minus 1.0% or better.

b) Winding Temperature Indicator (WTI)

A device for measuring the hot spot temperature of each of the windings shall be provided (HV, IV, Tertiary). It shall comprise of the following :-

i) Temperature sensing element.
ii) Image Coil.
iii) Auxiliary CTs, if required to match the image coil, shall be furnished and mounted in the cooler control cabinet.
iv) 150 mm dia local indicating instrument with maximum reading pointer mounted in cooler control cabinet and with two adjustable electrically independent ungrounded contacts (besides that required for control of cooling equipment), one for high winding temperature alarm and one for trip.
v) Calibration device.
vi) In addition to the above, the following indication equipment shall be provided for each winding.
    a) Signal transmitter.
    b) Remote winding temperature indicator, it shall be suitable for flush mounting on RTCC panel (this shall not be repeater dial of local WTI and shall operate by signal transmitter). The difference between local and remote WTI indication at any given time shall not exceed 1 deg. C. One RWTI with four point selector.
    c) Switch shall be provided for all the three windings (HV, IV and Tertiary).
vii) Auxiliary supply, if required, in RTCC panel, for RWTI, shall be 110V DC only.
viii) Accuracy class of WTI shall be plus or minus 1.0% or better.

ix) Any special cables required for shielding purpose for connection between cooler control cabinet and remote winding temperature indicator control circuit shall be in supplier's scope of work.

x) Provide current transducer with OTI & WTI to monitor these parameters on SCADA.

EARTHING TEMINALS

Two(2) earthing pads (each complete with two(2) Nos. tapped holes, M 10 bolts, plain and spring washers) suitable, for connection to 75 x 10 galvanized steel flat shall be provided each at position close to the two(2) diagonally bottom corners of tank. Earthing strip upto the ground level shall be provided by the Bidder.

CORE

- Core shall be constructed from high grade, non-ageing cold-rolled low loss and high Permeability grain oriented silicon steel laminations.
- Each lamination shall be insulated with a material that will not deteriorate due to pressure and the action of hot oil.
- Every care shall be exercised in the selection, treatment and handling core steel to ensure that as far as practicable the lamination are flat and the finally assembled core is free from distortion.
- Oil ducts shall be provided where necessary to ensure adequate cooling. The winding structure and major insulation shall not obstruct the free flow of oil through such ducts. Where the magnetic path is divided into packets by cooling ducts parallel to the plane of lamination or by insulating material above 0.254 mm thick, tinned copper strip bridging pieces shall be inserted to maintain electrical continuity between packets.
- All parts of the core shall be of robust design capable of withstanding any shocks to which they may be subjected to during lifting, transport. Installation and service. The bolts used in assembly of the core shall be suitably insulated and clamping structure shall be so constructed that the eddy currents are minimum.
- The core shall be provided with lugs suitable for lifting the complete core, coil, assembly of the transformers.
- Adequate provision shall be made to prevent movement of the transformer relative to the tank during transport and installation or while in service.
- The supporting frame work of the cores shall be so designed as to avoid the presence of pocket, which would prevent complete emptying of the tank through drain valve or trapping of air during filling.

- The maximum flux density in any part of the core and yoke at normal voltage and frequency and ratio must not exceed 1.53 Tesla.

WINDING

- The winding shall be so designed that all coil assemblies of identical voltage rating shall be inter-changeable and field repairs to the winding can be made readily without special equipment and also to reduce to a minimum the out of balances forces in transformer at all voltage ratios. The coils shall be supported between adjacent section by insulating spacers and the barriers, bracing and insulation used in the assembly of the windings shall be arranged to ensure a free circulation of oil and to reduced hot spots in the windings.

- Insulation of the coils shall be treated with a suitable insulating varnish or equivalent compound to develop the full electrical strength of the winding. All material used in the insulations and assembly of winding shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall be free from insulating composition liable to soften, doze out, shrink or collapse during service.

- All threaded connections shall be provided with locking facilities.

- All leads from the windings to the terminal Board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.

- The windings shall be clamped securely in place, so that they will not displaced or deformed during transit or short circuits. The assembled core & winding shall be vacuum dried and suitably impregnated before removal from treating tank. The copper conductor used in the coil structure should be best suited to the requirements and all permanent current carrying joints in the windings and the leads shall be as per best manufacturing practice to given trouble free service.

- Any metal pieces in contact with laminated rings shall be so designed that they do not weaken the electrical or mechanical properties of the rings.

- Gasket joints shall be provided with mechanical steps to prevent crashing.

- It is desirable that the impulse voltage distribution is measured after the coils are wound (with the help of a surge oscilloscope) and compared with the design values and suitable modifications be done, if deviation found, so as to get stress relieved construction.

- To avoid damage to tertiary winding due to high stress at the time of severe short circuit, it is desirable the some special constructional features like

encasing the tertiary winding in some epoxy compound etc., is done as per bidder practices. Suppliers shall elucidate the constructional features adopted by them for the same. Special constructional and design features adopted for avoiding displacement of coils / clamping structures during dynamic short circuit condition be given.

INSULATING OIL

a) The quality of the oil supplied with transformer shall conform to the oil parameters specified below. No inhibitors shall be used in the oil. The oil used shall be non- PCB (Poly Chlorinated Biphenyl) type. The oil samples will be drawn as follows :-

i) Prior to filling.
ii) Before and after heat run test.
iii) Before energizing.

All tests as per IS: 335 shall be conducted on all samples.

NEUTRAL BUSHING CTs

CT	RATIO	PROTECTION	BUR-DEN	ACCURACY CLASS	MIN. KNEE POINT VOLTAGE	MAX. EXCITING CURRENT	MAX. SEC. RESIS-TANCE IN OHMS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
220 KV	500 / 1 A	REF (Restricted earth fault).	-	PS	300 V	40mA at Vk/2	5.0
33 KV	2000 / 1 A	Earth Fault Protection	-	PS	300 V	40mA at Vk/4	5.0

1 All 60 MVA transformers are to be provided with bushing CT's of following ratio and Particulars :

2. The metering core of all CT's shall be of 30 VA burden, class of accuracy (as per BSS).
3. Over voltage protection devices shall be provided for all the cores of each CT to protect them against heavy current in CT primary, open circuiting or heavy burden of secondary.
4. All CTs shall have bar primaries.
5. Only molded epoxy terminations shall be provided on all the CTs secondary terminals with suitable terminal and cable glands.

SPECIFICATIONS

250 KVA 33/0.415 KV Station Transformers

STANDARDS

The transformers shall conform in all respects to IS:1180 (Part-1):-2014 subject to latest amendment and modifications. In case the provisions of ISS are not clear the provisions of IEC shall apply.

TECHNICAL SPECIFICATION FOR 245/145/36KV SOLID CORE POST INSULATORS

1.0 STANDARDS

Insulators should conform to the latest publications of IS 2544 & IEC in all respects except BIL which should be 1050Kvpfor 245 kV, and 650 kVp for 145 kV withstand. Equipment meeting any other authoritative standards which ensures equal or better quality than the IS mentioned above, is also acceptable.

2.0 **REQUIREMENT FOR INSULATORS**

2.1 **FOR 245 AND 145 KV POST INSULATORS**

(1)	Nominal voltage	245 KV	145 kV
(2)	Highest system voltage	245 KV	145 kV
(3)	Sytem frequency	50Hz.	50 Hz.
(4)	Number of phases	3 (Three)	3 (Three)
(5)	Neutral	Effectively earthed	Effectively earthed
(6)	Short circuit current	40.0 KA	31.5 KA
(7)	Phase to phase spacing	4.5 meters	3.0 meters
(8)	Height of the insulator support structure.	2750 mm.	2750 mm
(9)	PCD of Top Flange	127 mm.	127 mm
(10)	PCD of Bottom Flange	184 + .2 mm.	184+ .2 mm
(11)	BIL	1050 KV	650 mm
(12)	Height of insulator	2300.00mm	1500 mm

2.2 FOR 36 KV POSTINSULATORS

(1)	Nominal voltage	36 KV
(2)	Highest system voltage	36 KV
(3)	Sytem frequency	50Hz.
(4)	Number of phases	3 (Three)
(5)	Neutral	Effectively earthed.
(6)	Short circuit current	25.0 KA
(7)	Phase to phase spacing	1.5 meters
(8)	Height of the insulator support structure.	2750 mm.
(9)	PCD of Top Flange	127 mm.
(10)	BIL	250 KV
(11)	Height of insulator	508.00 mm

TECHNICAL SPECIFICATIONS OF 198 KV/120 KV/30 KV 10KA METAL OXIDE GAPLESS SURGE ARRESTERS

PRINCIPAL PARAMETERS

•	Rated system voltage	245 KV	145 KV	36 KV
•	System neutral earthing	Effectively earthed		
•	Installation	Outdoor		
•	Rated arrester voltage	198 KV	120 KV	30 KV
•	Max. continuous operating voltage (MCOV) at 500C	168 KV	102 KV	24 KV
•	Nominal discharge current	10 KA (8/20 microwave)		
•	Rated frequency	50 Hz		
•	Minimum line discharge capacity	2 KJ / KV		
•	Power frequency reference voltage	Not less than MCOV		
•	Max. Residual voltage at nominal discharge current of 10 KA and 8/20 Micro Sec.	550 KVP	400 KVP	100 KVP

•	Peak & value of high current (4/10 Microwave)	100 KA		
•	Creepage distance	25 mm/KV		
•	Partial discharge test on 1.05 MCOV	Net more than 50 Pico coulombs		
•	One minute power frequency voltage of arrester housing	460 KV	275 KV	70 KV
•	Impulse withstand voltage of arrester housing with 1.2/50 micro second wave.	1050 KVP	650 KVP	170 KVP
•	Minimum prospective fault current.	40 KA		
•	Radio interference voltage	Not more than 500 micro volts.		
•	Pressure relief class	Class-A		
•	Current for pressure relief.	40 KA		
•	Seismic acceleration	0.3 g.		
•	Long duration discharge class	Class 3 (as per IEC)		

The details of the equipments to be protected by these surge arresters are as under :-

Equipment Basic Insulation level

		220 KV	132 KV	33 KV
i)	Transformer 220 KV side	950 KVP	550 KVP	170 KVP
ii)	Switchgears, CTs and CVTs	1050 KVP	650 KVP	170 KVP

TECHNICAL SPECIFICATION OF 198 KV, 10 KA POLYMER HOUSED, METAL OXIDE GAPLESS SURGE ARRESTERS:

CONTROL AND RELAY PANELS

Control and Relay Panels shall consist of separate vertical stationary front panels with equipment mounted thereon and having wiring access from the rear. Each cubicle assembly shall be provided with doors on the rear having handles with built in locking facility. It shall have double leaf doors with lift off hinges at the back for panels of width more than 800 mm.

These panels shall be of the following approximate dimensions: -

Height: 2250mm + 15mm ant vibration pad + 50 mm (base)

Depth: 800mm to 1000mm

Width: 800 mm to 1000 mm

Metering Instruments:

APPLICABLE STANDARDS

The CT PT operated HT energy meter shall be of accuracy Class 0.2s and conform to following standards-

- IS 14697: 1999 — Specification for A.C Static Transformer operated Watt Hour & VAR – Hour meters, class 0.2S & 0.5S
- CBIP Technical Report No. 88 (Revised July 1996 and Amendments & Errata issued in April - 1999 and September'99) — Specification for A.C. Static Electrical Energy Meters.
- IEC – 687 - Alternating current static watt-hour meters for measurement of active energy, class 0.2.
- IS- 3202 Climatic proofing of electrical equipment.
- CBIP technical report – 111 where ever applicable.

PRINCIPAL PARAMETERS

The energy meters shall be indoor/ out door type connected with the secondary side of out door current and voltage transformers.

Sl. No.	Item	Specification
i.	Type of Installation	Indoor(non AC) /Outdoor
ii.	CT secondary	1 A
iii.	VT secondary	110 V/ √ 3 Volts
iv.	Auxiliary AC Supply	230 V+ 10 % to –15%
v.	Auxiliary DC Supply	110 V/220V/ + 10%
vi.	System frequency	50HZ + 5%
vii.	Earthing System	Solidly Grounded

GENERAL TECHNICAL REQUIREMENT

i) Application:	3 phase 4 wire, -/01A
ii) Rated Secondary Voltage:	-/110V AC, 63.5 Volts (Phase to Neutral)
iii) Rated secondary Current (I Basic):	1 Amp balanced & unbalanced load
iv) Maximum Current :	2 Amps.
v) Rated Frequency:	50 Hz.
vi) Accuracy class:	0.2s
vii) Power Factor:	Unity to Zero (all power factor lag to lead).
viii) Power Consumption:	Not more than 1.5Watt per phase(Active) 10 VA (Apparent) Apparent power consumption in each current circuit at basic current and reference frequency shall not exceed 1.0 VA
ix) Phase Sequence Immunity:	Shall be unaffected to phase sequence.

x) Data Transfer Speed from meter to MRI and from MRI to BCS: at least 19200 kbps.

xi) Communication Port: Optical port for MRI and communication port for remote data transfer.

xii) Degree of protection of encapsulation : shall be at IP 51/IP 54 or better.

xiii) Minimum Starting Current – 0.1% of I basic.

