



REPUBLIC OF THE PHILIPPINES
NATIONAL POWER CORPORATION
(Pambansang Korporasyon sa Elektrisidad)

BID DOCUMENTS

Name of Project : **SUPPLY AND ERECTION/INSTALLATION OF
TAP – USON 69kV TRANSMISSION LINE
PROJECT**

Project Location : **USON, MASBATE**

Specification No : **LuzP22Z1468Sdg**

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Design and Development Department





SECTION I

INVITATION TO BID





National Power Corporation

INVITATION TO BID

PUBLIC BIDDING – BCS 2022-0735

1. The NATIONAL POWER CORPORATION (NPC), through its approved Corporate Budget of CY 2023 intends to apply the sum of **(Please see schedule below)** being the Approved Budget for the Contract (ABC) to payments under the contract. Bids received in excess of the ABC shall be automatically rejected at Bid opening.

PR Nos./PB Ref No. & Description	Similar Contracts	Pre-bid Conference	Bid Submission / Opening	ABC/ Amt. of Bid Docs
SO-OPD22-021 / PB221109-JD00416 (PB2) Supply, Delivery, Erection / Installation, Testing and Commissioning of 7.97 / 13.8kV Distribution Line (Extension) Project at Guiwanon DPP • PCAB License: License Category of at least “Category D – Electrical Works” and registration classification of at least “Small B – Electrical Works”	Supply, Delivery, Erection / Installation, Testing and Commissioning of Transmission / Distribution Line with voltage of at least 13.2kV	01 December 2022 9:30 A.M	13 December 2022 9:30 A.M	₱ 9,508,000.00 / ₱ 10,000.00
HO-PES22-012 / PB221213-HG Supply and Delivery of Wind Monitoring Tower Spare Parts and Auxiliary Equipment	Supply and Delivery of Wind Monitoring Tower Parts, Accessories or Components	01 December 2022 9:30 A.M	13 December 2022 9:30 A.M	₱ 5,500,000.00 / ₱ 10,000.00
S1-JPR23-002 / PB221213-CM Supply and Delivery of Mechanical Spare, Security and PMS Parts for 2 x 300kW Cummins Genset-KTA19-G2 of Rizal DPP	Supply and Delivery of Diesel Generating Sets or Mechanical and/or Electrical Parts / Components / Equipment for Diesel Generating Sets	01 December 2022 9:30 A.M	13 December 2022 9:30 A.M	₱ 5,495,812.00 / ₱ 10,000.00
S1-JPR23-003 / PB221213-KB Supply and Delivery of Electrical Spare Parts for 2 x 300kW Cummins Genset-KTA19-G2 of Rizal DPP	Supply and Delivery of Diesel Generating Sets or Mechanical and/or Electrical Parts / Components / Equipment for Diesel Generating Sets	02 December 2022 9:30 A.M	14 December 2022 9:30 A.M	₱ 2,120,580.00 / ₱ 5,000.00

<p>S1-PWN23-003 / PB221213-KB</p> <p>Supply and Delivery of Consolidated Electrical Spare Parts for Cummins Diesel Engine for Palawan Area</p>	<p>Supply and Delivery of Diesel Generating Sets or Mechanical and/or Electrical Parts / Components / Equipment for Diesel Generating Sets</p>	<p>02 December 2022 9:30 A.M</p>	<p>14 December 2022 9:30 A.M</p>	<p>₱ 9,407,500.00 / ₱ 10,000.00</p>
<p>HO-PIG22-014 / PB221010-JD00384 (PB2)</p> <p>Supply and Erection / Installation of TAP – USON 69kV Transmission Line Project</p> <p>• PCAB License: License Category of at least “Category D – Electrical Works” and registration classification of at least “Small B – Electrical Works”</p>	<p>Supply, Delivery, Erection/ Installation, Test and Commissioning of Transmission Line with nominal voltage of at least 69kV</p>	<p>02 December 2022 9:30 A.M</p>	<p>14 December 2022 9:30 A.M</p>	<p>₱ 12,000,000.00 / ₱ 25,000.00</p>
<p>Venue: Kañao Function Room, NPC Bldg. Diliman, Quezon City</p>				

2. The NPC now invites bids for Items listed above. Delivery of the Goods is required (see table below) specified in the Technical Specifications. Bidders should have completed, within (see table below) from the date of submission and receipt of bids, a contract similar to the Project. The description of an eligible bidder is contained in the Bidding Documents, particularly, in Section II. (Instruction to Bidders).

PR No/s. / PB Ref No/s.	Delivery Period / Contract Duration	Relevant Period of SLCC reckoned from the date of submission & receipt of bids
SO-OPD22-021	Two Hundred (200) Calendar Days	-
HO-PES22-012	One Hundred Fifty (150) Calendar Days	Five (5) Years
S1-JPR23-002	Ninety (90) Calendar Days	Ten (10) Years
S1-JPR23-003	Ninety (90) Calendar Days	Ten (10) Years
S1-PWN23-003	Ninety (90) Calendar Days	Ten (10) Years
HO-PIG22-014	Ninety (90) Calendar Days	-

3. Bidding will be conducted through open competitive bidding procedures using a non-discretionary “pass/fail” criterion as specified in the 2016 revised Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 9184.

Bidding is restricted to Filipino citizens/sole proprietorships, partnerships, or organizations with at least sixty percent (60%) interest or outstanding capital stock belonging to citizens of the Philippines, and to citizens or organizations of a country the laws or regulations of which grant similar rights or privileges to Filipino citizens, pursuant to RA 5183.

4. Prospective Bidders may obtain further information from National Power Corporation, Bids and Contracts Services Division and inspect the Bidding Documents at the address given below during office hours (8:00AM to 5:00PM), Monday to Friday.

5. A complete set of Bidding Documents may be acquired by interested Bidders from the given address and website(s) and upon payment of the applicable fee for the Bidding Documents, pursuant to the latest Guidelines issued by the GPPB. Bidding fee may be refunded in accordance with the guidelines based on the grounds provided under Section 41 of R.A. 9184 and its Revised IRR.
6. The National Power Corporation will hold Pre-Bid Conference (**see table above**) and/or through video conferencing or webcasting which shall be open to prospective bidders.

Only registered bidder/s shall be allowed to participate for the conduct of virtual pre-bid conference. **Unregistered bidders** may attend the Pre-Bid Conference at the Kañao Room, NPC subject to the following:

- a. Only a maximum of two (2) representatives from each bidder / company shall be allowed to participate during the virtual pre-bid conference.
 - b. A "No Face mask / No Entry" policy shall be implemented in the NPC premises. Face mask shall be 3-ply surgical or KN95 mask type.
 - c. The requirements herein stated including the medium of submission shall be subject to GPPB Resolution No. 09-2020 dated 07 May 2020
 - d. The Guidelines on the Implementation of Early Procurement Activities (EPA) shall be subject to GPPB Circular No. 06-2019 dated 17 July 2019
7. Bids must be duly received by the BAC Secretariat through (i) manual submission at the office address indicated below; (ii) online or electronic submission before the specified time stated in the table above for opening of bids. Late bids shall not be accepted.
 8. All Bids must be accompanied by a bid security in any of the acceptable forms and in the amount stated in **ITB** Clause 14.
 9. Bid opening shall be on Kañao Function Room, NPC Head Office, Diliman, Quezon City and/or via online platform to be announced by NPC. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity.
 10. The National Power Corporation reserves the right to reject any and all bids, declare a failure of bidding, or not award the contract at any time prior to contract award in accordance with Sections 35.6 and 41 of the 2016 revised IRR of R.A. No. 9184, without thereby incurring any liability to the affected bidder or bidders.
 11. For further information, please refer to:

**Bids and Contracts Services Division,
Logistics Department**

BIR Road cor. Quezon Avenue
Diliman, Quezon City
Tel Nos.: 8924-5211 and 8921-3541 local 5611/5211
Fax No.: 8922-1622
Email: bcsd@napocor.gov.ph

12. You may visit the following websites:

For downloading of Bidding Documents: <https://www.napocor.gov.ph/bcsd/bids.php>


RENE B. BARQUILLA
Vice President, Corporate Affairs Group and
Chairman, Bids and Awards Committee

SECTION II

INSTRUCTIONS TO BIDDERS



SECTION II - INSTRUCTIONS TO BIDDERS

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SECTION II - INSTRUCTIONS TO BIDDERS

1. Scope of Bid

NPC invites Bids for the **SUPPLY AND ERECTION/INSTALLATION OF TAP-USON 69KV TRANSMISSION LINE PROJECT**, with Project Identification Number **LuzP22Z1468Sdg**.

The Procurement Project (referred to herein as "Project") is for the construction of Works, as described in Section VI (Specifications).

2. Funding Information

The GOP through the source of funding as indicated below for CY 2022 in the amount of **TWELVE MILLION PESOS (P 12,000,000.00)**. The source of funding is the proposed Corporate Operating Budget of the National Power Corporation (NPC).

3. Bidding Requirements

The Bidding for the Project shall be governed by all the provisions of RA No. 9184 and its 2016 revised IRR, including its Generic Procurement Manual and associated policies, rules and regulations as the primary source thereof, while the herein clauses shall serve as the secondary source thereof.

Any amendments made to the IRR and other GPPB issuances shall be applicable only to the ongoing posting, advertisement, or invitation to bid by the BAC through the issuance of a supplemental or bid bulletin.

The Bidder, by the act of submitting its Bid, shall be deemed to have inspected the site, determined the general characteristics of the contracted Works and the conditions for this Project, such as the location and the nature of the work; (b) climatic conditions; (c) transportation facilities; (c) nature and condition of the terrain, geological conditions at the site communication facilities, requirements, location and availability of construction aggregates and other materials, labor, water, electric power and access roads; and (d) other factors that may affect the cost, duration and execution or implementation of the contract, project, or work and examine all instructions, forms, terms, and project requirements in the Bidding Documents.

4. Corrupt, Fraudulent, Collusive, Coercive, and Obstructive Practices

The Procuring Entity, as well as the Bidders and Contractors, shall observe the highest standard of ethics during the procurement and execution of the contract. They or through an agent shall not engage in corrupt, fraudulent, collusive, coercive, and obstructive practices defined under Annex "I" of the 2016 revised IRR of RA No. 9184 or other integrity violations in competing for the Project.

5. Eligible Bidders

- 5.1. Only Bids of Bidders found to be legally, technically, and financially capable will be evaluated.
- 5.2. The Bidder must have an experience of having completed a Single Largest Completed Contract (SLCC) that is similar to this Project, equivalent to at least fifty percent (50%) of the ABC adjusted, if necessary, by the Bidder to

current prices using the PSA's CPI, except under conditions provided for in Section 23.4.2.4 of the 2016 revised IRR of RA No. 9184.

A contract is considered to be "similar" to the contract to be bid if it has the major categories of work stated in the **BDS**.

- 5.3. For Foreign-funded Procurement, the Procuring Entity and the foreign government/foreign or international financing institution may agree on another track record requirement, as specified in the Bidding Document prepared for this purpose.
- 5.4. The Bidders shall comply with the eligibility criteria under Section 23.4.2 of the 2016 IRR of RA No. 9184.