RELAYS:

All relays shall conform to the requirements of IS: 3231 or other applicable approved standards. Relays shall be suitable for flush or semi-flush mounting on the front with connections from the rear. Relays shall be rectangular in shape and shall have dust tight, dull black or egg shell black enamel painted cases with transparent cover removable from the front.

TECHNICALSPECIFICATIONS FOR 110/30A BATTERY CHARGERS AND 110V/30A DC DISTRIBUTION BOARDS

REQUIREMENT OF BATTERY CHARGER

TYPE & RATING

Each battery charger shall be of 3 phase type which must be able to meet the above requirement plus 20 Amps station load current on both float and boost charging modes with a voltage variation from 350 V to 470 V A.C. 50 Hz ± 5% separately or simultaneously.

The charger shall be stand-alone, floor mounted indoor type. The panels shall consist of fabricated sheet steel enclosures on the sides, front, rear and top. The rear door of panel shall be in the form of lockable, hinged tight fitting flap door which should close and open without keys. The front and rear sheets shall be folded construction for providing rigidity and strength (without using any frame works or screwed & bolted sheet steel sections) of not less than 14 SWG. All the switches, knob should be such mounted that only their operating handles protrude out of the panel. Suitable support channels shall be provided inside the cubicle. The charger unit will be completely vermin proof and neoprene gaskets will be provided around the edges of the door.

Important identifications/ markings shall be made on anodized plate with etching process (not with screening process) which shall be riveted.

All screws, nuts and bolts shall be rust proof and spring washers shall be provided wherever required.

Terminal blocks should be easily accessible and transparent flexible top covers (easily removable) shall be provided to cover the live parts.

TECHNICAL SPECIFICATIONS OF D.C. DISTRIBUTION BOARDS

The D.C. distribution board shall be similar in construction to the charger having preferably the same height using 14SWG sheet steel. The DCDB shall have single aluminum bus bar arrangement and arrangement for connecting the out put of charger. Automatic switching of D.C.emergency light circuit in the event of A.C. failure shall also be provided.

TECHNICAL SPECIFICATION OF DISC INSULATORS AND CONDUCTORS ETC

STANDARDS

The supply of accessory items covered by this specification shall comply with the latest editions of the Indian standards / IEC and codes of practice. Some of the applicable standards are given below :-

I.S.S No.	Particulars	Remarks
IS.731	Disc insulators	Or any other equivalent International standard
IS. 2544	Porcelain Insulators	- do -
IS. 6005	Code of practice for phosphating Iron & Steel	- do -
IS. 398	ACSR Conductor	- do -
IS. 226	M. S. Bars	- do -

REQUIREMENT OF ANTI-FOG TYPE DISC INSULATORS

A) 220 kV SWITCHYARD

(i) Single suspension string shall be complete with 14 nos. anti-fog type disc insulators and without suspension clamps & fittings.

(ii) Single strain string shall be complete with 16 nos. anti-fog type disc insulators and without strain clamps & fittings.

B) 132 kV SWITCHYARD (For 220 kV & 132 kV Substations)

(i) Single suspension string shall be complete with 9 nos. anti-fog type disc insulators and without suspension clamps & fittings.

(ii) Single strain string shall be complete with 10 nos. anti-fog type disc insulators & without strain clamps & fittings.

PARAMETERS OF DISC INSULATORS

These are required for 220 kV, 132 kV and 33 kV tension and suspension strings. The minimum guaranteed requirements of one unit of each type of insulators shall be as follows :

Anti-fog type insulators shall be of ball and socket type.

For 220 kV &132 kV Busbar Strings

i)	Types of insulator	Anti-fog type
ii)	Electromechanical strength	70

	(kN)	
iii)	Size of Insulator (mm)	280 x 146
iv)	Creepage distance	
	a) Total mm	430
	b) protected mm	290
v)	Power Frequency Flashover Voltage	
	a) Dry kV	100
	b) Wet kV	60
vii)	Power frequency with stand Test voltage	
	a) Dry kV.	85
	b) Wet kV.	50
vii)	50% Impulse 1.2/50 micro sec. Flashover voltage (dry)	
	a) Positive polarity / kV.	175
	b) Negative polarity/ kV.	170
viii)	Impulse 1.2 / 50 micro sec. withstand test voltage.	155
ix)	Power Frequency Puncture Voltage kV.	140
x)	Size of in ball shank in mm	16
xi)	Minimum corona extinction voltage kV. R.M.S.	18
xii)	Max. RIV at 10 kV. RMS.	50 micro Volt

BUS BAR CONDUCTORS

Aluminum strands for ACSR and all aluminum conductors shall be hard drawn from 99.5% pure electrolytic aluminum rods with 61% conductivity.

The steel wire for ACSR conductor shall be manufactured from high tensile steel of 134 to 143 kg. / Sq. mm. quality produced either by the acid or basic open hearth process or by electric process. It shall not contain sulphur or phosphorous exceeding 0.05 percent and total of sulphur or phosphorous shall not exceed 0.085 percent. No wires drawn from Bessemer process steel shall be used.

The surface of the conductor shall be clear and dry . The surface strands shall be smooth and free from burrs and other projections which may cause in creasing corona losses above those occurring on perfectly smooth conductor when used on extra high voltage lines.

TECHNICAL SPECIFICATIONS FOR 63KVA DIESEL GENERATOR

ELECTRICAL SUPPLY SPECIFICATIONS

Nominal voltage : 415V ±10%

No. of Phases : 3 + Neutral

Frequency : 50Hz ± 5%

Neutral earthing : Solidly Grounded

Control supply : 12 / 24V, 2-wire DC

PRINCIPAL TECHNICAL PARAMETERS

The Voltage Transformers shall conform to the following specific parameters:

Sl. No	Parameters	Specification
1	**2**	**3**
1.	Type of installation	Single Phase, Oil filled hermetically sealed and outdoor types
2.	Type of mounting	Pedestal type
3.	Suitable for system frequency	50 Hz ± 5%
4.	Highest system Voltage	245 Kv
5.	Transformation ratio on all windings	220,000 / 110 √3 √3
6.	Method of earthing	Effectively earthed
7.	1.2/50 micro second lightning impulse withstand voltage kV (peak)	1050
8.	1 minute dry power frequency withstand voltage kV (rms)	460
9.	Min. Creepage Distance mm.	6125
10.	Radio interference Voltage at 266 kV	Not exceeding 500 micro volts

REQUIREMENT OF 245 KV CVT

S. No.	DETAILS	PARTICULARS		
1.	Transformation ratio on all windings	220,000 / 110 √3 √3 (No. of secondary windings 3)		
2.	Supply frequency	50 Hz.		
3.	Type	Capacitor voltage type.		
4.	Rated voltage factor	1.2 continuous 1.5 for 30 seconds.		
5.	Application	Winding I Protection	Winding II Protection	Winding III Metering/Synchro.
6.	Accuracy	3P	3P	0.2
7.	Phase angle error	--------- As per IS ----------		
8.	Output burden	150 VA	150 VA	50 VA
9.	Rated capacitance	4400 + 10% - 5%		
10.	Rated total thermal burden	750 VA		
11.	Standard reference range of frequency for which the accuracies are valid.	97% to 103% for protection & 99% to 101% for measurement.		
12. a)	One minute power frequency test on secondary winding.	3 KV (r.m.s.)		
b)	Withstand voltage between low voltage terminal and earth terminal	4 KV (r.m.s.)		
(Note : This test voltage shall be 10 KV (r.m.s.) in the low voltage terminal exposed to weather).				
c)	Radio interference voltage of 266 KV (r.m.s.)	Not exceeding 500 microvolts.		
13.	Corona extinction voltage.	320 KV (r.m.s.)		
15.	Partial discharge level at rated voltage for capacitor divider.	Less than 10 pico coulombs		

TECHNICAL SPECIFICATION FOR 160 MVA, 220/132/11KV, AUTOTRANSFORMERS.

STANDARDS

The transformers shall conform in all respect to latest edition of IS 2026 and CBIP specification.

TYPE RATING AND QUANTITY

The auto transformers shall be of core type constructions, three phase, oil immersed for outdoor service as both step up and step down transformers, with types of cooling mentioned below. The rating and electrical characteristics of transformers shall be as follows :-

i)	Maximum continuous capacity	160 MVA
ii)	Frequency	50 C/s
iii)	No. of phase	3
iv)	Rated Voltage of HV winding	220 KV
v)	Rated Voltage of IV winding	132 KV
vi)	Rated voltage of Auxiliary winding	11 KV
vii)	% age impedance	
	a) HV to IV at normal tap no. 13 at 100% rating.	10%
	b) HV to IV at tap no. 1 at 100% rating.	11%
	c) HV to IV at Tap no. 17 at 100% rating.	11%
	d) HV to tertiary	60% (min.) ---------- (Offers with lower % impedance will not be considered)
	e) IV to tertiary	50% (min.) (Offers with lower % impedance will not be considered)

Note: No reactor either inside or outside the tank shall be used to achieve above %age impedance value.

viii)	Connections		
a)	Series and common winding	------Star-----	
b)	Auxiliary winding	--------delta------	
ix)	Reference voltage group and terminal markings	---HV/LV/Tertiary-- -----YNaod11.	
x)	On load taps steps of	---(-5%) to (+15%) 1.25% each for IV	in equal variation.
xi)	Polarity	----Subtractive----	
xii)	Type of Cooling	ONAN/ONAF/OFAF 80/ 112/ 160 MVA	
xiii)	Rated capacity of auxiliary winding	45 MVA	
xiv)	D.C. Voltage for relays etc.	110 V /220 Volt DC	

All the transformers shall be oil immersed, weather proof Auto-type for outdoor installation in lightening areas. The windings of 3 phase transformers shall be connected Star/Star to conform to vector symbol YNaod11 group no. in accordance with IS 2026-1977 and any amendment thereof.

TECHNICAL SPECIFICATIONS FOR 36 kV ISOLATORS

TYPE OF ISOLATORS

a) Three phase, 1250 A, 36 kV manually operated, Standard isolators without earth switch.

b) Three phase, 1250 A, 36 kV manually operated, Standard isolators with one earth switch.

PRINCIPAL PARAMETERS

DETAILS	**36 kV Isolator**
Rated Voltage	36 kV
System frequency	50 Hz

System Earthing	Effectively earthed
Type of Isolator	Outdoor, Horizontal air break suitable for upright mounting
Continuous current rating	1250 A
Operating mechanism	Manual
Phase to phase spacing	1500 mm
Rated short time withstand current	25 kA (rms)
Rated peak short circuit current	62.5 kA (peak)
Temperature rise	As per IEC-129 derated for an ambient of 50^0C
Seismic co-efficient	0.3 g.
1.2/50 microsecond full wave positive and negative impulse withstand voltage to earth	70 kV (peak)
One minute power frequency withstand voltage dry & wet to earth	70 kV (rms)
Auxiliary Contacts	4 normally open and 4 normally closed.
Insulation level of insulators	
i) Impulse voltage withstand test (1.2/50 micro second full wave)	170 kV (peak)
ii) Power frequency withstand voltage to earth (dry & wet)	70 kV (rms)
Creepage distance of insulators :	
i) Total	900 mm
ii) Protected	450 mm
Minimum strength :	Suitable to withstand wind, short circuit and operating forces
i) Torsional	
ii) Cantilever	
Interlocks with circuit breaker	1 set of electrical and casteltype interlocks.

Type of contacts	Hard drawn electrolytic copper with silver plating
Conductor take off	Horizontal/vertical according to actual requirement.
Phase-to phase clearance	1500 mm

TECHNICAL SPECIFICATIONS FOR 10 MVAR,33KV CAPACITOR BANK

CAPACITOR BANKS

Capacitor banks detailed above shall be complete with the Capacitor unit controlling breaker, manually operated OFF load isolators without earthing switch at bus bar side and with earthing switch at capacitor side, CT, NCT, VT, switching reactors, control & relay panel, necessary mounting racks, insulators, interconnecting materials, bi-metallic terminal connectors, junction boxes and any other material required for satisfactory operation and installation. As per system condition, switching reactor for harmonic suppression are not required.

General arrangements

The capacitor banks shall be out door type suitable for operation in the climatic conditions as detailed on page S-2 Mounting steel racks to be supplied by the tenderer shall be suitable for mounting on plinth. The Tenderers should offer compact design to occupy minimum ground area with least possible height. The bank shall suitable for mounting under the bus bars drawn on ganturies having height as mentioned in clause 3.1.6 of technical specification with due consideration for required clearances. The tender shall be complete with drawing showings the arrangements.

Each capacitor bank shall be in two double star groups of 5MVAR each with separate one number manually operated, OFF load type isolator with earthing switch for each group. Each group of 5MVAR shall be connected in double star formation with their neutral point ungrounded and protected through separate one number NCT. Each star formation shall be of 2.5 MVAR rating at 33KV.

Each capacitor bank shall be complete with all auxiliaries accessories and the following associated equipments:-

Sl. No.	Name of associated equipment	Qty. required for Bank
1	36KV, 3-ph, Circuit Breaker	1 No
2	36KV, 3-ph Isolator without earthing switch	1 No

3	36KV, 3-ph. Isolator with earthing switch	2 No
4	36KV, 1-ph. Current Transformer	3 No
5	36KV, 1-ph Neutral Current Transformer	2 No
6	3-ph. Switching reactor	4 Nos.
7	Control & Relay panel with relays	1 No
8	36KV, 3-ph/ 1-ph voltage Transformers	1/3 Nos.

The number of parallel units in each series group shall be such that failure of one unit shall not preferable creating.

i) More than 5% voltage rise with internal fuse on other units in the bank.

INDIVIDUAL CAPACITOR UNIT

Individual Capacitor Units of 5.485 KV, 276.25 KVAR, rating of Bank shall be self contained, outdoor types, having two bushing to give the required total Bank Capacity at 50Hz. And the Bank compact to occupy minimum ground area with least possible height. The bushing should be of metal coated porcelain and shall be joined to the case by solder sealing method. The Creepage distance of bushing shall not be less than 25mm/KV of voltage stress appearing between the terminal and the case. The bushing shall be suitable for heavily polluted. Atmospheric condition.

The impregnant used shall be non-PCB and the impregnation shall be carried out under high degree of vacuum and the unit shall be of totally sealed type.

Each capacitor unit shall be provided with internal discharge resistors designed to drain out the residual charge up- to 50 volts within less than 10 minutes after disconnection from supply.

Each capacitor unit shall be individually protected by fuse suitably rated for load current. Capacitor to be provided with additional external fuse should have arrangement for visual indication for detection of faulty units.

Each unit shall satisfactorily operate at 130% rated KVAR including the factor of over voltage (referred to rated voltage), harmonic currents and manufacturing tolerance.

Terminal and mounting arrangement may be in accordance with manufacturer’s standard practice, but should be amply proportioned with adequate safety margins.

The Containers of capacitor units shall be of sufficiently thick sheet painted with suitable anti- rust synthetic enamel primer paint and the finishing coats of paint as per the standard practice.

The Capacitor banks shall conform to latest edition of IS: 13925(Part-I: 1998/ IEC-70).

ISOLATORS (WITH AND WITHOUT EARTH SWITCH)

The isolators (with and without earthing switch both) shall be outdoor, manually gang operated, double break, OFF load type, 36kV, 800 amps, 1000MVA, 3 phase, 50 Hz triple pole complying in all respects with the requirements of the latest edition of IS: 9921-1981 and complete with insulators, mechanical and electrical inter locks, bi-metallic terminal connectors suitable for ACSR panther conductor all auxiliaries and accessories.

Current Transformers

The current transformers shall be of the outdoor dead tank type single phase, 50Hz, oil immersed self cooled.

The current transformers shall have following ratings:-

a	Nominal system voltage	33 KV
b	Highest system voltage	36 KV
c	No. of cores	Two
d	system earthing	Effective
e	Transformation ratio	400-200/1/1/A
f	Basic insulation level	170 KV (peak)
g	Short time current rating	25 KA
h	Fault level	1000 MVA
i	Rated output of each core	15 VA
j	Class of accuracy	5-P for protection, 1for metering
k	Max. resistance of secondary winding	5 ohms
l	Accuracy limit factor (protection core)	10
m	Instrument security factor (metering core)	5
n	Cree page distance a) Total b) Protected	 900 mm (Min) 450 mm (min)

The core shall be of high grade, non- ageing electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over current.

Voltage Transformers

The voltage transformer shall be of outdoor type, three phase / single phase, 50 Hz, oil immersed, self cooled.

The voltage transformer shall have the following ratings:-

a	Nominal system voltage	33 KV
b	Highest system voltage	36 KV
c	Frequency	50 Hz
d	System earthing	Effective
e	No. of secondary windings per phase	One
f	Ratio	33000/110 volts √3 / √3
g	Basic insulation level	170KV (peak)
h	Rated burden	100 VA
i	Rated voltage factor (continuous)	1.1.
j	Rated voltage factor (30sec.)	1.5
k	Class of accuracy	3.p
l	Creepage distance a) Total b) Protected	 900 mm (min) 450 mm (min)

The VTs shall conform to the latest edition of IS: 3156. The bushing shall comply with the latest edition of IS: 2099 and IS: 5347.

Neutral Current Transformer

Two NCT shall be required for one set of capacitor bank.

The neutral current transformer shall be as per specifications of CT except that it shall have single core, transformer ration 5/1 and accuracy class for the protection core shall 5 P 10.

Required number of suitable and matching bimetallic terminal connectors along- with required number of cable glands shall be supplied along- with the NCTs. And accordingly the prices may be quoted.

Control & Relay Panel (SAS Based)

The control and relay panels shall conform in all respects to relevant Indian standards. Equipment meeting any other authoritative standard which ensures an equal or better standard than mentioned above may also be considered.

The control and relay panel shall be of floor mounted, indoor free, standing cubicle type. The panels shall consist of fabricated sheet enclosures on the sides, front, rear and top.

The rear of the panels shall be in the form of lockable hinged flap door. The front and rear sheets shall be of folded construction for providing rigidity and strength without using any frame work or screwed or bolted sheet steel sections. The front of the panels which

accommodates most of the mountings shall be fabricated with sheet steel of thickness not less than 10 SWG. For the rest of the panel which carries no weight of the mountings, sheet steel of thickness not less than 14 SWG should be used.

FIBRE OPTIC EQUIPMENTS

Network Configuration and Equipment Characteristics

Introduction

This section describes the Fibre Optic Communication network configuration and the equipment characteristics for communication system to be installed under the project. The sub-systems addressed within this section are:

(1) Fibre Optic Transmission System (FOTS)

(2) Termination equipment Subsystems

(3) Network Management System (NMS)

(4) MDF, DDF and Cabling

Digital Tele-Protection Coupler (Stand (Stand-Alone type)

Protection coupler shall be of modular type having independent Command interfaces.

- Each coupler shall have redundant power supply source.
- Protection command signals shall be suitable for 110/220V DC (site programmable) directly from station battery without involving any intermediate converter. **Opto-coupler Interface shall be provided suitable for 110Volt & 220Volt DC.**
- **Power supply source 110V DC with additional provision for operation on 48V DC.**

BUS SCHEME FOR SUBSTATIONS			
400/220kV Jewar	**220/33kV Cantt (Chaukaghat)**	**220/33kV Vasundhara**	**220/132/33kV Khaga**
400- Double Main Bus Scheme	220- DoubleMain Bus Scheme	220- Double main Bus	220- Double main Bus & Transfer Scheme 132-

220- Double Main Bus Scheme	33- Single Main & Transfer Bus Scheme	scheme 33- Single Main & Transfer Bus Scheme	Double main Bus & Transfer Scheme 33- Single Main & Transfer Bus Scheme.

SPECIFIC TECHNICAL REQUIREMENT FOR COMMUNICATION

IN 220 kV, 132 kV and 33 kV SUBSTATION

In order to meet the requirement for grid management and operation of substations, Transmission Service Provider (TSP) shall conform to the following requirements.

On 220 kV and 132 kV D/C lines one OPGW containing 24 fibers is to be installed in place of conventional earth wire for grid management and substation operationpurpose by STU/CTU and 48 fibers to be installed on LILO lines.

220 kV, 132 kV, 66 kV, 33 kV & 11 kV System

SL No	Description of parameters	220 kV System	132 kV System	66 kV System	33 kV System	11kV System
1.	System operating voltage	220 kV	132 kV	66 kV	33 kV	11 kV
2.	Maximum operating voltage of the system (rms)	245 kV	145 kV	72.5 kV	36 kV	12 kV
3.	Rated frequency	50	50 Hz	50 Hz	50 Hz	50 Hz
4.	No. of phase	3	3	3	3	3
5.	Rated Insulation levels					
	i. Fullwave impulse withstand voltage (1.2/50 micro sec.)	1050 kVp	650 kVp	325 kVp	170 kVp	75 kVp
	ii. One minute power frequency dry and wet withstand voltage (rms)	-	275 kV	140 kV	70 kV	28 kV
6.	Corona extinction voltage	156 kV	105 kV	-	-	-

SL No	Description of parameters	220 kV System	132 kV System	66 kV System	33 kV System	11kV System
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 92 kV rms for132 kV system	1000 micro- volts	500 micro-volts	-	-	-
8.	Minimum creepage distance (25mm/kV)	6125mm	3625mm	1813mm	900mm	300mm
9.	Min. Clearances					
	i. Phase to phase	2100mm	1300mm	750mm	320mm	280mm
	ii. Phase to earth	2100mm	1300mm	630mm	320mm	140mm
	iii. Sectional clearances	5000mm	4000mm	3000mm	3000mm	3000mm
10.	Rated short circuit currentfor1 sec. Duration	40kA/50kA (as applicable)	31.5 kA	31.5 kA	25 kA	25 kA
11.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed	Effectively earthed	Effectively earthed

APPENDIX

FOR

TRANSMISSION LINES

&

400/220 KV GIS SUBSTATION

&

COMMUNICATION SYSTEM

SPECIFIC TECHNICAL REQUIREMENTS FOR 400 KV TRANSMISSION LINES

1.0 The Tower shall be fully galvanized using mild steel or/and high tensile steel sections. Bolts and nuts with spring washer are to be used for connection.

2.0 IS Steel section of tested quality in conformity with IS 2062:2011, grade E 250 (Designated Yield Strength 250 Mpa) and/or grade E 350 (Designated Yield Strength 350 MPa) are to be used in towers, extensions, gantry structures and stub setting templates. However, use of steel grade having designated yield strength more than 350 MPa is not permitted. The steel used for fabrication of towers shall be manufactured by primary steel producers only.

3.0 Towers shall be designed as per IS-802:1995 considering wind zone 4. However, drag coefficient of the tower shall be as follows:-

Solidity Ratio	Drag Coefficient
Upto 0.05	3.6
0.1	3.4
0.2	2.9
0.3	2.5
0.4	2.2
0.5 and above	2.0

As per Clause 12.1.2.1 b) 2) of IS 802:1995, Under security condition for tension and dead end towers, the transverse loads due to line deviation shall be the component of 100 percent mechanical tension of conductor and ground wire/ OPGW corresponding to 100% of design wind pressure at everyday temperature or 36% design wind pressure at minimum temperature after accounting for drag coefficient and gust response factor.

As per CEA's technical standards for construction of lines Regulation 2010, Transmission Service Provider (TSP) may adopt any additional loading/ design criteria for ensuring reliability of the line, if so desired and/ or deemed necessary.

4.0 The conductor configuration shall be as follows:-

4.1 For transmission lines with ACSR conductor:-

Transmission line	ACSR	Sub-conductor

	Conductor specified	Spacing
400kV D/C (Twin Moose) transmission lines	Moose : Stranding 54/3.53mm-Al + 7/3.53 mm-Steel, 597sq mm, Total Sectional Area, 31.77mm diameter	450 mm
400kV D/C (Twin HTLS) transmission lines	HTLS. type- INVAR/ GAP/ Composite Core/ ACSS, 1596A ampacity, 28.62 mm diameter, 0.05552 (Ω/km) resistance	450 mm

Note*: The transmission lines shall have to be designed for a maximum operating conductor temperature of 85 deg C for ACSR only.*

5.0 The required phase to phase spacing and horizontal spacing for 400 kV D/C line shall be governed by the tower design as well as minimum live metal clearances for 400kV voltage level respectively under different insulator swing angles.

a) <u>For 400 kV transmission lines:</u>

The minimum live metal clearances for 400kV D/C transmission lines may be considered as follows:

(i) Under stationary conditions

From tower body:

For 400 kV D/C: 3.05 m

(i) Under swing conditions

Wind pressure Condition	Minimum electrical clearance
a) Nil	3.05 mtrs
b) Swing angle (22º)	3.05 mtrs
c) Swing angle (44º)	1.86 mtrs

However the phase to phase spacing for 400kV D/C line shall not be less than 8.0 m

6.0 The minimum ground clearance for 400 kV D/C transmission lines shall be 8.84 m so that maximum electric field does not exceed 10kV/m within the ROW and does not exceed 5kV/m at the edge of the ROW as per international guidelines.

7.0 The minimum mid span separation between earth wire and conductor shall be 9.0 m for 400 kV D/C transmission lines. Shielding angle shall not exceed 20 deg for 400 kV D/C line D/C transmission lines.

8.0 Transposition is to be done for all transmission lines whose length is greater than 100 km. Transposition should be carried out at 1/3 and 2/3 of the line length tower positions. Transposition of the transmission line after the construction of LILO shall be maintained by the developer. Transposition disturbed from construction of LILO will be set right by the TSP in the resulting Loop in and Loop out Lines as per regulation issued by the competent authority.

9.0 The switching impulse withstands voltage (wet) for 400 kV line shall be 1050 kVp. Lightning impulse withstand voltage (dry) for 400kV line shall be 1550 kVp.

10.0 The Fault current for design of line shall be 63 kA for 1 sec for 400 kV.

11.0 The lines shall be designed for very heavy pollution level (creepage of 31mm/kV as per IEC-60815). Porcelain/ glass/ polymer insulators shall be used in the line as per requirement and site conditions for the transmission lines.