6. Origin of Associated Goods

There is no restriction on the origin of Goods other than those prohibited by a decision of the UN Security Council taken under Chapter VII of the Charter of the UN.

7. Subcontracts

- 7.1. The Bidder may subcontract portions of the Project to the extent allowed by the Procuring Entity as stated herein, but in no case more than fifty percent (50%) of the Project.
- 7.1. The Bidder must submit together with its Bid the documentary requirements of the subcontractor(s) complying with the eligibility criteria stated in **ITB** Clause 5 in accordance with Section 23.4 of the 2016 revised IRR of RA No. 9184 pursuant to Section 23.1 thereof.
- 7.2. Subcontracting of any portion of the Project does not relieve the Contractor of any liability or obligation under the Contract. The Supplier will be responsible for the acts, defaults, and negligence of any subcontractor, its agents, servants, or workmen as fully as if these were the Contractor's own acts, defaults, or negligence, or those of its agents, servants, or workmen.

8. Pre-Bid Conference

The Procuring Entity will hold a pre-bid conference for this Project on the specified date and time and either at its physical address and/or through videoconferencing/webcasting} as indicated in paragraph 6 of the **IB**.

9. Clarification and Amendment of Bidding Documents

Prospective bidders may request for clarification on and/or interpretation of any part of the Bidding Documents. Such requests must be in writing and received by the Procuring Entity, either at its given address or through electronic mail indicated in the **IB**, at least ten (10) calendar days before the deadline set for the submission and receipt of Bids.

10. Documents Comprising the Bid: Eligibility and Technical Components

- 10.1. The first envelope shall contain the eligibility and technical documents of the Bid as specified in **Form NPCSF-INFR-01 - Checklist of Technical and Financial Documents, Section VIII - Bidding Forms**.

- 10.2. If the eligibility requirements or statements, the bids, and all other documents for submission to the BAC are in foreign language other than English, it must be accompanied by a translation in English, which shall be authenticated by the appropriate Philippine foreign service establishment, post, or the equivalent office having jurisdiction over the foreign bidder's affairs in the Philippines. For Contracting Parties to the Apostille Convention, only the translated documents shall be authenticated through an apostille pursuant to GPPB Resolution No. 13-2019 dated 23 May 2019. The English translation shall govern, for purposes of interpretation of the bid.
 - 10.3. A valid PCAB License is required, and in case of joint ventures, a valid special PCAB License, and registration for the type and cost of the contract for this Project. Any additional type of Contractor license or permit shall be indicated in the **BDS**.
 - 10.4. A List of Contractor's key personnel (e.g., Project Manager, Project Engineers, Materials Engineers, and Foremen) assigned to the contract to be bid, with their complete qualification and experience data shall be provided. These key personnel must meet the required minimum years of experience set in the **BDS**.
 - 10.5. A List of Contractor's major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership, certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be, must meet the minimum requirements for the contract set in the **BDS**.
- 11. Documents Comprising the Bid: Financial Component**
- 11.1. The second bid envelope shall contain the financial documents for the Bid as specified in **Form NPCSF-INFR-01 - Checklist of Technical and Financial Documents, Section VIII - Bidding Forms**.
 - 11.2. Any bid exceeding the ABC indicated in paragraph 1 of the **IB** shall not be accepted.
 - 11.3. For Foreign-funded procurement, a ceiling may be applied to bid prices provided the conditions are met under Section 31.2 of the 2016 revised IRR of RA No. 9184.
- 12. Alternative Bids**
- Bidders shall submit offers that comply with the requirements of the Bidding Documents, including the basic technical design as indicated in the drawings and specifications. Unless there is a value engineering clause in the **BDS**, alternative Bids shall not be accepted.
- 13. Bid Prices**
- All bid prices for the given scope of work in the Project as awarded shall be considered as fixed prices, and therefore not subject to price escalation during contract implementation, except under extraordinary circumstances as determined by the NEDA and approved by the GPPB pursuant to the revised Guidelines for Contract Price Escalation guidelines.

14. Bid and Payment Currencies

- 14.1. Bid prices may be quoted in the local currency or tradeable currency accepted by the BSP at the discretion of the Bidder. However, for purposes of bid evaluation, Bids denominated in foreign currencies shall be converted to Philippine currency based on the exchange rate as published in the BSP reference rate bulletin on the day of the bid opening.
- 14.2. Payment of the contract price shall be made in Philippine Pesos.

15. Bid Security

- 15.1. The Bidder shall submit a Bid Securing Declaration or any form of Bid Security in the amount indicated in the **BDS**, which shall be not less than the percentage of the ABC in accordance with the schedule in the **BDS**.
- 15.2. The Bid and bid security shall be valid until **One Hundred Twenty (120) calendar days** from the date of opening of bids. Any bid not accompanied by an acceptable bid security shall be rejected by the Procuring Entity as non-responsive.

16. Sealing and Marking of Bids

Each Bidder shall submit one copy of the first and second components of its Bid.

The Procuring Entity may request additional hard copies and/or electronic copies of the Bid. However, failure of the Bidders to comply with the said request shall not be a ground for disqualification.

If the Procuring Entity allows the submission of bids through online submission to the given website or any other electronic means, the Bidder shall submit an electronic copy of its Bid, which must be digitally signed. An electronic copy that cannot be opened or is corrupted shall be considered non-responsive and, thus, automatically disqualified.

17. Deadline for Submission of Bids

The Bidders shall submit on the specified date and time and either at its physical address or through online submission as indicated in paragraph 7 of the **IB**.

18. Opening and Preliminary Examination of Bids

- 18.1. The BAC shall open the Bids in public at the time, on the date, and at the place specified in paragraph 9 of the **IB**. The Bidders' representatives who are present shall sign a register evidencing their attendance. In case videoconferencing, webcasting or other similar technologies will be used, attendance of participants shall likewise be recorded by the BAC Secretariat.

In case the Bids cannot be opened as scheduled due to justifiable reasons, the rescheduling requirements under Section 29 of the 2016 revised IRR of RA No. 9184 shall prevail.

- 18.2. The preliminary examination of Bids shall be governed by Section 30 of the 2016 revised IRR of RA No. 9184.

19. Detailed Evaluation and Comparison of Bids

- 19.1. The Procuring Entity's BAC shall immediately conduct a detailed evaluation of all Bids rated "*passed*" using non-discretionary pass/fail criteria. The BAC shall consider the conditions in the evaluation of Bids under Section 32.2 of 2016 revised IRR of RA No. 9184.
- 19.2. If the Project allows partial bids, all Bids and combinations of Bids as indicated in the **BDS** shall be received by the same deadline and opened and evaluated simultaneously so as to determine the Bid or combination of Bids offering the lowest calculated cost to the Procuring Entity. Bid Security as required by **ITB** Clause 15 shall be submitted for each contract (lot) separately.
- 19.3. In all cases, the NFCC computation pursuant to Section 23.4.2.6 of the 2016 revised IRR of RA No. 9184 must be sufficient for the total of the ABCs for all the lots participated in by the prospective Bidder.

20. Post Qualification

Within a non-extendible period of five (5) calendar days from receipt by the Bidder of the notice from the BAC that it submitted the Lowest Calculated Bid, the Bidder shall submit its latest income and business tax returns filed and paid through the BIR Electronic Filing and Payment System (eFPS), and other appropriate licenses and permits required by law and stated in the **BDS**.

21. Signing of the Contract

The documents required in Section 37.2 of the 2016 revised IRR of RA No. 9184 shall form part of the Contract. Additional Contract documents are indicated in the **BDS**.

SECTION III

BID DATA SHEETS



SECTION III - BID DATA SHEET

ITB Clause	
5.2	<p>For this purpose, contracts similar to the Project refer to Supply, Delivery, Erection/Installation, Test and Commissioning of Transmission Line with nominal voltage of at least 69 kV.</p> <p>The Single Largest Completed Contract (SLCC) as declared by the bidder shall be verified and validated to ascertain such completed contract. Hence, bidders must ensure access to sites of such projects/equipment to NPC representatives for verification and validation purposes during post-qualification process.</p> <p>It shall be a ground for disqualification, if verification and validation cannot be conducted for reasons attributable to the Bidder.</p>
7.1	<p>Only a maximum of fifty percent (50%) of the Works may be subcontracted. All Subcontractors must be approved by NPC.</p>
10.1	<p>The list of on-going contracts (Form No. NPCSF-INFR-02) shall be supported by the following documents for each on-going contract to be submitted during Post-Qualification:</p> <ol style="list-style-type: none"> 1. Contract/Purchase Order and/or Notice of Award 2. Certification coming from the project owner/client that the performance is satisfactory as of the bidding date. <p>The bidder shall declare in this form all his on-going government and private contracts including contracts where the bidder (either as individual or as a Joint Venture) is a partner in a Joint Venture agreement other than his current joint venture where he is a partner. Non declaration will be a ground for disqualification of bid.</p>
	<p>The Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid (Form No. NPCSF-INFR-03) shall be supported by the following documents to be submitted during Bid Opening:</p> <ol style="list-style-type: none"> 1. Contract/Purchase Order 2. Owner's Certificate of Final Acceptance issued by the project owner other than the contractor or a final rating of at least Satisfactory in the Constructors Performance Evaluation System (CPES). In case of contracts with the private sector, an equivalent document (Ex. Official Receipt or Sales Invoice) shall be submitted.
10.3	<p>The required License issued by the Philippine Contractors Accreditation Board (PCAB): License Category of at least "CATEGORY D – ELECTRICAL WORKS" and registration classification of at least "SMALL B – ELECTRICAL WORKS".</p>

<p>10.4</p>	<p>The list of key personnel shall include the following minimum requirements:</p> <p>a. One (1) Project Manager</p> <p>Professional Electrical Engineer (PEE) who had managed or supervised at least a similar project within the last ten (10) years.</p> <p>b. One (1) Project Engineer</p> <p>Registered Electrical Engineer or Registered Civil Engineer who had supervised at least one (1) similar project within the last ten (10) years. Must have at least five (5) years professional experience on similar project.</p> <p>c. One (1) Safety Officer 2</p> <p>Construction Safety Officer who has completed at least forty (40) hours of Construction Safety and Health Training (COSH) from Occupational Safety and Health Center (OSHC) or Safety Training Organizations (STOs) accredited by the Department of Labor and Employment (DOLE)</p> <p>Valid Professional Regulations Commission (PRC) license for professional personnel, Construction Safety and Health Training Certificate from OSHC/STOs accredited by DOLE for the Safety Officer, shall be submitted and included as an attachment in the Standard Form NPCSF-INFR-09: List of Key Personnel Proposed to be Assign to the Contract.</p> <p>The above key personnel must either be employed by the Bidder or contracted by the Bidder to be employed for the contract to be bid.</p>
<p>10.5</p>	<p>The list of construction equipment (owned or leased) shall include the following minimum requirements:</p> <ul style="list-style-type: none"> 1. Cargo Truck with boom – 1 unit 2. Concrete Mixer (1 bagger) – 1 unit 3. Concrete Vibrator – 1 unit 4. Stringing Equipment: <ul style="list-style-type: none"> a. Puller – 4 units b. Tensioner – 4 units c. Stringing Sheaves for ACSR – 30 pieces d. Stringing Sheaves for OHGW – 12 pieces e. Hydraulic Compressor for jointing clipping of ACSR & OHGW – 4 units f. Tools for crimping/clipping of ACSR & OHGW – 4 units
<p>10.6</p>	<p>Bidders shall also submit the following requirements in their first envelope, Eligibility and Technical Component of their bid:</p> <ul style="list-style-type: none"> 1. Documents to be submitted with the Bid/Proposal as specified in Annex A of Section VI – Part II, Technical Data Sheets; <p>Manufacturer's brochures, manuals and other supporting documents of equipment, materials, hardware and tools proposed by the bidders must comply with the technical specifications of such equipment, materials, hardware and tools. It shall be a ground for disqualification if the submitted brochures, manuals and other supporting documents are</p>