12.0 Each tower shall be earthed such that tower footing resistance does not exceed 10 ohms. Pipe type or Counterpoise type earthing shall be provided in accordance with relevant IS. If the value (before stringing) has been recorded higher than 10 ohm, earthing shall be changed to Counterpoise type. Additional earthing shall be provided on every 7 to 8 kms distance at tension tower for direct earthing of both shield wires.

13.0 The required grade of concreate and mix design for foundation of transmission line tower shall be as per relevant IS.

14.0 Technical specification for 400kv line on Monopole

i) The monopoles are of the following types:

400 kV Double Circuit (PA, PB, PC & PD)

Classification of Monopole/Towers

The Pole for 400 kV Lines are classified as given below:-

a) For Suspension Pole PA (0-2 deg.)

Normal Span	:	200m
Wind Span	:	200m
Weight Span	:	300m

b) For Tension Pole PB (2-15 deg.)

Normal Span : 200m

Wind Span : 200m

Weight Span : 300m

c) For Tension Pole PC (15-30 deg.)

Normal Span : 200m

Wind Span : 200m

Weight Span : 300m

d) For Tension Pole PD (30-60 deg.)

Normal Span : 200m

Wind Span : 200m

Weight Span : 300m

ii) **Broken wire Conditions**:

For Suspension pole (PA)	:	One Earthwire or One Conductor broken at a time, whichever is more stringent for a particular section.
For Tension pole (PB)	:	One Earthwire and any One Conductor broken or any two conductor broken at a time on same side, whichever is more stringent for a particular section.
For Tension pole (PC)	:	One Earthwire and any One Conductor broken or any two conductor broken at a time on same side, whichever is more stringent for a particular section.
For Tension pole (PD)	:	One Earthwire and any Two Conductor broken or any Three conductor broken at a time on same side, whichever is more stringent for a particular section.

Code Reference

Load Calculation : IS 802

Sag & Clearance : IS: 5613 CBIP Manual

Deflection Criteria: 5% of height of pole @ ultimate load conditions and 2% of the height of pole @ everyday condition (safety normal)

iii) **Ground Clearance**

The minimum ground clearance from the bottom conductor shall not be less than 8840 mm for 400KV lines at the maximum sag conditions i.e. at 85° C and still air.

An allowance of 150mm shall be provided to account for errors in stringing.

Conductor creep shall be compensated by over tensioning the conductor at a temperature of 26°C lower than the stringing temperature for ACSR ,MOOSE conductor.

iv) **Electrical System Data for 400 kV line**

1.	Nominal Voltage	kV	400
2.	Maximum system voltage	kV	420
3.	BIL (Impulse)	kV (Peak)	1550
4.	Power frequency withstand voltage (Wet)	kV (rms)	680
5.	Switching surge withstand voltage (Wet)	kV (rms)	1050
6.	Minimum Corona extinction voltage at 50 Hz AC system under dry condition	kV (rms) phase to earth.	320(Min)
7.	Radio interference voltage at one MHz for phase to earth voltage of 305 KV under dry condition.	Micro Volts	1000 (Max)

v) **Details of line Material: earthwire & OPGW**

Sl. No.	**Description**	**Earthwire**	**OPGW (tentative)**
1.	Type	7/3.66mm GS Earthwire	24 fibre OPGW
2.	Stranding and wire diameter		
	Aluminium	-	
	Steel	7/3.66	
3.	Conductor per phase	NA	NA

4.	Spacing between conductor of same phase(sub conductor spacing)(mm)	NA	NA
5.	Configuration	One continuously to run horizontally on top of the towers and conductors.	One continuo-usly to run on top of the towers and conductors
6.	Overall Diameter (mm)	10.98	≈ 10.98
7.	Unit mass (kg/km)	583	≈ 583
8.	Min. UTS (kN)	68.4	Equivalent to earthwire

15.0 For crossings design, installation and maintenance of overhead power lines shall be as per IS:5613 or latest amendments.

SPECIFIC TECHNICAL REQUIREMENTS FOR 400/220 KV SUBSTATION

The proposed 400/220 kV Jewar (2x500 MVA) substation shall be Gas Insulated Switchgear (GIS) type generally confirming to the requirement of CEA regulation for construction of sub-station.

1.0 Salient features of 400/220kV GIS Substation Equipment and Facilities

The design and specification of substation equipment are to be governed by the following factors:

2.0 Insulation Coordination

400kV System would be designed to limit the Switching overvoltage to 2.5 pu and is expected to decay to 1.5 p.u. in 5 to 6 cycles. Consistent with these values and protective levels provided by lightning arrestors, the following insulation levels are proposed to be adopted for 400 KV & 220kV systems:

Sl. No.	Particulars	400kV	220kV
a.	Impulse withstand voltage for - Transformer and reactors	1300kVp	950kVp
	- for Other Equipment	1425 kVp	1050 kVp
	- for insulator strings	1550kVp	1050 kVp
b.	Switching surge withstand voltage	1050 kVp	-NA-
c.	Minimum creepage distance - for insulator strings	13020mm	7595 mm
	- for other equipment	13020mm	7595 mm
d.	Max. fault current	63 kA	40 kA
e.	Duration of fault	1 Sec	1 Sec
f.	Corona extinction voltage	320kV rms	156kV rms

3.0 Switching Schemes

It is essential that the system should remain secured even under conditions of major equipment or bus-bar failure. Sub-stations being the main connection points have large influence on the security of the system as a whole. The selection of the bus

switching scheme is governed by the various technical and other related factors. One & Half breaker bus scheme has been considered for 400kV side of the substation due to their merits in terms of reliability, security, operational flexibility and ease of maintenance of equipment.

Substation	Bus Scheme
400/220 kV (2×500 MVA) GIS Substation at Jewar	400 kV- Double Main Bus Scheme 220 kV- Double Main Bus Scheme

4.0 Substation Equipment and Facilities

The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All equipments shall be designed considering the transmission line capacity.

Current rating for various feeders & bus bar are as follows

Sl. No	Description of bay	400 kV	220 kV
1	Bus Bar	4000A	3000A
2	Line bays	3150	1600A
3	ICT bays	3150	1600A
4	Bus Reactor bays	3150	NA
5	Bus coupler bays	NA	2500A

4.1 400/220KV GIS Substation equipment

GIS (Gas Insulated Switchgear) shall be indoor type and in accordance to IEC: 62271-203. The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All the switchgear such as Circuit Breaker, isolator, earth switch including CT, PT etc. shall be GIS type. Surge Arrestors used for transformer/Reactor connections will be AIS or GIS type. 400kV scheme shall be designed in such a way that it shall be possible to use line reactors (if provided) as bus reactors, in case of outage of line, to control bus voltage. Local control cabinets (LCC) shall be provided as per requirement. The alarm & annunciation of GIS equipment shall be wired to SCADA System.

4.1.1 Circuit Breakers

GIS Circuit breakers shall in general be of C2-M2 class and comply to IEC- 62271-100. The rated break time shall not exceed 40 ms for 420KV breaker and 60 ms for 245kV breaker. 420 kV & 245 kV Circuit breakers shall be provided with single phase and three phase auto reclosing. The Circuit breakers controlling 400kV lines of more than 200km length shall also be provided with pre insertion closing resistor of about 400 ohms maximum with 9 ms minimum insertion time. The short line fault capacity shall be same as the rated capacity and this is

proposed to be achieved without use of opening resistors. The short line fault capacity shall be same as the rated capacity and this is proposed to be achieved without use of opening resistors. Control switching device shall be provided in Circuit breaker of switchable line reactor and in Main & Tie circuit breakers of Transformers, line with non-switchable line reactors and Bus reactors. Further, it shall be possible to use line reactors as bus reactors, in case of outage of line.

4.1.2 Isolators

The isolators shall comply to IEC 62271-102 in general. Isolators shall be motor (DC powered) operated. Earth switches are provided at various locations to facilitate maintenance. Main blades and earth blades shall be interlocked and interlock shall be fail safe type. All earth switches shall be motor operated type.

4.1.3 Current Transformers

Current Transformers shall comply with IEC 61869 in general. All ratios shall be obtained by secondary taps. Generally, Current Transformers (CT) shall have five cores (four for protection and one for metering) whereas; CT in Tie bays shall have six cores (four for protections & two for metering) suitably distributed on both sides of CB. The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry. Accuracy class for protection core shall be PX and for metering core it shall be 0.2S.

4.1.4 Voltage Transformer

The voltage transformers shall conform to IEC- 61869 Voltage transformers shall be of the electromagnetic type with SF6 gas insulation. The earth end of the high voltage winding and the ends of the secondary winding shall be brought out in the terminal box. The voltage transformers shall be located as a separate bay module and will be connected phase to ground and shall be used for protection, metering and synchronization. The voltage transformers shall be of inductive type, nonresistant and shall be contained in their own- SF6 compartment, separated from other parts of installation. The voltage transformers shall be effectively shielded against high frequency electromagnetic transients. The voltage transformers shall have three secondary windings. The voltage transformer should be thermally and dielectrically safe when the secondary terminals are loaded with the guaranteed thermal burdens. The accuracy class for core –I & II for 400 kV shall be 0.5/3P and for 220 kV shall be 3P. The accuracy of 0.2 on secondary III should be maintained throughout the entire burden range up to 50VA on all the three windings without any adjustments during operation.

4.1.5 SF6 to Air Bushing

Outdoor bushings, for the connection of conventional external conductors to the SF6 metal enclosed switchgear, shall be provided. Bushings shall generally be in accordance with the requirements of IEC -60137. The creepage distance over the external surface of outdoor bushings shall not be less than 31 mm/kV considering

polluted area. SF6 to air Bushing shall be of Polymer / composite type and shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition. The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137. Polymer / composite insulator shall be seamless sheath of a silicone rubber compound. The housing & weather sheds should have silicon content of minimum 30% by weight. It should protect the bushing against environmental influences, external pollution and humidity. The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217.

4.1.6 Capacitor Voltage Transformers

Capacitive Voltage transformers shall comply to IEC 61869-1 & 61869-5 in general. These shall have three secondaries out of which two shall be used for protection and one for metering. Accuracy class for protection cores shall be 3P and for metering core shall be 0.2. The capacitive voltage transformers on lines shall be suitable for Carrier Coupling. The Capacitance of CVT for 400kV and 220kV shall be of 4400/8800 pF depending on PLCC requirements.

4.1.7 Surge Arresters

Station class current limiting, heavy duty gapless type Surge arresters conforming to IEC 60099-4 in general shall be provided.

The rated voltage of Surge arrester and other characteristics are chosen in accordance with system requirements. Surge arresters shall be provided near line entrances, transformers so as to achieve proper insulation coordination. Surge arrester should be providing with porcelain / polymer housing.

4.1.8 Power Transformers

CODES AND STANDARDS

The latest revisions of the following Codes and Standards shall be applicable for the equipment/material covered in this Specification. In case of conflict, the manufacturer may propose equipment/material conforming to one group of Industry Codes and Standards quoted hereunder without jeopardizing the requirement of this specification:

IEC60044	Instruments transformers
IEC60076	Power transformers
IEC60137	Insulating bushing for alternating voltages above 1000 V
IEC60214	On-load tap-changers
IEC60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V

IEC 60282-2	High-voltage fuses
IEC60289	Reactors
IEC60529	Degrees of protection provided by enclosures (IPCode)
IEC60815 conditions	Guide for the selection of insulators in respect of polluted
IEC60947	Low-voltage switchgear and control gear

Design and Construction Requirements

Core

1. The core shall be assembled with oriented grain steel, cold rolled sheet, and treated with an insulating layer heat and oil resistant.
2. The core supports shall be designed to counter the effects of marine and overland transport under poor conditions. The air core reactance of the core shall be less than 20%.

Over Fluxing

The transformer shall withstand without injurious heating combined voltage and frequency fluctuations which produce the following overfluxing conditions and give desired performance:

- 105% for 10minutes
- 125% for 1minute
- 140% for 5seconds
- Bidder shall provide the overvoltage withstand time for 150% and 170% over fluxing

(a) Transformer shall conform to IEC 60076 in general. The transformer and all its accessories including bushing/ built in CTs etc shall be designed to withstand thermal and mechanical stresses caused by symmetrical or asymmetrical faults on any terminals. Mechanical strength of the transformer shall be such that it can withstand 3-phase and 1- phase through fault for transformer rated voltage applied to HV and / or IV terminals of transformer. The short circuit shall alternatively be considered to be applied to each of the HV, IV and tertiary (LV) transformer terminals. Tertiary is not considered to be connected to source.

Core shall be constructed from high grade, non-ageing cold rolled super grain oriented silicon steel laminations (HI-B or better grade). The maximum flux density in any part of the core and yoke at the rated MVA, voltage and

frequency shall not exceed 1.9 Tesla at all tap positions during 10% continuous over voltage condition. Transformers shall withstand without damage and over-heating due to over fluxing conditions of 110 % for continuous, 125 % for 1 minute and 140 % for 5seconds.

All the windings shall be capable of withstanding the Dielectric, mechanical and thermal stresses which may be caused by switching, dead short circuit on its terminals. Transfer surge at tertiary shall not exceed 250kVp during impulse and switching impulse from HV & IV Terminals. The tertiary windings shall be suitable for connection of reactors or capacitors which would be subjected to frequent switching and shall be suitable for connection to LT Transformer for auxiliary supply. The air core reactance of HV winding of transformer shall not be less than 20% for 400kV class Transformer. External or internal reactors shall not be used to achieve the specified HV/LV and IV/LV impedances.