	<p>determined not complying with the specifications during technical evaluation and post-qualification process.</p> <p>Equipment, materials, hardware and tools proposed by the winning bidder to be supplied, which were evaluated to be complying with the technical specifications, shall not be replaced and must be the same items to be delivered/installed/used during the contract implementation. Any proposed changes/replacement of said items may be allowed on meritorious reasons subject to validation and prior approval by NPC.</p> <p>2. Complete eligibility documents of the proposed sub-contractor, if any</p>
10.7	The prospective bidders shall declare its Joint Venture partner during the purchase of bid/tender documents. Any single bidder/s who already procured/secured the bidding documents but want to avail the Joint Venture Agreement (JVA) shall inform the BAC in writing prior to the bid opening for records and documentation purposes. Failure to do so shall be a ground for disqualification/non-acceptance of its bid.
12	No further instructions
15.1	<p>The bid security shall be in the form of a Bid Securing Declaration or any of the following forms and amounts:</p> <ol style="list-style-type: none"> 1. The amount of not less than <i>2% of ABC</i>, if bid security is in cash, cashier's/manager's check, bank draft/guarantee or irrevocable letter of credit; 2. The amount of not less than <i>5% of ABC</i> if bid security is in Surety Bond.
19.2	Partial Bid is not allowed
20	<ol style="list-style-type: none"> a. Contract/Purchase Order and/or Notice of Award for the contracts stated in the List of all Ongoing Government & Private Contracts Including Contracts Awarded but not yet Started (NPCSF-INFR-02); b. Certification coming from the project owner/client that the performance is satisfactory as of the bidding date for all ongoing contracts stated in form NPCSF-INFR-02. c. Documents to be submitted during post-qualification process as specified in Annex B of Section – Part II, Technical Data Sheets; d. Bar Chart e. The licenses and permits relevant to the Project and the corresponding law requiring it as specified in the Technical Specifications, if any.
21	<p>The following documents shall form part of the contract:</p> <ol style="list-style-type: none"> 1. Notice to Proceed 2. Construction schedule and S-curve 3. Manpower Schedule 4. Construction Methods

	<ol style="list-style-type: none">5. Equipment Utilization Schedule6. Construction safety and health program of the contractor duly approved by the Bureau of Working Condition (BWC) of the Department of Labor and Employment (DOLE) or proof of submission to BWC7. PERT/CPM.
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SECTION IV

**GENERAL CONDITIONS OF
CONTRACT**



SECTION IV – GENERAL CONDITIONS OF CONTRACT

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SECTION IV – GENERAL CONDITIONS OF CONTRACT

1. Scope of Contract

This Contract shall include all such items, although not specifically mentioned, that can be reasonably inferred as being required for its completion as if such items were expressly mentioned herein. All the provisions of RA No. 9184 and its 2016 revised IRR, including the Generic Procurement Manual, and associated issuances, constitute the primary source for the terms and conditions of the Contract, and thus, applicable in contract implementation. Herein clauses shall serve as the secondary source for the terms and conditions of the Contract.

This is without prejudice to Sections 74.1 and 74.2 of the 2016 revised IRR of RA No. 9184 allowing the GPPB to amend the IRR, which shall be applied to all procurement activities, the advertisement, posting, or invitation of which were issued after the effectivity of the said amendment.

2. Sectional Completion of Works

If sectional completion is specified in the **Special Conditions of Contract (SCC)**, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date shall apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

3. Possession of Site

3.1 The Procuring Entity shall give possession of all or parts of the Site to the Contractor based on the schedule of delivery indicated in the **SCC**, which corresponds to the execution of the Works. If the Contractor suffers delay or incurs cost from failure on the part of the Procuring Entity to give possession in accordance with the terms of this clause, the Procuring Entity's Representative shall give the Contractor a Contract Time Extension and certify such sum as fair to cover the cost incurred, which sum shall be paid by Procuring Entity.

3.2 If possession of a portion is not given by the above date, the Procuring Entity will be deemed to have delayed the start of the relevant activities. The resulting adjustments in contract time to address such delay may be addressed through contract extension provided under Annex "E" of the 2016 revised IRR of RA No. 9184.

4. The Contractor's Obligations

The Contractor shall employ the key personnel named in the Schedule of Key Personnel indicating their designation, in accordance with ITB Clause 10.3 and specified in the **BDS**, to carry out the supervision of the Works.

The Procuring Entity will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are equal to or better than those of the personnel listed in the Schedule.

5. Performance Security

- 5.1. Within ten (10) calendar days from receipt of the Notice of Award from the Procuring Entity but in no case later than the signing of the contract by both parties, the successful Bidder shall furnish the performance security in any of the forms prescribed in Section 39 of the 2016 revised IRR.
- 5.2. The Contractor, by entering into the Contract with the Procuring Entity, acknowledges the right of the Procuring Entity to institute action pursuant to RA No. 3688 against any subcontractor be they an individual, firm, partnership, corporation, or association supplying the Contractor with labor, materials and/or equipment for the performance of this Contract.

6. Site Investigation Reports

The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to in the SCC supplemented by any information obtained by the Contractor.

7. Warranty

- 7.1. In case the Contractor fails to undertake the repair works under Section 62.2.2 of the 2016 revised IRR, the Procuring Entity shall forfeit its performance security, subject its property(ies) to attachment or garnishment proceedings, and perpetually disqualify it from participating in any public bidding. All payables of the GOP in his favor shall be offset to recover the costs.
- 7.2. The warranty against Structural Defects/Failures, except that occasioned-on force majeure, shall cover the period from the date of issuance of the Certificate of Final Acceptance by the Procuring Entity. Specific duration of the warranty is found in the SCC.

8. Liability of the Contractor

Subject to additional provisions, if any, set forth in the SCC, the Contractor's liability under this Contract shall be as provided by the laws of the Republic of the Philippines.

If the Contractor is a joint venture, all partners to the joint venture shall be jointly and severally liable to the Procuring Entity.

9. Termination for Other Causes

Contract termination shall be initiated in case it is determined *prima facie* by the Procuring Entity that the Contractor has engaged, before, or during the implementation of the contract, in unlawful deeds and behaviors relative to contract acquisition and implementation, such as, but not limited to corrupt, fraudulent, collusive, coercive, and obstructive practices as stated in ITB Clause 4.

10. Dayworks

Subject to the guidelines on Variation Order in Annex "E" of the 2016 revised IRR of RA No. 9184, and if applicable as indicated in the SCC, the Dayworks rates in the Contractor's Bid shall be used for small additional amounts of work only when the

Procuring Entity's Representative has given written instructions in advance for additional work to be paid for in that way.

11. Program of Work

11.1. The Contractor shall submit to the Procuring Entity's Representative for approval the said Program of Work showing the general methods, arrangements, order, and timing for all the activities in the Works. The submissions of the Program of Work are indicated in the **SCC**.

11.2. The Contractor shall submit to the Procuring Entity's Representative for approval an updated Program of Work at intervals no longer than the period stated in the **SCC**. If the Contractor does not submit an updated Program of Work within this period, the Procuring Entity's Representative may withhold the amount stated in the **SCC** from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program of Work has been submitted.

12. Instructions, Inspections and Audits

The Contractor shall permit the GOP or the Procuring Entity to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors of the GOP or the Procuring Entity, as may be required.

13. Advance Payment

The Procuring Entity shall, upon a written request of the Contractor which shall be submitted as a Contract document, make an advance payment to the Contractor in an amount not exceeding fifteen percent (15%) of the total contract price, to be made in lump sum, or at the most two installments according to a schedule specified in the **SCC**, subject to the requirements in Annex "E" of the 2016 revised IRR of RA No. 9184.

14. Progress Payments

The Contractor may submit a request for payment for Work accomplished. Such requests for payment shall be verified and certified by the Procuring Entity's Representative/Project Engineer. Except as otherwise stipulated in the **SCC**, materials and equipment delivered on the site but not completely put in place shall not be included for payment.

15. Operating and Maintenance Manuals

15.1. If required, the Contractor will provide "as built" Drawings and/or operating and maintenance manuals as specified in the **SCC**.

15.2. If the Contractor does not provide the Drawings and/or manuals by the dates stated above, or they do not receive the Procuring Entity's Representative's approval, the Procuring Entity's Representative may withhold the amount stated in the **SCC** from payments due to the Contractor.

SECTION V

**SPECIAL CONDITIONS OF
CONTRACT**

SECTION V – SPECIAL CONDITIONS OF CONTRACT

GCC Clause	
2	Sectional completion is not specified.
4	<p>It shall also be the obligation and responsibility of the Contractor to carry out the Works properly and in accordance with this Contract, including but not limited to the following conditions:</p> <p>a. The Contractor shall conduct the Works with due regard to safety and health in accordance with its Construction Safety and Health Program (CSHP) duly approved by the Department of Labor & Employment (DOLE) and in compliance with the DOLE Department Order No. 13 – The Guidelines Governing Occupational Safety and Health in the Construction Industry.</p> <p>Failure to comply with the approved CSHP will be considered as non-compliance with the Contract and shall result to the imposition of Section 19, Violation and Penalties of the DOLE Department Order No. 13 and any appropriate sanctions such as, but not limited to:</p> <ol style="list-style-type: none"> 1. Suspend the work until the Contractor complies with the approved CSHP with the condition that the work resumption will not incur additional cost to the Corporation; 2. Suspend payment of the portion of work under question; 3. Correct the situation by employing 3rd party and charge all expenses incurred to the Contractor's collectibles/securities; and 4. Report the condition to the Bureau of Working Conditions of the DOLE for their appropriate action. <p>b. The Contractor shall be responsible for the strict compliance with the provision of the Philippine Laws affecting labor and operation of Work under the contract and shall be responsible for the payment of all indemnities arising out of any labor accident which may occur in the execution of the Works and for which he may be responsible under Republic Act 3428, as amended, known as the Workmen's Compensation Law.</p> <p>c. The Contractor is obliged to exercise due care so as not to endanger life and property in the vicinity of the Works where he operates in connection with this Contract. He shall be liable for all damages incurred in any manner by acts of negligence of his own, or his agents, employees, or workmen.</p> <p>d. It is the responsibility of the Contractor for the strict compliance with the requirements of the Philippine Clean Air Act of 1999 (R.A. 8749) and Philippine Clean Water Act of 2004 (R.A. 9275). The Contractor shall be liable for any damages/destructions to the environment including penalties that will be imposed by the Department of Environment and Natural Resources (DENR) arising from non-compliance of the requirements thereof.</p>