Transformers shall be fitted with two cooler banks, each capable of dissipating 50 per cent of the loss at continuous maximum rating. Transformer shall be capable of operating at full load for 20 minutes in the event of failure of the oil circulating pump or blowers associated with one cooler bank and for at least ten (10) minutes in the event of total failure of power supply to cooling fans and oil pumps, without winding hot spot temperature exceeding 140 deg C. Transformer shall be designed so that tank hotspot shall not exceed 130 deg C, considering maximum ambient temperature of 50ºC.

The transformer shall be complete with all required accessories, Bushing CTs, Neutral CT (outdoor type), cooler control cabinet, individual and common marshalling box, RTCC etc as required for satisfactory operations of transformer. The transformer shall be provided with IEC 61850 compliant digital RTCC relay having automatic voltage regulating features to operate OLTC including parallel operation of transformers. Neutral of the transformer shall be solidly grounded.

HV and IV bushing shall be RIP (Resin Impregnated Paper)/RIS (Resin Impregnated Synthetic) with composite insulator type. LV bushing shall be OIP/RIP/RIS. 36kV Neutral bushing shall be solid porcelain or oil communicating type.

The major technical particulars / parameters of transformer are given below:

(A) 500MVA, 400/220/33kV, 3-Phase Auto transformer (applicable standard: IEC-60076)

Sl. No.	Description	Unit	Technical Parameters
1.	Rated Capacity: HV/IV/LV (Tertiary)	MVA	500/500/167 (Active loading of tertiary: 5 MVA)
2.	Voltage ratio (Line to Line)		400/220/33
3.	Frequency	Hz	50
4.	No. of Phase	Nos	3
5.	Vector Group (unless specified differently elsewhere)		YNa0d11
6.	Cooling		ONAN/ONAF/(OFAF or ODAF) OR ONAN/ONAF1/ONAF2
7.	Rating at different cooling above	%	60/80/100
8.	Type of Transformer		Constant Ohmic impedance type
9.	Impedance at 75 Deg C		
a)	HV – IV (with tolerance as per IEC)	%	At Max./ Principal/ Min. Voltage Tap: 10.3/12.5/15.4
b)	HV - LV	%	At Principal tap(minimum) : 60
c)	IV - LV	%	At Principal tap (minimum):
			45
10.	Losses		
a)	Maximum No-Load Loss at rated voltage and frequency	kW	90
b)	Maximum Load Loss at rated current and 75^0C	kW	500
c)	Maximum I^2R Loss at rated current and frequency and at 75^0C for HV and IV windings	kW	375
d)	Maximum Auxiliary Loss at rated voltage and frequency	kW	15
11.	Max. Temperature rise over 50 deg C ambient Temp	Deg. C	Top oil: 50 & Winding: 55
12.	Windings		
i)	Insulation Level (LI/SI/PF)		kVp/kVp/kVrms
	HV		1300/1050/570
	IV		950/-/395
	LV		250/-/95
	Neutral		95/-/38
ii)	Tan delta of winding	%	< 0.5

Sl. No.	Description	Unit	Technical Parameters
13.	Tap Changer & Tappings		OLTC with range ? 10% for HV variation in the step of 1.25%, 17 steps, on 220kV side of series winding
14.	Maximum Partial discharge (PD) level at 1.58*Ur/√3	pC	100
15.	Noise level at rated voltage and at principal tap at no load and all cooling active	dB	< 80
16.	Bushing		
i)	Rated voltage (HV/IV/LV/Neutral)	kV	420/245/52/36
ii)	Rated current(Min.) HV/IV/LV/Neutral	A	1250/2000/3150/2000
iii)	Insulation Level (LI/SI/PF)		kVp/ kVp/ kVrms
	HV		1425/ 1050/ 630
	IV		1050/ -/ 460
	LV		250/ -/ 95
	Neutral		170/ -/ 75
iv)	Tan delta of bushings HV/IV/LV	%	< 0.4
v)	Max. PD of bushings at level @ 1.5 pu	pC	100
17.	Insulating Oil		virgin high grade inhibited, conforming to IEC-60296

4.1.9 125 MVAR Bus Reactors

Reactor shall conform to IS:5553 and IEC 60076-6 in general.

The Technical Particulars / Parameters of Shunt Reactor are given below:

REACTOR (3-PHASE)

(i)	Power	125 MVAR Bus Reactor
(ii)	Rated voltage	420 kV(1.0 p.u)
(iii)	System fault level	50 kA
(iv)	Connection	Star with neutral brought out
(v)	**Winding Insulation level**	
a)	Lightning impulse 1.2/50microseconds withstand voltage	1300 kV (peak)

b)	Switching surge withstand voltage	1050 kV (peak)
)`	One minute power frequency withstand voltage	NA
(vi)	Maximum admissible Temperature Rise over an ambient temp of 50 deg. C and at highest Voltage	
a)	Winding measured by resistance method	45 degree C
b)	Top oil measured by thermometer	40 degree C
(vii)	Cooling system	ONAN
(viii)	**Insulation level of Neutral**	
a)	Impulse withstand voltage	550 kV (peak)
b)	Power frequency voltage	230 kV (rms)
c)	Whether neutral is to be brought out	Yes (through 145kV class bushing)
(ix)	Ratio of zero sequence reactance to positive reactance (X0/X1)	Between 0.9 and 1.0 (The bidder must clearly specify the exact figure)
(x)	Range of constant impedance	Upto1.5p.u.voltage (The bidder shall furnish complete saturation characteristics of the reactor up-to 2.5 p.u. voltage).
(xi)	Tolerance on current	0 to +5%
(xii)	Harmonic content in phase	The crest value of the third harmonic current component in phase current not to exceed 3% of the crest value of fundamental, when reactor is energized at rated voltage with sinusoidal wave form.
(xiii)	Permissible current unbalance among different phases	±2%
(xiv)	Minimum clearance in air at rated voltage of 420 kV with terminal connector	
a)	Phase to Phase	4000mm

<table>
<tr><td>b)</td><td>Phase to ground</td><td>3500mm</td></tr>
<tr><td>(xv)</td><td>Noise level at rated voltage and frequency</td><td>80 db.</td></tr>
<tr><td>(xvi)</td><td>Vibration level at rated voltage and frequency</td><td>Not more than 200 microns peak. Average vibration shall not exceed 60 microns peak to peak Tank stresses shall not exceed 2.0 kg/mm² at any point on the tank</td></tr>
<tr><td>(xvii)</td><td colspan="2"><table>
<tr><td>Bushings</td><td>Line side</td><td>Neutral side</td></tr>
<tr><td>a) Rated voltage</td><td>420 kV</td><td>145 kV</td></tr>
<tr><td>b)Creepage distance (total)</td><td>10500 mm</td><td>3625 mm</td></tr>
<tr><td>c)Mounting</td><td>Tank Cover</td><td>Tank Cover</td></tr>
<tr><td>d)Lightning impulse withstand voltage (kVp)</td><td>1425</td><td>650</td></tr>
<tr><td>e)Switching impulse withstand voltage (kVp</td><td>1175</td><td>-</td></tr>
<tr><td>f) Power frequency with stand voltage (kV) (rms)</td><td>630</td><td>275</td></tr>
<tr><td>g) Rated current (Amps)</td><td>800</td><td>800</td></tr>
</table></td></tr>
</table>

4.1.10 Protection and Control

The protective relaying system proposed to be provided for transmission lines, auto-transformers, reactors and bus bars to minimize the damage to the equipments in the events of faults and abnormal conditions, is dealt in this section. All main protective relays shall be numerical type with IEC 61850 communication interface. All numerical relays shall have built in disturbance recording feature.

a) Transmission Line Protection

400 kV, 220 kV and 132 kV lines shall have MAIN-I numerical three zone distance protection scheme with carrier aided inter-tripping feature. 400 kV, 220 kV and 132 kV lines shall also have MAIN-II numerical distance protection scheme like Main-I but from different make that of MAIN-I. Line Current Differential as Main–I & Main-II may be considered, for short lines (line length below 30 km) having Fibre Optic communication link. In case of loop in loop out of transmission lines, the existing protection scheme shall be studied and suitable up-gradation (if required) shall be carried out.

All 400 kV lines shall also be provided with two stages over voltage protection. Further, all 400 lines shall be provided with single and three phase auto-reclosing facility to allow reclosing of circuit breakers in case of transient faults. These lines shall also be provided with distance to fault locators to identify the location of fault on transmission lines.

a) These shall have the following protections:

i) Numerical Differential protection
ii) Numerical Restricted earth fault protection
iii) Numerical Over-current and earth fault protection on HV & MV side
iv) Numerical Over fluxing protection on HV & MV side
v) Numerical Overload alarm

Besides these, power transformers shall also be provided with BUCHOLZ relay, protection against high oil and winding temperature and pressure relief device etc.

b) 420kV Reactor Protection

Reactor shall be provided with the following protections:

i) Numerical Differential protection

ii) Numerical Restricted earth fault protection

iii) Numerical Back-up impedance protection

Besides these, reactors shall also be provided with Bucholz relay, protection against oil and winding temperatures & pressure relief device etc.

c) Numerical Bus Bar Protection

The high speed bus bar differential protection, which is essential to minimize the damage and maintain system stability at the time of bus bar faults, shall be provided for 400kV, 220kV and 132kV buses. Duplicated busbar protection is envisaged for 400kV bus-bar protection. Bus bar protection scheme shall be such that it operates

selectively for each bus and incorporate necessary features required for ensuring security. The scheme shall have the provision for future expansion. For existing substations, the existing bus bar protection shall be augmented wherever required.

d) Numerical Local Breaker Back up Protection

This shall be provided for each 420 kV, 245 kV and 145 kV breakers and will be connected to de-energize the affected stuck breaker from both sides.

e) Substation Automation System

For all the new substations, state of art Substation Automation System (SAS) conforming to IEC-61850 shall be provided. The distributed architecture shall be used for Substation Automation system, where the controls shall be provided through Bay control units. The Bay control unit is to be provided bay wise for voltage level 132kV and above. All bay control units as well as protection units are normally connected through an Optic fibre high speed network. The control and monitoring of circuit breaker, dis-connector, re- setting of relays etc. can be done from Human Machine Interface (HMI) from the control room. SAS shall be equipped with the facility of remote operation and by providing remote HMI and suitable communication link, the substation can be controlled from a remote location. Necessary gateway & modems (as required) shall be provided to send data to RLDC/SLDC.

The functions of control, annunciation, disturbance recording, event logging and measurement of electrical parameters shall be integrated in Substation Automation System. The Automation System shall be provided with the facility of communication and control for remote end operation. In existing Substations where Substation automation is not provided, control functions shall be done through control panels.

f) Time Synchronization Equipment

Time synchronization equipment complete in all respect including antenna, cable, processing equipment required to receive time signal through GPS or from National Physical Laboratory(NPL) through INSAT shall be provided. This equipment shall be used to synchronize SAS & IEDs etc.

4.1.11 Control Concept

All the EHV breakers in substation/switching stations shall be controlled and synchronized from the switchyard control room and remote control centre. Each breaker would have two sets of trip circuits which would be connected to separately fused DC supplies for greater reliability. All the isolators shall have control from remote/local whereas the earth switches shall have local control only.

4.1.12 PLCC

Power line carrier communication (PLCC) equipment complete for speech transmission line, tele-protection commands and data channels shall be provided on each 400 KV , 220 kV and 132 kV transmission line. The protections for transmission line and the line compensating equipment shall have hundred percent back up communication channels. The PLCC equipment shall in brief include the following:-

Coupling device, line traps, carrier terminals, protection couplers, HF cables, PABX and maintenance and testing instruments.

A telephone exchange (PABX) of 24 lines shall be provided at new substations as means of effective communication among various buildings of the substation, remote end substations and with control centres (RLDC/SLDC) etc.

Coupling devices shall be suitable for 4400pF 400kV , 220 kV and 132 kV CVT. Phase to phase coupling for 400 kV line , 220 kV and 132 kV single circuit line shall be provided. For D/c line Inter circuit coupling can be provided. The pass band of coupling devices shall have sufficient margin for adding communication channel in future if required. Necessary protection devices for the safety of personnel and low voltage part against power frequency voltages and transient over voltage shall also be provided.

The line traps shall be broad band tuned suitable for blocking the complete range of carrier frequencies. Line Trap shall have the necessary protective devices such as lightning arresters for the protection of tuning device and shall be equipped with corona rings. Decoupling network consisting of line traps and coupling capacitors may also be required at certain substation in case of extreme frequency congestion.

The carrier terminals shall be of single side - band (SSB) amplitude modulation (AM) type and shall have 4 kHz band width. PLCC Carrier terminal & Protection coupler shall be considered at both ends of line.

Wherever Fiber Optic/OPGW based telecommunication terminal equipment (i.e. SDH/MUX) are being provided; the same shall be utilized for Data, Voice and line protection applications. For protection purposes, both end Digital Protection Couplers (DPCs) shall be included at both ends. However, for line protection application, back up communication channel/link may be considered as per requirement so as to take care of OPGW/Telecommunication equipment outage.