	<p>e. The Contractor shall be responsible for the strict compliance with the requirements of the Environmental Compliance Certificate (ECC) issued for this project (if any) and DENR Administrative Order No. 26. He shall be liable for any damages/destructions to the environment including penalties that will be imposed by the DENR arising from non-compliance thereof, in any manner by his acts or negligence, or by his agents, employees, or workmen in the execution of the Works. The Contractor may employ a Pollution Control Officer accredited with the DENR for the duration of the project, if so required by the DENR Administrative Order No. 26</p> <p>f. It shall be the Contractor’s responsibility for the correctness, accuracy and quality of works. NPC’s approval does not relieve his contractual obligation and responsibility under this contract.</p> <p>g. Payment of all forms of taxes, such as value added tax (VAT) including municipal licenses and permits, and others that may be imposed by the Philippine Government or any of its agencies and political subdivisions in connection with the Contract shall be for the account of the Contractor.</p> <p>h. In general, the Contractor is totally responsible for the execution of the Works and therefore, takes upon himself all the technical, legal and economic risks and all obligations which could arise therefrom or connected therewith. The overall responsibility of the Contractor includes the responsibility for actions or omissions of his own personnel as well as the personnel of the sub-contractors.</p>
<p>4.1</p>	<p>NPC shall give access to the Site for the Contractor to commence and proceed with the works on the start date. The access to the site referred herein shall not be exclusive to the Contractor but only to enable him to execute the Work.</p>
<p>5</p>	<ol style="list-style-type: none"> 1. The following must be indicated in the performance bond to be posted by the Contractor: <ol style="list-style-type: none"> i. Company Name ii. Correct amount of the Bond iii. Contract/Purchase Order Reference Number iv. Purpose of the Bond: “To guarantee the faithful performance of the Principal’s obligation to undertake <u>(Contract/Purchase Order Description)</u> in accordance with the terms and conditions of <u>(Contract No. & Schedule/Purchase Order No.)</u> entered into by the parties.” 2. The bond shall remain valid and effective until the duration of the contract <u>(should be specific date reckoned from the contract effectivity)</u> plus sixty (60) days after NPC’s acceptance of the last delivery/final acceptance of the project. 3. In case of surety bond, any extension of the contract duration or delivery period granted to the CONTRACTOR shall be considered as given, and any modification of the contract shall be considered as authorized, as if with the expressed consent of the surety, provided that such extension or modifications falls within the effective period of the said surety bond. However, in the event that the extension of the contract duration or delivery schedule would be beyond the

	<p>effective period of the surety bond first posted, it shall be the sole obligation of the CONTRACTOR to post an acceptable Performance Security within ten (10) calendar days after the contract duration/delivery period extension has been granted by NPC.</p> <p>4. Other required conditions in addition to the standard policy terms issued by the Bonding Company:</p> <ul style="list-style-type: none"> i. The bond is a penal bond, callable on demand and the entire amount thereof shall be forfeited in favor of the Obligee upon default of the Principal without the need to prove or to show grounds or reasons for demand for the sum specified therein; ii. The amount claimed by the Obligee under this bond shall be paid in full and shall never be subject to any adjustment by the Surety; iii. In case of claim, the Surety shall pay such claim within sixty (60) days from receipt by the Surety of the Obligee's notice of claim/demand letter notwithstanding any objection thereto by the Principal.
<p>6</p>	<p>No site investigation report.</p>
<p>7.2</p>	<p>In case of permanent structures, such as buildings of types 4 and 5 as classified under the National Building Code of the Philippines and other structures made of steel, iron, or concrete which comply with relevant structural codes (e.g., DPWH Standard Specifications), such as, but not limited to, steel/concrete bridges, flyovers, aircraft movement areas, ports, dams, tunnels, filtration and treatment plants, sewerage systems, power plants, transmission and communication towers, railway system, and other similar permanent structures: Fifteen (15) years.</p> <p>In case of semi-permanent structures, such as buildings of types 1, 2, and 3 as classified under the National Building Code of the Philippines, concrete/asphalt roads, concrete river control, drainage, irrigation lined canals, river landing, deep wells, rock causeway, pedestrian overpass, and other similar semi-permanent structures: Five (5) years.</p> <p>In case of other structures, such as Bailey and wooden bridges, shallow wells, spring developments, and other similar structures: Two (2) years.</p>
<p>10</p>	<p>No dayworks are applicable to the contract.</p>
<p>11.1</p>	<p>The Contractor shall submit the Program of Work to the Procuring Entity's Representative within Ten (10) calendar days of delivery of the Notice of Award/Letter of Acceptance.</p>
<p>11.2</p>	<p>The period between Program of Work updates is Thirty (30) calendar days.</p> <p>The amount to be withheld for late submission of an updated Program of Work is One percent (1%) of contract amount.</p>



<p>12</p>	<p>During contract implementation, the Procuring Entity shall conduct Constructors Performance Evaluation in accordance with Section 12, Annex E of the Revised Implementing Rules and Regulation of R.A. 9184 using the NPC Constructors Performance Evaluation System (CPES) Guidelines.</p> <p>CPES ratings shall be used for the following purposes: a) eligibility screening/post-qualification; b) awarding of contracts; c) project monitoring & control; d) issuance of Certificate of Completion; and in adopting measures to further improve performance of contractors in the prosecution of government projects.</p> <p>Qualified Constructors Performance Evaluators (CPE) shall conduct project evaluation as follows:</p> <p>(a) During Construction - Except for those projects with a duration of 90 calendar days and below which may be subjected to at least one (1) visit, all projects shall be subjected to a minimum of two (2) evaluations to be performed by the CPE. The number of evaluations beyond the prescribed minimum shall be determined by the CPES-Implementing Unit based on the size, nature and complexity of the project and shall be subject to approval by the proper authorities within the agency. The first evaluation shall be performed when the project is at least thirty percent (30%) physically complete or as maybe required by the CPES-IU using the S-curve or other appropriate means to determine whether there is substantial work completed for evaluation.</p> <p>(b) Upon Completion - only one evaluation shall be performed by the CPE right after the Project Implementation Group reports one hundred percent (100%) completion of the project.</p>
<p>13</p>	<p>The maximum amount of advance payment is fifteen percent (15%) of the Contract Price and paid in lump sum.</p>
<p>14</p>	<p>No further instructions.</p>
<p>15.1</p>	<p>The date by which "as built" drawings and operating and maintenance manuals are required is within thirty (30) calendar days after completion of contract.</p>
<p>15.2</p>	<p>The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals by the date required is Five percent (5%) of contract amount.</p>



SECTION VI

TECHNICAL REQUIREMENTS

**PART I – TECHNICAL SPECIFICATIONS
PART II - TECHNICAL DATA SHEETS**



SECTION VI

TECHNICAL REQUIREMENTS

PART I – TECHNICAL SPECIFICATIONS



PART I – TECHNICAL SPECIFICATIONS

- E.1.0 - PROJECT HIGHLIGHTS**
- E.2.0 - GENERAL ADMINISTRATIVE REQUIREMENTS**
- E.2.1 - GENERAL TECHNICAL REQUIREMENTS**
- E.2.3 - STEEL POLES**
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- E.2.6 - OVERHEAD GROUND WIRE**
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PART I – TECHNICAL SPECIFICATIONS

E.1.0 PROJECT HIGHLIGHTS

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E.1.0 PROJECT HIGHLIGHTS

1.0.0 PROJECT DESCRIPTION

The project constitutes the Supply and Erection/Installation of the proposed new **Tap - Uson 69kV Transmission Line**. It is expected that after the completion of the project, a safe and reliable transmission of power going to Masbate Electric Cooperative's (Maselco's) Load-End Substation will substantially ensure. The proposed new transmission line will be tapped at existing pole structure number MC-193 along Mobo-Cataingan Transmission line located at Buenavista Uson, Masbate.

The existing NPC's Mobo-Cataingan 69kV transmission line is presently energized at 13.8kV level and is being used by Maselco.

The work to be done by the successful bidder shall consists of but not limited to furnishing all superintendence, labor, materials, tools and other incidentals for the complete supply & erection/installation of the aforementioned line which will be constructed for single circuit, 336.4 MCM ACSR and utilized steel poles of various sizes/heights with a total line length of approximately 1.2 circuit kilometers. The scope covers the supply and erection/installation of the 69kV, single circuit, steel pole structures and transmission line materials as specified in the relevant specifications.

1.0.1 LOCATION OF THE PROJECT

The project is located within the municipality of Uson, province of Masbate.

1.0.2 CONTRACT DURATION

Contract Period: **Ninety (90)** calendar days.

The contract period is inclusive of twenty (20) rainy/unworkable days, considered unfavorable for the execution of works at the site. The number of calendar days shall be counted from the date of effectivity of the Notice to Proceed.

1.0.3 GENERAL

The work shall be performed and completed in a workmanlike manner, in accordance with generally accepted modern practice in the erection and installation of transmission lines.

All equipment and materials which the Contractor shall supply and install shall be new and unused. They shall be suitable for their intended purpose complying with all applicable regulations, quality and dimension standards.

1.0.4 SCOPE OF WORK

The works and services to be performed by the successful bidder shall essentially consist of but not limited to the following:



- a. Moving-in, including furnishing, superintendence, installation, construction, operation and maintenance of general construction facilities and moving-out thereof after completion and acceptance;
- b. Check survey based on the plan and profile;
- c. Clearing of right-of-way (15 meters wide) for the entire route, which shall include cutting, gathering, transporting and stockpiling "cut trees" from project site (NPC ROW) to DENR CUSTODIAL AREA in the locality;
- d. Dismantling and Extraction of existing pole structure number MC-193 (3D-50 concrete) and haul to nearest NPC stockyard (refer to Bill of Quantities (BOQ) and Annexes - Structure List);
- e. Supply and erection of additional (intermediate steel pole) Type E-55 with concrete encasement between MC-192 and MC-193;
- f. Supply and erection of new Type D-60 steel pole with concrete encasement as replacement to the extracted MC-193 to be used as the tapping point (see Dwg. No.TU-BDE-04-006 and Structure List);
- g. Staking of pole sites;
- h. Excavation works for the erection of various types of steel pole structures, anchor blocks for guying, etc.;
- i. Supply and erection/installation of various type of new steel pole structures including dressing and accessories;
- j. Supply and installation/stringing of power conductor and overhead ground wires complete with appurtenances and accessories;
- k. Supply and installation of various type of insulators and ground string assemblies;
- l. Supply and installation of vibration dampers for power conductors and overhead ground wire;
- m. Supply and installation of various type of guying assemblies;
- n. Furnishing and installation of pole numberings;
- o. Conduct of continuity test on the entire line; and
- p. All other works necessary although not specifically mentioned and detailed but are required for the complete, safe and reliable operation of the transmission line.

Bidders are required to make an ocular survey of the route of the line to enable them to see the actual field conditions in order to offer a realistic and equitable bid. NPC will extend reasonable assistance and cooperation in showing the route of the line.

The Contractor shall conduct check survey of the proposed line route and shall establish the required staking for all sites. Any discrepancy between the Plan and Profile and the actual survey conducted by the Contractor shall be reported to NPC.

The Contractor will be required to perform the entire quantity of work necessary to complete the erection of the line at the Contract Unit Price, be it more or less than the quantity herein estimated.

PART I – TECHNICAL SPECIFICATIONS

E.2.0: GENERAL ADMINISTRATIVE REQUIREMENTS

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E.2.0: GENERAL ADMINISTRATIVE REQUIREMENTS

2.0.0 GENERAL

2.0.0.1 Purpose

2.0.0.1.1 This Section specifies the general requirements applicable to engineering documentation, planning and scheduling, inspection, tests, materials, workmanship and standards related to the implementation of the Contract. Supplementary requirements of a special nature are contained in subsequent sections.

2.0.0.2 Correspondence

2.0.0.2.1 To expedite action or response to all communications pertaining to this Contract, the Contractor shall address all such communication to:

THE MANAGER

Design and Development Department
National Power Corporation
Quezon Avenue corner Agham Road
Diliman, Quezon City

2.0.0.2.2 The Contractor shall maintain a record for all correspondences which shall be accessible to NPC for information. The Contractor shall forward correspondences to NPC in one (1) original.

2.0.0.2.3 All correspondences between NPC and the Contractor shall be numbered consecutively.

2.0.0.3 Language and System of Measurement

2.0.0.3.1 All documentation relative to this Contract shall be in English. Submitted drawings, literature, etc., which are not in English language will be considered as not submitted at all.

2.0.0.3.2 Metric units shall be used in all documents, correspondence, technical schedules and drawings. On drawings or printed pamphlets where other units have been used, the metric equivalent shall be marked in addition.

2.0.1 CONTRACTOR'S ORGANIZATION AND PERSONNEL

2.0.1.1 Organization

2.0.1.1.1 The Contractor shall maintain in its project site offices, the Contractor's project organization charts for management, control and execution of the Contract. The Contractor's organization and personnel shall be as stated in the proposal. Any changes in the organization and personnel will be allowed upon approval of NPC.

2.0.1.1.2 The Contractor shall maintain an up-to-date project organization chart, which shall be submitted to NPC for approval in the event of any changes.



2.0.1.2 Key Positions

2.0.1.2.1 The key positions in the organization charts of the Contractor pertain to individuals assigned to management/supervisory positions, who at any time during the execution of the work can give decision and recommendation to NPC on matters pertaining to the proper and early completion of the Work.

2.0.1.2.2 The appointment, transfer and replacement of personnel to all key positions shall be subject to NPC's prior approval.

2.0.1.2.3 Engineering and procurement in key positions shall be committed to continue through the Contract period in order to maintain continuity.

2.0.2 PLANNING AND SCHEDULING**2.0.2.1 General**

2.0.2.1.1 The Contractor shall be responsible for planning and scheduling, progress monitoring and reporting of all works and activities at sites.

2.0.2.1.2 The Contractor shall submit for approval by NPC within fifteen (15) days of the Effective Date of Contract, a detailed Contract Schedule resulting from the deployment of the Contractor's project management tool(s) for monitoring project activity progress, such as a Critical Path Method (CPM) Network or Project Evaluation and Review Technique (PERT) Diagram. The detailed schedule shall show commencement and completion dates for at least the following activities and "milestones":

- a. Engineering Design;
- b. Submittal of specifications and drawings for review and approval of NPC;
- c. Fabrication or manufacture of all transmission line materials, poles and hardware;
- d. System integration and shop testing;
- e. Factory Acceptance Tests;
- f. Shipments;
- g. Arrival of transmission line materials, poles and hardware at site;
- h. Civil works, erection;
- i. Tower/pole erection/ installation and dressing;
- j. Stringing works;
- k. Testing and commissioning;
- l. Trial operation;
- m. Handover to NPC.

2.0.2.2 Format and Presentation

2.0.2.2.1 The Contractor shall prepare an activity network with the activities listed in early start order and showing the following:

- a. activity code
- b. activity description
- c. duration in days
- d. early start and finish dates
- e. late start and finish dates.



2.0.2.2.2 The Contractor shall also prepare a bar chart identifying all activities which cannot be performed without NPC's approval, and the need dates for NPC's decision.

2.0.2.2.3 The Contract Schedule submitted shall meet the completion dates in the Construction Schedule and Schedule of Timings and shall clearly demonstrate the manner in which the various phases of the Works shall be completed.

2.0.2.2.4 All activities required for execution of the Works shall be carried out in accordance with the sequence and times and completion dates shown on the Contract Schedule or subsequent revisions thereto as approved by NPC.

2.0.2.3 Progress Monitoring Principle and System

2.0.2.3.1 Throughout the duration of the Contract, the Contractor shall monitor progress of the Works, and shall immediately advise NPC in advance of any anticipated schedule delays, and the reason therefore.

2.0.2.3.2 If the Contractor believes it is necessary or advantageous to change the sequence of events shown on the Contract Schedule, he shall submit a proposed revision accompanied by a full explanation of the reasons and ramification of the change to NPC for approval. No change shall be made in the order in which the Works activities are being performed until NPC's approval for the revised Contract Schedule has been obtained.

2.0.2.3.3 Actual progress of each activity of the Works shall be compared with progress indicated on the approved Contract Schedule at least once every month by the Contractor.

2.0.2.3.4 After NPC approves the Contractor's detailed Contract Schedule and planned activity completion dates, the Contractor shall update and analyze the Contract Schedule once a month and submit updated revision to NPC on or before the 5th day of the following month.

2.0.2.3.5 The Contractor shall not change the sequence of activities shown on the approved Contract Schedule without NPC's prior approval.

2.0.3 MEETINGS

2.0.3.1 Progress Review Meetings

2.0.3.1.1 The Contractor shall schedule and hold monthly progress review meetings with NPC to a mutually agreed agenda. The meetings shall normally take place at the Contractor's site offices.

2.0.3.2 Interface Meetings

2.0.3.2.1 The Contractor shall attend interface meetings with NPC's other contractors if any, as arranged by NPC on a monthly or specifically called basis. The Contractor may also call for such meetings, if necessary.



2.0.3.3 Design Review Meetings

2.0.3.3.1 The Contractor may request for a design review meeting during the processing stage of seeking the approval of NPC to all design drawings to review, clarify and evaluate the design submitted with reference to the tender, the final design and the Contract Specification. The Contractor shall submit a meeting agenda seven (7) days prior to the meeting.

2.0.3.4 Other Meetings

2.0.3.4.1 The Contractor shall arrange discipline meetings and other meetings as necessary with sub-contractors, etc. NPC shall be notified in due time of such arrangements and given opportunity to attend.

2.0.3.4.2 The Contractor and NPC shall as required, hold meetings on specific subjects.

2.0.3.5 Call for Meetings

2.0.3.5.1 Except for regular scheduled meetings, calls for meetings and agenda shall be sent out by the party calling the meeting to all requested attendees.

2.0.3.6 Minutes of Meetings

2.0.3.6.1 Minutes shall be prepared by the Contractor on an agreed form and be issued for NPC's review the next working day after the meeting has taken place. Minutes shall be approved by NPC before copies are distributed to all attendees.

2.0.3.6.2 Matters requiring action shall be assigned the responsible party with dates for completion of such action. Result of action from previous meetings shall be recorded.

2.0.3.6.3 Copies of minutes of meetings from interface meetings and other meetings, ref. Paragraphs 2.0.3.1 and 2.0.3.3 shall be sent to NPC in six (6) copies.

2.0.4 REPORTS**2.0.4.1 Monthly Reports**

2.0.4.1.1 The Contractor shall from the second month after Commencement Date, submit to NPC a monthly report related to the Works performed during the previous month. The Contractor shall present the report with diagrams in printed format.

2.0.4.1.2 Cut-off date for the report shall be the last Sunday of each month. The monthly report shall be submitted to NPC no later than 12.00 hours on Wednesday after the cut-off date. The monthly report shall include as a minimum the following items:

- a. narrative of major achievements and any deviations from time schedule, reasons for delays and deviations, with recommended actions and potential effects;



- b. the Contract Detail Schedule showing the status at the cut-off date by means of a front line or equivalent;
- c. a systematic listing and analysis of all significant time critical activities;
- d. a summary of HSE activities and reported incidents in own and major sub-contractor's activities;
- e. report on interface activities; and
- f. narrative report on quality management activities.

2.0.4.2 Close-out Reports

2.0.4.2.1 Project Control Close-out Report

2.0.4.2.1.1 The Contractor shall submit to NPC a project control close-out report within ten (10) days after issue of the Completion Certificate which shall contain as a minimum the following items:

- a. final as-is Contract Detail Schedule;
- b. final as-is Cost report; and
- c. final as-is Contract amendment (if any) and Variation Order register, if any.

2.0.5 HEALTH, SAFETY AND ENVIRONMENT (HSE)

2.0.5.1 General

2.0.5.1.1 The Contractor shall at all time during the performance of the Contract be responsible for the safety of all personnel involved therewith.

2.0.5.1.2 Safe working practice for engineering and manufacturing shall be based on regulations, standards and HSE objectives.

2.0.5.1.3 The Contractor shall take all necessary precautions in connection with the performance of the Works in order to ensure the safety and health of the personnel of NPC, the Contractor as well as Third Parties, and to protect the Works, the property of NPC and all Third Parties.

2.0.5.1.4 The Contractor shall prepare and HSE program and submit this to NPC for review and acceptance within thirty (30) days after the Effective Date of Contract.

2.0.5.1.5 The HSE program shall indicate how the Contractor shall implement his HSE requirements, how to perform follow-up and a proposed level of reporting to NPC. The Contractor has the overall responsibility to ensure that all Site activities are planned, organized, performed and documented according to the Contractor's program. Accordingly, the Contractor is responsible for coordinating the HSE activities for all Site personnel working on the Contract.

2.0.5.2 Reporting to NPC

2.0.5.2.1 All situations not complying with approved procedures and other requirements shall immediately be reported to NPC. All accidents shall be reported to NPC.



2.0.5.3 Pollution Control

2.0.5.3.1 The Contractor shall perform the Works without discharge into the atmosphere, from any source whatever, smoke, dust or other air contaminants in violation of law.

2.0.5.4 Fossils and Articles of Value

2.0.5.4.1 All fossils, coins, precious or semi-precious stones, precious metals, articles of value or antiquity, and structures and other remains or things of geological or archaeological interest discovered on the Site of the Works shall be deemed to be the absolute property of the Government. The Contractor shall take appropriate precautions to prevent his workmen or any person from removing or damaging any such article or thing and shall immediately, upon discovery and carry out, at the expense of the Government, NPC's orders as to the disposal of same.

2.0.6 DOCUMENTS TO BE PREPARED BY THE CONTRACTOR**2.0.6.1 General**

2.0.6.1.1 The general documents, calculations, certifications, manuals, drawings, etc. relating to the manufacturing works, civil works, installation, testing and commissioning works which are to be prepared during detailed design by the Contractor are listed here below. The Contractor's attention is drawn to various sections of this Specification, where detailed contents of documentation are specified.