Addition /Modification /shifting/re-commissioning etc. as required of PLCC due to LILO of transmission lines shall be covered under the scope according to element wise detailed given below:-

Sr. No	**Detail of element (line)**	**Coverage under the scope**
1	LILO of one ckt. of 400 kV Gr. Noida (765 kV) – Sector-148 (400) Noida DC line at 400/220 kV GIS substation	Addition/Modification/ shifting/re-commissioning of PLCC shall be covered under the

	Jewar (GautamBudh Nagar) (for LILO, twin HTLS conductor and OPGW stringing work on Narrowbase multi circuit towers)	scope.

PLCC equipment for the transmission lines at serial 01 covered under the package (Consisting of one set of analog PLCC channel along with circuit protection coupler and one set of Digital Protection Coupler for both ends of one line segment due to LILO of existing line) shall be provided by the bidder. All other associated equipment for ends cabling, coupling device and HF cable shall also be provided by the bidder. 48 V DC Power supply for PLCC panels shall be provided by the respective substation bay owner. The wave traps, CVT's required for communications from PLCC shall be provided by respective substation owner.

4.1.13 Substation Support Facilities

Certain facilities required for operation & maintenance of substations as de- scribed below shall be provided in new substation. In existing substation, these facilities have already been provided and would be extended/ augmented, wherever required.

4.1.14 AC & DC Power Supplies

For catering to the requirements of three phase & single phase AC supply and DC supply for various substation equipment, the following arrangement is envisaged:-

i) For LT Supply at each new Substation, two (2) nos. 630 kVA LT Transformers shall be provided out of which one shall be connected with SEB supply and other one shall be connected to tertiary of 400/220 kV transformer.

ii) SEB supply at 33kV level shall be connected to 630kVA LT transformer through 33kV AIS equipments i.e. LA, CT, PT, Isolators and breaker where as tertiary supply of 400/220kV transformer shall be connected to LT transformer through 72.5kV AIS equipments.

iii) 2 Nos. batteries of 220V for control & protection and 2 Nos. 48V batteries for PLCC/ Communication equipment shall be provided at each new Substation. Each battery bank would have a float-cum-boost charger. Battery shall be of VRLA type.

iv) Suitable AC & DC distribution boards and associated LT Switchgear would be provided at new Substations. For Substation Extensions, existing facilities shall be augmented as required. For new substations following switch boards with minimum rating as is specified here under shall be considered with duplicate supply

a) 415V Main switch board – 1no.

b) AC distribution board – 1no.

c) Main lighting distribution board –1no.

d) Emergency lighting distribution board –1no.

e) 220 volt DC distribution board –2nos.

f) 48 volt DC distribution board –2nos.

v) In new Substations, one No. 250 KVA DG set shall be provided for emergency applications Sizing of Auxiliary system (like battery, charger, LT switchgear) may be done considering future bay requirements to avoid replacement in future with higher sizes.

4.1.15 Fire Fighting System

Fire fighting system in general conforms to fire insurance regulations of India. The fire fighting system is proposed with both AC motor & diesel engine driven pumps housed in a fire fighting pump house building along with water storage tank of adequate capacity. Automatic heat actuated mulsifying system is proposed for transformers & reactors. In addition for alarm system based on heat/smoke detectors are proposed to be installed at sensitive points in a substation e.g. Cable Vault, Control Room building and other buildings etc. Further, adequate water hydrants and portable fire extinguishers shall be provided in the substations. At existing substations the fire fighting systems if already available, would be extended for meeting the additional requirements.

4.1.16 OIL EVACUATING, FILTERING, TESTING & FILLING APPARATUS

To monitor the quality of oil for satisfactory performance of transformers, shunt reactors and for periodical maintenance necessary oil evacuating, filtering, testing and filling apparatus would be provided at new substations. Oil tanks of adequate capacities for storage of transformer oil would be provided.

4.1.17 Illumination

Adequate normal & emergency AC & DC illumination shall be provided in the control room, GIS hall & other buildings of the substation. The switchyard shall also be provided with adequate illumination. The entire control room building, fire fighting pump house lighting shall be done by LED based low power consumption luminaries

4.1.18 Control Room

Substation control room would be provided to house substation work station for station level control (SAS) along with its peripheral and recording equipments, AC & DC distribution boards, DC batteries & associated battery chargers, Fire Protection panels, Telecommunication panels & other panels as per requirements. Air conditioning will be provided in the building as functional requirements.

4.1.19 GIS Hall

The Gas Insulated Switchgear (GIS) of each voltage other associated equipment shall be housed separately and inside in the GIS buildings. The panels i.e. Bay level units, bay mimic, relay and protection panels, RTCC panels, PLCC panels etc. are to be placed in a separate room in the GIS building. The size of the room shall be such that all the panels for the future bays/ diameters shall be accommodated in the above room. The panel room shall be air-conditioned. Further, the temperature of the room shall be monitored through substation automation system by providing necessary temperature transducers.

One EOT Crane each for GIS hall of suitable capacity shall be provided for erection & maintenance of largest GIS component/assembly and all plant installed in the GIS switchgear room. The crane shall capable of fulfilling all special requirements for erection & maintenance of GIS equipment The capacity of the crane shall be sized to lift the heaviest GIS switchgear component.

SPECIFIC TECHNICAL REQUIREMENT FOR 400 KV and 220 KV COMMUNICATION

In order to meet the requirement for grid management and operation of substations, Transmission Service Provider (TSP) shall conform to the following requirements.

On 400 kV D/C transmission lines one earth wire and one OPGW containing 24 fibers is to be installed by the TSP in place of conventional earth wire during the construction of line for grid management and substation operation purpose by STU/CTU and 48 fibers to be installed on LILO lines. The installation of OPGW shall be done from gantry of one substation up to gantry of another substation and shall be terminated in a joint box by the TSP at both ends.

On 220 kV and 132 kV D/C lines one OPGW containing 24 fibers is to be installed in place of conventional earth wire for grid management and substation operation purpose by STU/CTU and 48 fibers to be installed on LILO lines.

400 kV & 220 kV System Parameters

Sr. No	Description of parameters	400 kV System	220 kV System
1.	System operating voltage	400 kV	220 kV
2.	Maximum operating voltage of the system	420 kV	245 kV
3.	Rated frequency	50 HZ	50 HZ
4.	No. of phase	3	3
5.	Rated Insulation levels		
	i. Full wave impulse withstand voltage (1.2/50 micro sec.)	1550 kVp	1050 kVp
	ii. Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	1050 kVp	-
	iii. One minute power frequency dry withstand voltage (rms)	630 kV	-
	iv. One minute power frequency dryand wet withstand voltage (rms)	-	460 kV
6.	Corona extinction voltage	320 kV	156 kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765 kV system, 266kV rms for 400kV system and156kV rms for 220 kV system	1000 micro-volts	1000 micro-volts
8.	Minimum Creepage distage (25mm/kV)	10500 mm	6125 mm

9.	Min. Clearances		
	i. Phase to phase	4000mm	
		(for conductor-conductor configuration) 4200 mm (for rod- conductor configuration)	2100 mm
	ii. Phase to earth	3500 mm	2100mm
	iii. Sectional clearances	6500mm	5000mm
10.	Rated short circuit current for 1 sec. duration	40kA/50kA /63kA(as applicable)	40kA/50kA (as applicable)
11.	System neutral earthing	Effectively earthed	Effectively earthed
12.	DC Voltage	220V	110V

Note:

1. The above parameters are applicable for installations up to an altitude of 1000m above mean sea level. For altitude exceeding 1000m, necessary altitude correction factor shall be applicable.
2. The insulation and RIV levels of the equipments shall be as per values given in the respective chapter of the equipments.

Schedule: 2

Scheduled COD

[Note: As referred to in the definition of "Element", "Scheduled COD", and in Articles 3.1.3 (c), 4.1 (b) and 4.3 (a) of this Agreement]

S. No.	Name of the Transmission Element	Scheduled COD in months from Effective Date	Percentage of Quoted Transmission Charges recoverable on Scheduled COD of the Element of the Project	Element(s) which are pre-required for declaring the commercial operation (COD) of the respective Element
A.	**Construction of 400/220kV, 2×500 MVA GIS substation Jewar with associated lines**			
A1	Construction of 400/220 kV, 2×500MVA GIS substation Jewar (GautamBudh Nagar) (alongwith 125MVAR reactor)	18 months	30.85%	Elements at Sr. No. A1 & A2 shall be required simultaneously.
A2	LILO of one ckt. of 400 kV Gr. Noida (765 kV) – Sector-148 (400) Noida DC line at400/220 kV GIS			
B.	**Construction of 220/33 kV, 2×60 MVA GIS substation Cantt. (Chaukaghat) Varanasi with associated lines**			
B1	Construction of 220/33 kV GIS substation Cantt. (Chaukaghat) Varanasi	18 months	26.78%	Elements at Sr. No. B1 & B2 shall be required simultaneously.
B2	LILO of one ckt. of 220 kV Sarnath (400) – Gajokhar DC line at Cantt. (Chaukaghat) Varanasi construction of 41.5 Km (37 Km overhead line (Zebra Conductor) on			

	Lattice Tower and construction of 4.5 Km 630 mm2 line with copper XLPE cable			
C.	**Construction of 220/33 kV, 3×60 MVA GIS substation Vasundhara (Ghaziabad) with associated lines**			
C1	Construction of 220/33 kV GIS substation Vasundhara	18 months	17.11%	Elements at Sr. No. C1 & C2 shall be required simultaneously.
C2	LILO of one ckt. of 220 kV Muradnagar (400) – Sahibabad (220) SC line at 220 kV substation Vasundhara (Ghaziabad) (Multi Ckt./Monopole Tower) (Zebra conductor)			
D.	**Construction of 220/132/33 kV, 2×160+2×40MVA substationKhaga (Fatehpur) with associated lines**			
D1	Construction of 220/132/33 kV substation Khaga (Fatehpur)	18 months	25.26%	Elements at Sr. No. D1, D2, D3, D4, D5 & D6 shall be required simultaneously.
D2	220 kV Fatehpur (765) PG – Khaga DC line (Zebra Conductor)			
D3	132 kV Khaga (220) – Khaga DC line			
D4	132 kV Khaga (220) – Hussainganj SC line			
D5	132 kV Bay at 132 kV substation Khaga			
D6	132 kV Hybrid Bay at 132 kV substation Hussainganj			

The payment of Transmission Charges for any Element, irrespective of its successful commissioning on or before its Scheduled COD, shall only be considered after successful commissioning of the Element(s), which are pre-required for declaring the commercial operation of such Element as mentioned in the above table.

Scheduled COD for the Project is: **18 Months from Effective Date.**

Schedule: 3

Safety Rules and Procedures

[Note: As referred to in Articles 5.6 of this Agreement]

1: **Site Regulations and Safety:**

The TSP shall establish Site regulations within sixty (60) days from fulfilment of conditions subsequent, as per Prudent Utility Practices setting out the rules to be observed till expiry of the Agreement at the Site and shall comply therewith.

Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Project, gate control, sanitation, medical care, and fire prevention, public health, environment protection, security of public life, etc.

Copies of such Site regulations shall be provided to the Long Term Transmission Customers and the CEA for the purpose of monitoring of the Project.

2: **Emergency Work:**

In cases of any emergency, the TSP shall carry out all necessary remedial work as may be necessary.

If the work done or caused to be done by any entity, other than the TSP, the TSP shall, reimburse the actual costs incurred, to the other Party carrying out such remedial works.

3: **Site Clearance:**

In the course of execution of the Agreement, the TSP shall keep the Site reasonably free from all unnecessary obstruction, storage, remove any surplus materials, clear away any wreckage, rubbish and temporary works from the Site, and remove any equipment no longer required for execution of the Agreement. After completion of all Elements of the Project, the TSP shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site clean and safe.

4: **Watching and Lighting:**

The TSP shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper construction, operation, maintenance / repair of any of the Elements of the Project, or for the safety of the owners and occupiers of adjacent property and for the safety of the public, during such maintenance / repair.

Schedule: 4

Computation of Transmission Charges

1.1 General

The Monthly Transmission Charges to be paid to the TSP for providing Transmission Service for any Contract Year during the term of the Agreement shall be computed in accordance with this Schedule and paid as per applicable Regulations.