2.0.6.2 Outline Drawings

2.0.6.2.1 The Contractor shall, within thirty (30) calendar days after the Effective Date of Contract, submit outline drawings of the transmission line materials and equipment to be furnished under this Contract, together with weights, external forces, anchoring details and sufficient overall dimensions to facilitate preparation of final designs of the structure foundations.

2.0.6.3 Detailed Drawings, Designs and Specifications

2.0.6.3.1 Before proceeding with the manufacture of equipment materials, the Contractor shall submit corresponding detailed drawings, designs and detailed specifications (in typewritten hardbound form) which shall show all details of materials, manufacture, assembly, testing, erection, commissioning, operation and maintenance of the equipment in conformity with the Contract requirements.

2.0.6.3.2 The detailed drawings and specification shall include, but not necessarily be limited to the following:

- (i) general assembly drawings;
- (ii) pole erection/installation methods and procedure indicating:
 - the various equipment and tools that will be used for the erection/installation,



- systems and procedures for installation/erection,
 - systems and procedures for pole dressing and stringing of conductors,
 - testing and commissioning,
- (iii) assembly drawings, showing:
- sectional views
 - details of mounting of the internal equipment,
 - function of the assemblies,
 - adjustment and operating ranges,
 - concrete pedestals and foundation bolts and anchors'
 - field tolerances,
 - all field joints,
 - methods of lubrication (if required)
- (iv) detail manufacturing drawings showing:
- detail dimensions
 - tolerances
 - materials
 - nameplate diagrams
- (v) engineering instructions and detailed specifications for:
- manufacturing
 - fabrication
 - painting, including final color scheme
 - heat treatment
 - welding
 - surface treatment
 - testing

2.0.6.4 Design Computation and Final Design Data

2.0.6.4.1 After the Contractor has completed the preliminary design of the equipment, he shall submit the final design data, design analysis and design computations (referred to as designs) along with all other specified designs and studies, all in type written and book bound form, clearly laid out with all the design criteria and standards indicated for NPC's review and approval.

2.0.6.5 Parts Bills

2.0.6.5.1 The Contractor shall submit with the first drawing issue, where applicable, corresponding parts bills. Reference to the respective detail or assembly drawing, materials used or catalog shall be made.

2.0.6.6 Catalogue Cuts, Illustrations, Etc.

2.0.6.6.1 Applicable requirements of this paragraph with reference to drawings shall apply equally to catalogue cuts, illustrations, printed specifications, design data, analysis and calculation, and manufacturer's descriptive literature and instructions for all equipment furnished to demonstrate fully that all parts will conform with the requirements and intent of the Contract Documents.

2.0.6.7 Installation Manual

- 2.0.6.7.1 The Contractor shall provide NPC with an Installation Manual covering installation procedure and instruction to facilitate smooth erection, assembly and testing on site of all equipment to be installed.
- 2.0.6.7.2 The instructions therein shall specify the exact procedures to be followed during installation, indicate data to be measured and recorded (adjustments, setting of limits, etc.), quantities, dimensions and tolerances to be checked, etc.
- 2.0.6.7.3 The manual shall include information on handling and slinging the major pieces of equipment, erection, tolerances, settings and adjustments and special precautions to be taken during installation.
- 2.0.6.7.4 The Contractor shall submit six (6) copies each of the Installation Manual to NPC.

2.0.6.8 Final/As-Built Drawings

- 2.0.6.8.1 The Contractor shall furnish a complete set of original reproducible copies of an approved type and four (4) sets of recordable CDs which can be loaded and handled on a personal computer each containing copies of all drawings as finally approved and built. Such CDs shall be suitable for CD ROM/WRITE drive of computer system. The Contractor, if required in Section E.2.1 of the Technical Data Sheets, shall supply the necessary hardware and software as a complement for the submission of Final/As-Built Drawings. Four (4) additional prints of same drawing with dark lines on a white background shall be furnished. For all approved drawings with no subsequent revisions, the reproducible copies earlier furnished may be considered part of this set. NPC will not release the final payment and the performance security until the foregoing conditions have been fulfilled.

2.0.7 PRESENTATION OF DOCUMENTATION

- 2.0.7.1 Drawings and documents mentioned above under Paragraph 2.0.6 shall be submitted to NPC for approval. The timing of such submission shall be in accordance with Paragraph 2.0.8.
- 2.0.7.2 All documents to be approved by the NPC shall meet the following requirements:
- a. Metric units shall be used in all documents, correspondence, technical schedules and drawings.
 - b. All other documentation shall be forwarded in A4 format with four (4) holes at intervals of 80-80-80 mm symmetrically around the center axis of the document. NPC's document number, document name and revision index must be readable on all pages.
 - c. All drawings and copies shall be on white paper and with black print unless otherwise agreed upon.



- d. All drawings shall be provided with clear space (approximately 80 mm x 50mm) for NPC's stamping of **"Approved"** or **"Approved With Corrections Indicated"** or **"Returned for Correction"**.

"Approved"; this mark authorizes the Contractor to proceed with the Contract Work therein indicated.

"Approved with Corrections Indicated"; this mark authorizes the Contractor to proceed with the Contract Work therein indicated taking into account of the notes and/or comments by the Contractor and re-submit the drawings, specifications or designs for approval.

"Returned for Correction"; this mark requires the Contractor to make the corrections indicated and re-submit the drawings, specifications or designs for approval before commencing the Contract Work therein indicated.

- e. For documentation submitted in binders, the binders shall have four (4) rings at intervals of 80-80-80mm symmetrically around the center axis. The maximum width of the binder shall be 75 mm. The binders shall have text at front and at spine.

- 2.0.7.3 Award of contract does not imply approval of drawings and data submitted by the Contractor with his tender.
- 2.0.7.4 Approval of the Contractor's drawings shall not be held to relieve the Contractor or any part of the Contractor's obligations to meet all the requirements of this specification nor of the responsibility for the correctness of the Contractor's drawings.
- 2.0.7.5 When revised drawings or drawings which have been returned to the Contractor marked **"Approved with Corrections Indicated"** or **"Returned for Correction"** are re-submitted for approval, the revision block shall be completed with the description and date of revision and the appropriate revision letter or numeral which shall be clearly indicated adjacent to the revision or modification which requires approval.
- 2.0.7.6 No revision affecting the design shall be made after a drawing has been **"Approved"** without re-submitting the drawings suitably revised for formal approval.
- 2.0.7.7 NPC will complete the review and/or approval of the Contractor's drawings within twenty (20) calendar days after receipt at NPC's office. If within the twenty (20) calendar days, Contractor has not received any reply from NPC regarding the approval drawings, the Contractor may proceed with the design and manufacture of equipment or materials as if the drawings have been approved. The Contractor however, is referred to the provisions of Paragraph 2.0.7.4 regarding approval of Contractor's drawings.

2.0.8 PROCEDURE FOR DELIVERY OF DOCUMENTS**2.0.8.1 General**

2.0.8.1.1 The Contractor shall submit the following information to NPC. The number of copies to be supplied shall be as indicated below:

2.0.8.2 Within Fifteen (15) Days after the Effective Date of Contract:

Detailed time schedule showing the commencement and completion dates for the various activities and milestone specified in Paragraph 2.0.2.1.2

six (6) sets of:

- Drawing classification plan
- List of detailed drawings
- Quality Control and Assurance Program
- HSE Program
- detailed Contract Schedule

2.0.8.3 Within Thirty (30) Days after the Effective Date of Contract:

six (6) sets of:

- Design and manufacturing schedules
- Delivery, erection and commissioning schedules
- Principal drawings, schemes, tables and electrical diagrams
- Type test reports and literature concerning the equipment if not submitted with the bid
- A program of performance, material and workshop tests to be carried out
- Outline Drawings of the equipment
- Loading of foundations for all items of equipment to be supplied and details of anchors and supports
- Drawings for structures
- Delivery of all drawings related to civil works

2.0.8.4 At Least Fifteen (15) Days Prior to Shipment

- Six (6) copies of Inspection report
- Five (5) copies of Test certificates or test reports together with certificate of inspections (additional two (2) complete set bound in books required)

2.0.8.5 At Least Thirty (30) Days Prior to Shipment

- Six (6) sets of packing lists for each consignment
- Six (6) sets of instructions for loading, unloading, handling and special precautions to be observed for storage at site
- Six (6) sets of Installation Manuals for each equipment to be supplied

2.0.8.6 Before Issuance of Certificate of Provisional Acceptance

- One (1) reproducible (rolled) and six (6) copies of all drawings marked “**Final/As-Built Drawings**” and four (4) sets of recordable CDs each containing copies of all the drawings as finally approved and built.

2.0.9 QUALITY MANAGEMENT REQUIREMENTS**2.0.9.1 General**

2.0.9.1.1 The Contractor shall have an established, documented, implemented and maintained Quality Management System (QMS) that conform with the requirements of ISO 9001 Quality Management System – Requirements or equivalent quality management standard relevant for the Works to assure that items and services, including subcontracted items and services, comply with this specification.

2.0.9.1.2 Within fifteen (15) days of the Effective Date of Contract, the Contractor shall submit six (6) copies of his complete quality control and assurance procedures, manuals for review and approval by NPC. The manual shall include pro-forma check lists for all requirements of the Contractor’s quality control and assurance program and those called for in this Specification.

2.0.9.2 Quality Assurance Program

2.0.9.2.1 In the absence of a QMS Certification the Contractor shall have an established, documented, implemented and maintained Quality Assurance Program to ensure that works and services, including sub-contractual works and services conform to the required Specification.

2.0.9.2.2 The Contractor shall, for all work covered by the Contract:

- a. Establish procedures for adequate planning and resource of all quality related activities including the preparation of quality plans.
- b. Establish measures for the identification and control of items throughout the stages of the Contract. This shall include measures to maintain traceability as identified in agreed quality plans.
- c. Arrange for the protection of the quality of the product to include delivery to the specified destination.
- d. Control their measuring and test equipment in accordance with established procedures for measurements and calibration systems and ensure that such equipment that may be used by subcontractors to verify work is similarly controlled.
- e. Ensure adequate quality systems exist for compliance with the requirements identified in Paragraph 2.0.9.1 to 2.0.9.10 inclusive.

2.0.9.2.3 Where any site installation and/or test and commissioning work is involved, the Contractor shall prepare contract-specific quality assurance procedures in agreement with NPC prior to commencements of such works.