Illustration regarding payment of Transmission Charges under various scenarios (considering definitions of Contract Year, Expiry Date & Monthly Transmission Charges above) is as below: -

Illustration-1: In case the Project Elements achieve COD as per Schedule

Quoted Transmission Charges: **Rs. 140 Million**

Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	28	1-Feb-2018	1-Feb-2018	25%
Element 2	38	1-Dec-2018	1-Dec-2018	75%

Tariff Payable as follows:

Transmission Charges for Element 1			**Transmission Charges for Element 2**		
1-Feb-18 to 31-Mar-18	140 X 25% X ((28+31)/365)	5.65		--	0.00
1-Apr-18 to 30-Nov-18	140 X 25% X (244/365)	23.39		--	0.00
1-Dec-18 to 31-Mar-19	140 X 100% X (121/365)				46.41
2	140 X 100% X 1				140
3	140 X 100% X 1				140
4	140 X 100% X 1				140
5	140 X 100% X 1				140
…….					
…….					
36 (1-Apr to 30-Nov)	140 X 100% X (244/365)				93.59

Illustration-2: In case of extension of Scheduled COD as per Article 4.4.1 & 4.4.2 of this Agreement

Quoted Transmission Charges: **Rs. 140 Million**

Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	20	1-Feb-2018	1-Jul-2018	25%
Element 2	28	1-Oct-2018	1-Dec-2018	75%

Tariff Payable as follows:

Transmission Charges for Element 1			**Transmission Charges for Element 2**		
1-Feb-18 to 31-Mar-18	--	0.00		--	0.00
1-Apr-18 to 30-Jun-18	--	0.00		--	0.00
1-Jul-18 to 30-Nov-18	140 X 25% X (153/365)	14.67		--	0.00
1-Dec-18 to 31-Mar-19	140 X 100% X (121/365)				46.41
2	140 X 100% X 1				140
3	140 X 100% X 1				140
4	140 X 100% X 1				140
5	140 X 100% X 1				140
…….					
……..					
36 (1-Apr to 30-Nov)	140 X 100% X (244/365)				93.59

Illustration-3: In case of delay in achieving COD of Project & all individual Elements (COD of the Project achieved in Contract Year 1)

Quoted Transmission Charges: **Rs. 140 Million**

Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	20	1-Feb-2018	1-Dec-2018	25%
Element 2	28	1-Oct-2018	1-Dec-2018	75%

Tariff Payable as follows:

Transmission Charges for Element 1			**Transmission Charges for Element 2**		
1-Feb-18 to 31-Mar-18	--	0.00		--	0.00
1-Apr-18 to 30-Sept-18	--	0.00		--	0.00
1-Oct-18 to 30-Nov-18	--	0.00	1-Oct-18 to 30-Nov-18	--	0.00
1-Dec-18 to 31-Mar-19	140 X 100% X (121/365)				46.41
2	140 X 100% X 1				140
3	140 X 100% X 1				140
4	140 X 100% X 1				140
5	140 X 100% X 1				140
…….					
……..					
36 (1-Apr to 30-Nov)	140 X 100% X (244/365)				93.59

Illustration-4: In case of delay in achieving COD of Project & all individual Elements (COD of the Project achieved in Contract Year other than Contact Year 1)

Quoted Transmission Charges: **Rs. 140 Million**

Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	38	1-Oct-2019	1-May-2020	25%
Element 2	38	1-Oct-2019	1-May-2020	75%

Tariff Payment to be paid as:

Transmission Charges for Element 1			**Transmission Charges for Element 2**		
1-Oct-19 to 31-Mar-20	--	0.00	1-Oct-19 to 31-Mar-20	--	0.00
1-Apr-20 to 30-Apr-20	-	0.00	1-Apr-20 to 30-Apr-20	-	0.00
1-May-20 to 31-Mar-21	140 X 100% X (335/365)				128.49
2	140 X 100% X 1				140
3	140 X 100% X 1				140
4	140 X 100% X 1				140
5	140 X 100% X 1				140
…….					
……..					
36 (1-Apr to 30-Apr)	140 X 100% X (30/ 365)				11.51

Illustration5: In case of delay in achieving COD of Element but Project COD achieved on time

Quoted Transmission Charges: **Rs. 140 Million**

Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	20	1-Feb-2018	1-Jul-2018	25%
Element 2	30	1-Dec-2018	1-Dec-2018	75%

Tariff Payable as follows:

Transmission Charges for Element 1			Transmission Charges for Element 2		
1-Feb-18 to 31-Mar-18	--	0.00		--	0.00
1-Apr-18 to 30-Jun-18	--	0.00		--	0.00
1-Jul-18 to 30-Nov-18	140 X 25% X (153/365)	14.67		--	0.00
1-Dec-18 to 31-Mar-19	140 X 100% X (121/365)				46.41
2	140 X 100% X 1				140
3	140 X 100% X 1				140
4	140 X 100% X 1				140
5	140 X 100% X 1				140
…….					
……..					
36 (1-Apr to 30-Nov)	140 X 100% X (244/365)				93.59

Illustration-6: In case of early commissioning of Project

Quoted Transmission Charges: **Rs. 140 Million**

Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	38	1-Oct-2019	1-Jul-2019	25%
Element 2	38	1-Oct-2019	1-Jul-2019	75%

Tariff Payment to be paid as:

Transmission Charges for Element 1		**Transmission Charges for Element 2**
1-July-19 to 31-Mar-20	140 X 100% X (274/365)	105.09
2	140 X 100% X 1	140
3	140 X 100% X 1	140
4	140 X 100% X 1	140
5	140 X 100% X 1	140
…….		
……..		
36 (1-Apr to 30-Jun)	140 X 100% X (91/365)	34.91

Illustration-7: In case of early commissioning of an element

Quoted Transmission Charges: **Rs. 140 Million**
Completion Schedule:

Element No.	Completion Schedule in Months	Scheduled CoD of the Element	Actual CoD of the Element	% Charges recoverable on Scheduled CoD of the Element
Element 1	38	1-Oct-2019	1-Apr-2019	25%
Element 2	38	1-Jul-2019	1-Jul-2019	75%

Tariff Payment to be paid as:

Transmission Charges for Element 1			Transmission Charges for Element 2		
1-Apr-2019 to 30-Jun-19	140 X 25% X (91/365)	8.72	1-Apr-2019 to 30-Jun-19	--	0.00
1-July-19 to 31-Mar-20	140 X 100% X (274/ 365)				105.09
2	140 X 100% X 1				140
3	140 X 100% X 1				140
4	140 X 100% X 1				140
5	140 X 100% X 1				140
…….					
……..					
36 (1-Apr-30-Jun)	140 X 100% X (91/365)				34.91

The Transmission Charges shall be payable on monthly basis as computed above.

1.2 Computation of Monthly Transmission Charges

The Monthly Transmission Charges for any month m in a Contract Year n shall be calculated as below:

For AC System:

a. If Actual Transmission System Availability for the month m of contract year n is greater than or equal to 98% and less than or equal to 98.5%;

Monthly Transmission Charges MTC(m) = Tmn *1

a. If Actual Transmission System Availability for the month m of contract year n exceeds 98.5% and less than or equal to 99.75%;

Monthly Transmission Charges MTC(m) = Tmn * (AA/ 98.5%)

c. If Actual Transmission System Availability for the month m of contract year n is greater than 99.75%;

Monthly Transmission Charges MTC(m) = Tmn * (99.75% / 98.5%)

d. If Actual Transmission System Availability for the month m of contract year n is less than 98%and greater than or equal to 95.00%;

   Monthly Transmission Charges MTC(m) = Tmn * (AA/ 98%)

e. If Actual Transmission System Availability for the month m of contract year falls below 95%;

   Monthly Transmission Charges MTC(m) = Tmn * (AA/ 98%) - 0.02 * (Tmn * (AA/ 95%)

For DC System:

a. If Actual Transmission System Availability for the month m of contract year n is greater than or equal to 95% and less than or equal to 96%;

   Monthly Transmission Charges MTC(m) = Tmn *1

b. If Actual Transmission System Availability for the month m of contract year n exceeds 96% and less than or equal to 99.75%;

   Monthly Transmission Charges MTC(m) = Tmn * (AA/ 96%)

c. If Actual Transmission System Availability for the month m of contract year n is greater than 99.75%;

   Monthly Transmission Charges MTC(m) = Tmn * (99.75% / 96%)

d. If Actual Transmission System Availability for the month m of contract year n is less than 95% and greater than or equal to 92.00%;

   Monthly Transmission Charges MTC(m) = Tmn * (AA/ 95%)

e. If Actual Transmission System Availability for the month m of contract year falls below 92%;

   Monthly Transmission Charges MTC(m) = Tmn * (AA/ 95%) - 0.02 * (Tmn * (AA/ 92%)

where:

- AA is the actual Availability, as certified by RPC, as per procedure provided in Schedule 6.
- m is the month in Contract Year ‘n’

- Tmn= Transmission Charges for the month 'm' in Contract Year 'n' = (=Transmission Charge/ no. of days in the Year n)* no. of days in month m

Provided, no Transmission Charges shall be paid during the period for which the RLDC has not allowed the operation of the Element/Project due to the failure of the TSP to operate it as per the provisions of the Grid Code.

1.3 Recovery from Short Term Transmission Customers

The charges payable by the Short Term Intra State Transmission Customers shall be calculated on the basis of the provisions of the Uttar Pradesh Electricity Regulatory Commission (Terms and Conditions or Open Access) Regulations, 2019 or as amendment from time to time.

In accordance to Uttar Pradesh Electricity Regulatory Commission (Terms and Conditions or Open Access) Regulations, 2019 or as amendment from time to time, the Short Term Intra State Transmission Consumers shall pay the transmission Charges to STU. However, even in special case, any payment made directly to TSP, for use of element/project, the same shall be reduced from the transmission charge payable by Long Term Transmission Customer's to TSP.

1.4 Scheduling Charges

The payment of RLDC fee & charges, in accordance with relevant regulations of UPERC, shall be the responsibility of the TSP. Whereas, the payment of scheduling charges to the respective SLDC, as the case may be, shall be the responsibility of the Long Term Transmission Customer's.

Schedule: 5

Quoted Transmission Charges

[Quoted Transmission Charges from Annexure - 21 of the RFP of the Selected Bidder to be inserted here]

[To be incorporated from the Bid of the Selected Bidder submitted during the e-reverse auction after its selection]

Quoted Transmission Charges: Rs. …… Million

.**Proportionate Transmission Charges payable for each Element of the Project:**

S. No.	Name of the Transmission Element	Percentage of total Transmission Charges payable to the TSP on Commissioning / COD of the Element
A.	**Construction of 400/220kV, 2×500 MVA GIS substation Jewar with associated lines**	
A1	Construction of 400/220 kV, 2×500MVA GIS substation Jewar (GautamBudh Nagar) (alongwith 125MVAR reactor)	30.85%
A2	LILO of one ckt. of 400 kV Gr. Noida (765 kV) – Sector-148 (400) Noida DC line at400/220 kV GIS	
B.	**Construction of 220/33 kV, 2×60 MVA GIS substation Cantt. (Chaukaghat) Varanasi with associated lines**	
B1	Construction of 220/33 kV GIS substation Cantt. (Chaukaghat) Varanasi	26.78%
B2	LILO of one ckt. of 220 kV Sarnath (400) – Gajokhar DC line at Cantt. (Chaukaghat) Varanasi construction of 41.5 Km (37 Km overhead line (Zebra Conductor) on Lattice Tower and construction of 4.5 Km 630 mm2 line with copper XLPE cable	

C.	**Construction of 220/33 kV, 3×60 MVA GIS substation Vasundhara (Ghaziabad) with associated lines**	
C1	Construction of 220/33 kV GIS substation Vasundhara	17.11%
C2	LILO of one ckt. of 220 kV Muradnagar (400) – Sahibabad (220) SC line at 220 kV substation Vasundhara (Ghaziabad) (Multi Ckt./Monopole Tower) (Zebra conductor)	
D.	**Construction of 220/132/33 kV, 2×160+2×40MVA substationKhaga (Fatehpur) with associated lines**	
D1	Construction of 220/132/33 kV substation Khaga (Fatehpur)	25.26%
D2	220 kV Fatehpur (765) PG – Khaga DC line (Zebra Conductor)	
D3	132 kV Khaga (220) – Khaga DC line	
D4	132 kV Khaga (220) – Hussainganj SC line	
D5	132 kV Bay at 132 kV substation Khaga	
D6	132 kV Hybrid Bay at 132 kV substation Hussainganj	

Schedule: 6

Appendix B of Uttar Pradesh Electricity Regulatory Commission (Multi Year Tariff for Distribution and Transmission) Regulations, 2019

Procedure for Calculation of Transmission System Availability Factor for a Month

Annexure-B:Procedure for calculation of Transmission System Availability Factor for a Month

1) Transmission System Availability Factor for a Calendar Month (TAFM) shall be calculated by the respective Transmission Licensee, got verified and certified by the SLDC and separately for each A.C. Transmission System and grouped according to sharing of transmission charges.
2) TAFM, in percent, shall be equal to (100-100 x NAFM), where NAFM is the non-availability factor in per unit for the month, for the Transmission System / sub-system.
3) NAFM for A.C. systems / sub-systems shall be equal to:

$$= \frac{[\sum_{l=1}^{L}(OH_l \times Cktkm_l \times NSC_l) + \sum_{t=1}^{T}(OH_t \times MVA_t \times 2.5) + \sum_{r=1}^{R}(OH_r \times MVAR_r \times 4)]}{THM \times [\sum_{l=1}^{L}(Cktkm_l \times NSC_l) + \sum_{t=1}^{T}(MVA_t \times 2.5) + \sum_{r=1}^{R}(MVAR_r \times 4)]}$$

Where,

I = identifies a transmission line circuit;

t = identifies a transformer / Inter connecting transformer (ICT);

r = identifies a bus reactor, switchable line reactor or Static VAR Compensation (SVC);

L = total number of line circuits;

T = total number of bus reactors, switchable line reactors and SVCs;