- 2.0.9.2.4 The Contractor shall be responsible for specifying the quality assurance requirements to his subcontractors, for approving sub contractors quality assurance program and for ensuring compliance with the requirements.
- 2.0.9.2.5 The Contractor shall ensure that all appropriate technical information is extracted from the Contract documents and specifications and passed on to the subcontractors.
- 2.0.9.2.6 The Contractor shall ensure that all computer systems and software to be utilized on the project is qualified for the application under consideration and such qualification is documented.
- 2.0.9.3 Quality Plan**
- 2.0.9.3.1 The Contractor shall establish and implement quality plans detailing the specific activities, design reviews, operations, control procedures, requirement for the product, inspections, testing, criteria for product acceptance, approvals and certification requirements applicable. All procedures, which support the quality plan shall be referenced and distributed to NPC together with the quality plan. Quality plans shall be submitted to NPC for review and approval.
- 2.0.9.3.2 Where inspection schedules are generated in support of a quality plan, these are also required by NPC for review and approval. The format and content of schedules shall ensure that inspection operations are planned and performed in a systematic manner.
- 2.0.9.3.3 The Contractor shall keep NPC informed of any changes in the quality plan during the Contract period.
- 2.0.9.3.4 The quality plan shall document how the Contractor shall apply his quality system in the execution of the Contract. For the quality plan description and definition, the Contractor is referred to ISO 9000 and ISO 9001. The quality plan shall meet the guidelines of ISO 10005.
- 2.0.9.3.5 The quality plan shall consist of a set of plans, for which other terms than quality plan may be used, e.g. inspection plan. The hierarchy of the quality plan shall be shown. The quality plan shall contain a master test plan.
- 2.0.9.3.6 The Interface Coordination plan shall be a part of the Quality Plan and reflect the interfaces in the project and to the Scope of Work of the Contract. The Interface Coordination plan shall be a tool in safeguarding the handling of interface issues as well as a documentation of the same. The plan shall be maintained on a continuous basis and shall contain all interfaces towards other contractors and/or NPC, including target dates for exchange of information/documentation. The Contractor shall prepare the required documentation as input to other contractors in order to enable them to perform their scope of works.
- 2.0.9.3.7 Documents referred to in quality plans shall be available to NPC for review, if required.
- 2.0.9.3.8 Specific quality plans shall be prepared for site work and submitted for review and approval by NPC prior to commencement of such work.

- 2.0.9.3.9 The Contractor shall approve all quality plans, inspection and test schedules of their subcontractors and vendors.
- 2.0.9.3.10 The Contractor shall identify his verification requirements on the quality plans submitted to NPC for review and approval and shall identify the following:
- a. Stages subject to random surveillance.
 - b. Inspection that require to be carried out or witnessed, by NPC or a third party following satisfactory verification and acceptance by the Contractor.
 - c. Hold points beyond which work cannot proceed before completion of all operations, verifications and related activities identified after the previous hold point on the quality plan.

2.0.9.4 Subcontractors and Contractors

- 2.0.9.4.1 For each sub contractors, the Contractor shall identify the relevant quality standard ISO 9001, 9002 or 9003 to be selected in accordance with guidelines given in ISO 9000-1 and ISO 9000-3. The Contractor shall assess subcontractor's quality system and their implementation to confirm adequate qualification standard.
- 2.0.9.4.2 The Contractor shall plan and carry out the Quality Surveillance (QS) of his subcontractors (ref. ISO 8402, Clause 3.11) at a level of detail sufficient to ensure fulfillment of the quality requirements of the Contract. NPC shall have the right to participate as observer in such QS activities.
- 2.0.9.4.3 The Contractor shall submit his QS plans to NPC for acceptance and keep NPC informed of any change thereof.

2.0.9.5 Quality Audits

- 2.0.9.5.1 The Contractor shall plan and carry out quality audits in his own organization and in sub-contractors organizations. NPC shall review the Contractor's audit plans and coordinate his own audit plans with the Contractor's. The scope and frequency of the audits shall be adequate to confirm that the quality activities and results comply with the quality system and the planned arrangements.
- 2.0.9.5.2 NPC reserves the right to request, review and maintain for the duration of the contract a copy of the Contractor's Quality Manual.
- 2.0.9.5.3 During the course of the Contract, NPC reserves the right to carry out quality audits of the Contractor or their subcontractors. Monitoring will be by means of surveillance of activities at the work locations and where appropriate by formal audits. NPC representatives shall be provided unrestricted access, facilities and assistance at all reasonable times to carry out this quality audits.

2.0.9.6 Records

- 2.0.9.6.1 The Contractor shall generate records as required by the quality management system and quality plans. Records, including audit reports shall be made available for inspection by NPC.

- 2.0.9.6.2 All records shall remain legible, concisely compiled, indexed and cross referenced to the project contract number and the relevant subcontract numbers. They shall be clearly identifiable to the individual parts and assemblies to which they refer.
- 2.0.9.6.3 Those records required by NPC, as defined in the contract specifications and quality plans shall be available at the time of delivery of the equipment. Such records shall include reports and certification in respect of pressure retaining components together with general traceability records for all items through certification and build documentation as a minimum. Six (6) copies of these records shall be supplied to NPC with the exception of radiographic films where the original set of films shall be supplied.
- 2.0.9.6.4 All records generated during the course of the Contract, including those generated as evidence of effective implementation of the quality management system of the Contractor and his subcontractors, shall be retained by the Contractor for a minimum period of five (5) years from the date of contract completion. These records shall be made available to NPC on request during the retention period.
- 2.0.9.7 Particular QA Requirements**
- 2.0.9.7.1 General**
- 2.0.9.7.1.1 As a supplemental document to the QA program, the Contractor shall submit for approval of NPC, a separate document with detailed particular requirements and specific acceptance criteria of all equipment.
- 2.0.9.7.2 At Shop**
- 2.0.9.7.2.1 Corresponding to major and minor equipment, the following data are required for submission to and approval of NPC:
- a. Test and inspection procedure;
 - b. Guaranteed technical rated or design data;
 - c. List of hold points and/or routine tests;
 - d. Acceptance criteria and reference standards;
 - e. For test results/data with comparison to the guaranteed data. All allowable tolerances with respect to dimensional control of assemblies and sub-assemblies at shop shall be clearly indicated in the manufacturer's drawings.
- 2.0.9.7.3 At Site**
- 2.0.9.7.3.1 The dry tests at site shall be in accordance with the latest edition of ANSI or applicable IEC Standard. Verification tests after installation shall be thoroughly discussed with the requirements similar to the Paragraph 2.0.9.7.2.
- 2.0.9.7.3.2 NPC or his duly authorized representative shall control said site tests, in collaboration with the Contractor's representatives.

2.0.9.8 Reporting and Corrective Action

2.0.9.8.1 The Contractor's quality management system shall provide for prompt detection and correction of all conditions adversely affecting quality, including failures, malfunctions, incidents, trends, deficiencies, deviations, non-conformances, and defective materials. The Contractor shall establish and maintain methods for verifying and determining the cause of an adverse condition and for initiating necessary improvement and corrections to preclude repetition. Quality trends shall be analyzed to furnish a basis for improvement in work performance. The Contractor's corrective action system shall extend to the performance of other participating contractors, sub-contractors, and Contractors, when necessary, and shall provide for the interchange of corrective action information. Identification of the adverse condition, its cause, and the corrective action taken shall be recorded and reported to appropriate levels of management.

2.0.9.8.2 The Contractor shall establish and implement procedures for reporting, verifying, analyzing, and correcting failures, including those that occur during development and qualification testing. The procedure shall provide assurance that the cause and mode of each failure are determined, that potential safety and availability implications are evaluated, and that corrective action is taken.

2.0.9.8.3 A failure report shall be prepared to identify the failed item and its origin or source of manufacture and shall describe the failure, the test status at time of failure, the probable cause and mode of failure, and the recommended corrective action.

2.0.9.9 Design Revision and Substitution of Material

2.0.9.9.1 Any revision affecting the design and manufacturing of the equipment as well as substitution of materials that is deemed necessary shall be notified by the Contractor to NPC for the latter's review and approval.

2.0.9.10 Non-conformity Handling

2.0.9.10.1 For nonconformity handling, the requirements of ISO 9001, Clause 8.3 shall apply.

2.0.9.10.2 The Contractor shall provide all information required to enable the NPC to evaluate the Contractor's nonconformity request.

2.0.9.10.3 Nonconformities which had been accepted by NPC and decided to be "as is" shall be documented in the as-built documentation.

2.0.9.10.4 Nonconformities caused by subcontractors and their subcontractors, shall also be recorded and handled by the Contractor.

2.0.9.10.5 Any request for NPC's approval of a non-conformity shall be on a specific report form which shall fulfill the following requirement. The nonconformity report shall:

- a. clearly state whether the nonconformity will be a permanent "as is" nonconformity or not;

- b. give reference to violated requirements;
- c. state whether it is violating authority requirements;
- d. be justified with sufficient explanation and documentation for easy review and approval
- e. clearly refer to affected area where applicable.

2.0.9.11 Contractor's Responsibility

2.0.9.11.1 Approval by NPC of the Contractor's quality assurance program, quality plans and inspection and test plans, or of those of his subcontractors will not relieve the Contractor of his obligation to provide goods and services which meet the requirements of the Contract.

2.0.9.11.2 Within fifteen (15) days of the Effective Date of Contract, the Contractor shall submit six (6) copies of his complete quality control and assurance procedures, manuals for review and approval by NPC. The manual shall include pro-forma check lists for all requirements of the Contractor's quality control and assurance program and those called for in this Specification.

2.0.10 TRANSPORT, PACKING, ETC.

2.0.10.1 General

2.0.10.1.1 No shipping or transport limitation shall be imposed by NPC on the Contractor. The responsibility shall lie on the Contractor whether the dimensions of his supplied equipment and materials in crate or in box will be appropriate for loading, unloading and transported to the Site.

2.0.10.1.2 The Contractor must at his own expense, conduct an ocular route survey of all roads, bridges, overpasses, etc. from the Port of Entry to the Site and examine for himself the conditions of all roads and bridges.

2.0.10.1.3 The Contractor shall check the capacity and availability of loading and unloading facilities which will be utilized in connection with his transport operation, as well as its characteristics, taking appropriate measures to avoid damaging the same. All costs related to the reinforcement of roads, bridges and the like, if any, shall be borne by the Contractor.

2.0.10.1.4 The Contractor shall coordinate his own transport program and shall advise proper authorities of the transit of the heaviest items to be transported and shall comply with the instructions given by said authorities.

2.0.10.1.5 All damages caused to public roads, streets or public structures shall be compensated by the Contractor at his own expense.

2.0.10.2 Packing

2.0.10.2.1 All parts of the Contracted Equipment and the Contractor's equipment shall be well-packed and protected against loss or damage during transport by sea and overland, and while in storage. Perishable material provided in spares and repair sets shall be provided in sealed containers with a shelf-life of at least ten (10) years. All packaging shall be performed in a such a way that overturning of the packages will not damage the equipment.

2.0.10.2.2 Any damage, loss or deterioration which is attributed to inadequate packing or protection of transport, shall be replaced at the Contractor's own expense or be compensated to the satisfaction of the NPC.