R = total number of bus reactors, switchable line reactors and SVCs;

OH = Outage hours or hours of non-availability in the month, excluding the duration of outages not attributable to the Transmission Licensee,

Ckt km = Length of a transmission line circuit in km;

NSC = Number of sub-conductors per phase;

MVA = MVA rating of a transformer / ICT;

MVAR = MVAR rating of a bus reactor switchable line reactor or an SVC (in which case it would be the sum of inductive and capacitive capabilities);

THM = Total hours in the month;

4) The transmission elements under outage due to following reasons shall be deemed to be available:
   a. Shutdown availed for maintenance or construction of elements of another transmission scheme. If the other transmission scheme belongs to Transmission Licensee, the SLDC may restrict the deemed availability period to that considered reasonably by him for the work involved.
   b. Switching off of a transmission line to restrict over voltage and manual tripping of switched reactors as per the directions of SLDC.
5) Outage time of transmission elements for the following contingencies shall be excluded from the total time of the element under period of consideration:
   a. Outage of elements due to force majeure events such as war, strike riot, floods, earthquake etc. beyond the control of the Transmission Licensee.
   b. However, onus of satisfying the SLDC that element outage was due to aforesaid events and not due to design failure shall rest with the Transmission Licensee. A reasonable restoration time for the element shall be considered by SLDC and any additional time taken by the Transmission Licensee for restoration of the element beyond the reasonable time shall be treated as outage time attributable to the Transmission Licensee. SLDC may consult the Transmission Licensee or any expert for estimation of reasonable time. Circuits restored through ERS (Emergency Restoration System) shall be considered as available.
6) Outage caused by grid incident / disturbance not attributable to the Transmission Licensee, e.g.faults in substation or bays owned by other agency causing outage of the Transmission Licensee's elements and tripping of lines, ICTs, etc due to grid disturbance. However, if the element is not restored on receipt of direction from SLDC while normalizing the system following grid incident / disturbance within reasonable time, the element will be considered not available for the period of outage after issuance of SLDC's direction for restoration.

Schedule: 7

Entire Bid (both financial bid and technical bid) of the Selected Bidder to be attached here

Schedule: 8

Contract Performance Guarantee

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign entities submitting Bids are required to follow the applicable law in their country.)

In consideration of the ……..[Insert name of the SPV or Selected Bidder on behalf of the TSP, or Lead Member in case of the Consortium, with address] agreeing to undertake the obligations under the Transmission Service Agreement dated …….and the other RFP Project Documents and the Long Term Transmission Customers and the ……..[Insert the name of the BPC], agreeing to execute the *RFP Project Documents* with the Selected Bidder, regarding setting up the Project, the …… [Insert name and address of the bank issuing the guarantee and address of the head office] (hereinafter referred to as "Guarantor Bank") hereby agrees unequivocally, irrevocably and unconditionally to pay to Long Term Transmission Customers at ……[Insert the Place from the address of the Long Term Transmission Customers indicated in the TSA] forthwith on demand in writing from the Long Term Transmission Customers or any Officer authorized by it in this behalf, any amount up to and not exceeding Rupees …….. Crores (Rs. …….) only [Insert the amount of the bank guarantee] on behalf of M/s. …….. [Insert name of the Selected Bidder or SPV].

This guarantee shall be valid and binding on the Guarantor Bank up to and including ……..and shall not be terminable by notice or any change in the constitution of the Bank or the term of the Transmission Service Agreement or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between parties to the respective agreement.

Our liability under this Guarantee is restricted to Rs. …….. Crores (Rs. ……..) only. Our Guarantee shall remain in force until …….. [Insert the date of validity of the Guarantee as per Article 3.1.2 of this Agreement]. The Long Term Transmission Customers, shall be entitled to invoke

this Guarantee up to three hundred sixty five (365) days of the last date of the validity of this Guarantee.

The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand from …… (in its roles as the Long Term Transmission Customers), made in any format, raised at the above mentioned address of the Guarantor Bank, in order to make the said payment to Long Term Transmission Customers.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection by ..... [Insert name of the Selected Bidder], ... [Insert name of the TSP] and / or any other person. The Guarantor Bank shall not require Long Term Transmission Customers to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against Long Term Transmission Customers in respect of any payment made hereunder.

THIS BANK GUARANTEE shall be interpreted in accordance with the laws of India.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

THIS BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring, liquidation, winding up, dissolution or any other change in the constitution of the Guarantor Bank.

THIS BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly Long Term Transmission Customers shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against …… [Insert name of the SPV] or the Selected Bidder, as the case may be, to make any claim against or any demand on …… [Insert name of the SPV] or the Selected Bidder, as the case may be, or to give any notice to …… [Insert name of the SPV] or the Selected Bidder, as the case may be, or to enforce any security held by the Long Term Transmission Customers or to exercise, levy or enforce any distress, diligence or other process against …… [Insert name of the SPV] or the Selected Bidder, as the case may be.

The Guarantor Bank acknowledges that this BANK GUARANTEE is not personal to Long Term Transmission Customers and may be assigned, in whole or in part, (whether absolutely or by way of security) by Long Term Transmission Customers to any entity to whom the Long Term Transmission Customers is entitled to assign its rights and obligations under the Transmission Service Agreement.

The Guarantor Bank hereby agrees and acknowledges that Long Term Transmission Customers shall have a right to invoke this Bank Guarantee either in part or in full, as it may deem fit.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rs. …….. Crores (Rs. ……..) only and it shall remain in force until ……[Date to be inserted on the basis of Article 3.1.2of the Transmission Service Agreement], with an additional claim period of three hundred sixty five (365) days thereafter. This BANK GUARANTEE shall be extended from time to time for such period, as may be desired by …….. [Insert name of the Selected Bidder or Lead Member in case of the Consortium or SPV]. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if Long Term Transmission Customers serves upon us a written claim or demand.

In witness where of:

Signature .....

Name: .....

Power of attorney No.: ……

For:

…….. [Insert Name of the Bank]

Banker's Seal and Full Address, including mailing address of the Head Office

Schedule: 9

Methodology for determining the Relief Under Force Majeure Event & Change in Law during Construction Period

The relief in the form of revision in tariff due to Force Majeure Event leading to extension of Scheduled COD for a period beyond one hundred eighty (180) days and/ or Change in Law during the construction period shall be as under:

$\Delta T = [(P \times d)] \div [1-(1+ d)^{(-n)}]$

Where,

ΔT = Change in Transmission Charges for each year

P = Sum of cumulative increase or decrease in the cost of the Project due to Change in Law and interest cost during construction corresponding to the period exceeding one hundred eighty (180) due to Force Majeure Event leading to extension of Scheduled COD for a period beyond one hundred eighty (180) days

n = number of years over which the Transmission Charges has to be paid

d = Discount rate as notified by the CERC, applicable on the Bid Deadline

The increase in Transmission Charges as stated above shall be applicable only if the value of increase in Transmission Charges as calculated above exceeds 0.30% (zero point three percent) of the quoted Transmission Charges of the TSP.

Schedule: 10

List of Long Term Transmission Customer

Note: As referred in the recital of this Agreement and in the definition of "Long Term Transmission Customer" in this Agreement

Sl. No.	Name of the Long Term Transmission Customer	Address of Registered Office	Law under which incorporated	Allocated Project Capacity (in %)
1.	Paschimanchal Vidyut Vitran Nigam Ltd.	Hydel Colony, Victoria Park, Meerut-250001 E-mail: md@pvvnl.org Fax: 0121-2666062 Phone: 0121-2665734	Companies Act	31%
2.	Madhyanchal Vidyut Vitran Nigam Ltd.	4A Gokhale Marg, Lucknow-226001 E-mail: md.mvvnl2010@gmail.com Fax: 0522-2208769 Phone: 0522-2208737	Companies Act	21%
3.	Purvanchal Vidyut Vitran Nigam Ltd.	Vidyut Nagar, Bhikharipur, P.O. DLW, Varanasi-221010 E-mail: mdpurvanchalvvnl@ gmail.com Fax: 0542-2319158 Phone: 0542-2318437	Companies Act	24%
4.	Dakshinanchal Vidyut Vitran Nigam Ltd.	Urja Bhawan, NH-2 (Agra-Delhi bypass Road) Sikandra Agra-282002 E-mail: dvvnlmd@gmail.com Fax: 0562-2605465 Phone: 0562-2605699	Companies Act	21%
5.	Kanpur Electricity Supply Co. Ltd.	Kesa House, 14/17 Civil Lines, Kanpur - 208001 E-mail: md@kesco.co.in Phone: 0512-2530832	Companies Act	3%

Note: The above list of Long Term Transmission Customer subject to change. Any addition or deletion in this list after the award of LoI shall be duly notified to the parties to the Agreement.

The new Long Term Transmission Customer shall become a party to the TSA after agreeing to the terms and conditions of this Agreement and signing a Supplemental Agreement as annexed in Schedule 11 to this Agreement.

Schedule: 11

SUPPLEMENTARY AGREEMENT

BETWEEN

……..……. [Insert name of the TSP]

AND

…… [Insert name of the new Long Term Transmission Customer 1],

……. [Insert name of the new Long Term Transmission Customer 2],

.
.
.

…… [Insert name of the new Long Term Transmission Customer n]

THIS SUPPLEMENTARY AGREEMENT entered into on ……. [Insert date] …… [Insert day] of ……[Insert month] in …… [Insert year] by and between, …….. [Insert name of the Transmission Service Provider] incorporated under the Companies Act, 1956, having its registered office at …….. (here in after referred to as Transmission Service Provider or "TSP", which expression shall unless repugnant to the context or meaning thereof include its successors, and permitted assigns) as Party of the first part,

AND

……. [Insert name of the new Long Term Transmission Customer '1'] having its registered office at……. [Insert address of the new Long Term Transmission Customer 1] and having an Allocated Project Capacity as specified in the Table 2 of this Supplementary Agreement, (which expression shall unless repugnant to the context or meaning thereof include its successors, and permitted assigns) as Party of the second part,

……. [Insert name of the new Long Term Transmission Customer '2'] having its registered office at……. [Insert address of the new Long Term Transmission Customer 1] and having an Allocated Project Capacity as specified in the Table 2 of this Supplementary Agreement, (which expression shall unless repugnant to the context or meaning thereof include its successors, and permitted assigns) as Party of the third part,
.

.

……. [Insert name of the new Long Term Transmission Customer 'n'] having its registered office at……. [Insert address of the new Long Term Transmission Customer 1] and having an Allocated Project Capacity as specified in the Table 2 of this Supplementary Agreement, (which expression shall unless repugnant to the context or meaning thereof include its successors, and permitted assigns) as Party of the nth part.

WHEREAS:

A. The TSP has executed the TSA with the existing Long Term Transmission Customer as listed out in Schedule 10 of the TSA.

B. The existing Long Term Transmission Customer as listed out in Schedule 10 of the TSA have executed the TSA with the TSP.

C. The TSP has agreed to provide the Transmission Service to the existing Long Term Transmission Customer as per the terms and conditions of the TSA.

D. The Allocated Project Capacity of the existing Long Term Transmission Customer as on this date……[Insert date] is as detailed below:

Table : 1

Sl. No.	**Name of the existing Long Term Transmission Customer**	**Allocated Project Capacity (in MW)**
1		
2		
3		
.		

E. The existing Long Term Transmission Customer have agreed, on the terms and subject to the conditions of the TSA, to use the available transmission capacity of the Project and pay TSP the Transmission Charges as determined in accordance with the terms of the TSA.

NOW THEREFORE THIS AGREEMENT WITNESSETH as under:

1) The new Long Term Transmission Customer and their Allocated Project Capacity as on this date…. [Insert date] are as detailed below:

Table 2:

Sl. No.	**Name of the new Long Term Transmission Customer**	**Allocated Project Capacity (in MW)**
1		

2		
3		
.		
.		

2) The new Long Term Transmission Customer have been granted long term open access from the CTU/STU, as the case may be, and are beneficiaries to the Project.

3) The new Long Term Transmission Customer agree to the terms and conditions laid down in the TSA, to use the Project and pay the TSP the Transmission Charges as determined in accordance with the terms of the TSA and the provisions of this Supplementary Agreement.

4) The TSP agrees to provide the Transmission Service to the new Long Term Transmission Customer as per the terms and conditions of the TSA.

5) All terms and conditions of the TSA between the TSP and the existing Long Term Transmission Customer (as listed out in Table 1 of this Supplementary Agreement) shall apply, mutatis mutandis without any change, to the new Long Term Transmission Customer (as listed out in Table 2 of this Supplementary Agreement)

IN WITNESS WHEREOF the parties have executed these presents through their Authorised Representatives

WITNESS:

Table 3:
WITNESS

1. Signature: Name: …….. Designation: …….	For and on behalf of ……. [Insert name of the TSP]
2. Signature: Name: …….. Designation: …….	For and on behalf of ……. [Insert name of the new Long Term Transmission Customer 1]
3. Signature: Name: …….. Designation: …….	For and on behalf of ……. [Insert name of the new Long Term Transmission Customer 1]
. n. Signature:	; For and on behalf of …….

Name: ……..	[Insert name of the new Long Term Transmission Customer n]
Designation: …….	