- 2.0.10.4.1.2 Materials shall be completely drained of all water and thoroughly dry prior to shipment. When such draining requires removal of plugs, drain valves, etc., the Contractor shall make sure that these parts are reinserted or reassembled prior to shipment.
- 2.0.10.4.1.3 The structures, its components and other materials shall be adequately supported for shipment. All loose parts shall be crated or boxed for shipment and appropriately identified.
- 2.0.10.4.1.4 All large and heavy shipping units shall have suitable skids for moving. Crating shall also be adequate for lifting with slings. If location of slings is critical, these locations shall be marked accordingly.
- 2.0.10.4.1.5 All transmission line structures and its components shall be shipped from the factory, subject to the limitations of length, height, depth, and weight, etc. described in the **Technical Data Sheets** for each of the materials under this Specification.
- 2.0.10.4.1.6 For the conductors, it shall be supplied on reels as required in the Technical Data Sheets and shall be sturdy enough to withstand rough, but normal and customary, handling during loading, transport, unloading, field deployment and installation. The inside surfaces of the drum and flanges shall be smooth and without protrusions so that the conductor is not damaged during winding and unwinding. The cable shall be protected by plastic or other suitable material against dust and sprays (particularly salt spray). Steel-banded lagging is required on the outside of wooden flanges and between the flange I-beams of metal reels. Reels shall be marked consecutively from a production run.
- 2.0.10.4.1.7 Tools shall be packed in individual boxes. Individual boxes may be shipped in larger shipping units such as containers or pallets.
- 2.0.10.4.1.8 All fittings, connectors, spacers and clamps shall be neatly packed in boxes or crates and shall be protected against dust and sprays (particularly salt sprays) by providing a hermetically sealed polyethylene sheet covering. Shipment without this covering will not be accepted.
- 2.0.10.4.1.9 All setting templates, anchor bolts and accessories shall be packaged per unit structure such that a bundle shall contain the corresponding approved number of setting templates, bolts and accessories.
- 2.0.10.4.2 Shipping and Transportation to Site**
- 2.0.10.4.2.1 The Contractor shall arrange and pay for the transport of the transmission line materials, hardware, accessories, etc. to the site, as well as handling and storage within the site. The Contractor shall also be responsible for the transport, handling and storage of his equipment and tools that he will be using in the installation/erection, stringing works, testing and commissioning of the transmission line under the Contract, as well as the return of these equipment and tools to the country of origin.

- 2.0.10.4.2.2 The Contractor shall be responsible for making sure that shipping is arranged on vessels having suitable equipment for loading and unloading of the transmission line materials, equipment and hardware, or that harbor has the corresponding facilities.
- 2.0.10.4.2.3 NPC shall approve the transport arrangements. The Contractor shall, in good time, inform NPC about each consignment by providing a list of contents, including the shipping date and the expected date of arrival.
- 2.0.10.4.2.4 It shall be deemed that all costs in connection with the transport, including storage, insurance, etc., detailed above and in Conditions of Contract, being the responsibility of the Contractor, have been included and allocated in his prices stated in the Schedule of Prices.
- 2.0.10.4.2.5 The Contractor shall arrange and carry out under his own responsibility and supervision, the local transport from the port of unloading to the Site.
- 2.0.10.4.2.6 The Contractor shall gather all information and arrange for all necessary provisions in order to obtain accurate information about unloading and local transport facilities, as well as prevailing local conditions, specifically the safe load bearing capacity of public road and bridges. The Contractor shall bear all expenses related herewith, which shall be included in the tender.
- 2.0.10.4.2.7 The Contractor shall use every reasonable means and care to prevent any of the roads and bridges on the route to the Site from being damaged by any traffic by the Contractor or any of his sub-contractors. He shall select routes, choose and use vehicles, restrict and distribute loads so that any such extra ordinary traffic that will inevitably arise from the moving of the Contractor's equipment and material to or from the Site shall be limited as far as reasonably possible, and so that no damage may be caused to roads and bridges.
- 2.0.10.4.2.8 If, during execution of the Work or at any time afterwards, the Contractor should receive any claim arising from the execution of the Works with respect to damage to roads or bridges, he shall immediately report this to NPC and subsequently negotiate the settlement of any payment of all sums due with respect to all claims, proceedings, damages, costs, charges and expenses in related to the claim.
- 2.0.10.4.3 Inventory List**
- 2.0.10.4.3.1 An inventory list approved by NPC shall be furnished prior to shipment of materials and equipment, and shall consist of lists for:
- a. Materials
 - b. Spare parts, tools and equipment
 - c. Test Equipment
- 2.0.10.4.3.2 The materials listed shall consist of an itemization of materials furnished at the factory site.

2.0.10.4.4 Storage

- 2.0.10.4.4.1 The storage will be in an environment similar to the installed location, i.e., indoor equipment will be stored indoors (without heating and ventilation), and outdoor equipment will be stored outdoors. Where required to protect against condensation and humidity, a desiccant shall be provided and its presence, with the need of periodic removal and dry out, shall be so marked. When electric space heaters are provided for that purpose, these should be wired to the outside of the equipment so that energizing immediately upon receipt is possible without disassembly of crates, etc. This also requires that no combustible materials be left in the inside of the equipment.
- 2.0.10.4.4.2 Items which maybe subjected to open storage for several months on site shall be suitably packed and protected from the weather.
- 2.0.10.4.4.3 The Contractor shall provide storage and handling instructions including descriptions for periodic inspection and/or storage maintenance to ascertain that no deterioration will occur during storage. One set of these instructions shall be fastened securely to the outside of the shipping unit.
- 2.0.10.4.4.4 The Contractor shall provide at NPC's request, the Contractor recommended instructions for long term storage.
- 2.0.10.4.4.5 When equipment is specified for export shipment, the Contractor shall include packaging adequate for export shipment, and this packaging shall be such as to obtain approval and acceptance by transportation companies.
- 2.0.10.4.4.6 All transmission line structures, materials and equipment shall be shipped from the factory completely packed or contained in the container as far as practicable, subject to the limitations of length, height, depth, and weight, etc. described in the Special Conditions of Contract or in the Technical Data Sheets for each of the equipment under this Specification.

2.0.11 EXECUTION OF THE WORK**2.0.11.1 General**

- 2.0.11.1.1 All works shall be executed in accordance with the requirements and in a manner set forth in the various documents in this Specification and in accordance with the Conditions of the Contract.
- 2.0.11.1.2 All construction work shall be planned and carried out in collaboration with NPC and executed in compliance with all regulations, orders and rulings in force in the Republic of the Philippines, which may affect or be applicable to the performance of the Contract. The Contractor shall be responsible for all damages and liabilities arising from failure to comply with said regulations, orders and rulings. NPC will assist the Contractor in obtaining access and permissions required for the performance of the Work.

2.0.11.2 Workmanship

2.0.11.2.1 All work, methods of work and workmanship, whether fully specified herein or not, shall be of the highest order. In all respects, the generally accepted requirements and commonly recognized good practice for first class work of this nature are to be adhered to. All work shall be performed to the satisfaction and approval of NPC. Such approval will not release the Contractor from his responsibilities arising from damages and liabilities due to poor workmanship.

2.0.11.3 Access to the Site

2.0.11.3.1 NPC shall permit access to the Site to the Contractor immediately after the effective date of the Contract, and, unless the specification may provide to the contrary, the Contractor shall provide and maintain all temporary entrances and roadways necessary for execution of the Works under this Contract. NPC will be responsible for the basic approvals and consents required for the project and all approvals, consents and permits required for the implementation of the Works shall be obtained by the Contractor, at his cost.

2.0.11.3.2 NPC shall have free access to the Site at all times and to all places where any part of the work is being executed for inspection of such works in progress.

2.0.11.3.2 NPC shall have free access to the Site at all times and to all places where any part of the work is being executed for inspection of such works in progress.

2.0.11.3.3 NPC reserves the right to place his representatives at the Site throughout the entire period of the Contract. NPC also reserve the right to conduct visits around the project throughout the entire construction, manufacturing, testing and erection period for the benefit of public relations and/or official inspections.

2.0.11.3.4 The Contractor shall provide to NPC and to other contractor's, whose names shall have been previously communicated in writing to the Contractor by NPC, every reasonable facility for execution of work, which is concurrently performed with his own.

2.0.11.4 Technical Staff

2.0.11.4.1 The Contractor shall assign a skilled superintendent and the necessary competent construction foremen constantly for the performance of the work at Site.

2.0.11.4.2 The Contractor shall have an available authorized member of his organization at site during regular working hours whom NPC may contact regarding any problem with respect to materials, workmanship, specification compliance, work progress, etc., so that decisions maybe obtained on such matters without delay.

2.0.11.5 Labor

- 2.0.11.5.1 Labor shall be the responsibility of the Contractor. The Contractor shall employ such skilled, semi-skilled and unskilled Labor as necessary for the proper execution of the Contract. The rate of pay for local Labor at project site shall not be less than the prevailing wage scales for similar duties in the locality. The Contractor shall furthermore make all efforts to avoid labor disputes, strikes, slow-downs and similar difficulties that may delay the completion of the contract.
- 2.0.11.5.2 The personnel used for the works shall be sober and if the Contractor or NPC finds anyone influenced by alcoholics during working time, he/she shall immediately be expelled from further rendering service. The use of narcotics will not be accepted either during working time or off-duty time.
- 2.0.11.5.3 The Contractor shall be responsible for making himself acquainted with, as well as the observation of all Labor Laws of the Government of the Republic of the Philippines.
- 2.0.11.5.4 Termination of employment shall be in accordance with the Philippine Labor Laws.

2.0.11.6 Working Hours

- 2.0.11.6.1 The Contractor shall if possible carry out the work at Site continuously during the normal working hours generally recognized in the area. For certain route portions, it may be necessary to perform the outside normal working hours to avoid traffic problems etc. NPC may, after consulting with the Contractor, direct work to be done at other times when practicable. Extra costs for work performed in the event of default by the Contractor shall be at the sole expense of the Contractor. Otherwise, extra costs, for work so performed, upon written instructions by the NPC, will be added to the contract price. If it is the Contractor's wish to instruct his personnel to work overtime, the agreement with NPC shall not be unreasonably withheld and no extra charges shall be paid to the Contractor.

2.0.11.7 Safety and Protection

- 2.0.11.7.1 The Contractor shall provide his own security measures for safety of equipment and materials.
- 2.0.11.7.2 Precautions shall be exercised at all times by the Contractor for the protection of persons and property regardless of jurisdiction, ownership or responsibility. The safety provisions of applicable laws, ordinances, codes and good practice in the Philippines shall be observed. Machinery, equipment and other parts of the Contract Equipment shall be guarded in strict accordance with these provisions.
- 2.0.11.7.3 The Contractor shall immediately advise NPC of the occurrence of any accident at the Site or in connection with the execution of the Contract.
- 2.0.11.7.4 The Contractor shall provide and adequate crew at all times for continuous clean-up work at the Site.

2.0.11.8 Rejection

- 2.0.11.8.1 Should NPC find evidence of poor workmanship, defects or other variations from the Specifications, the Contractor will be notified promptly and shall proceed immediately to rectify such faults or causes of rejection.

2.0.12 MISCELLANEOUS**2.0.12.1 Contractor's Superintendence**

- 2.0.12.1.1 The Contractor shall provide a competent Service Engineer, or technician during installation/erection and stringing works and perform the complete tests, commissioning and start-up of the transmission line system.
- 2.0.12.1.2 The Contractor shall send only service engineer, or technician who have adequate working knowledge of the English language.
- 2.0.12.1.3 NPC reserves the right, if services for a longer period are needed, to ask for extension of the Contractor's supervisors until such time that NPC's personnel have been fully trained in the operation, test and maintenance of the transmission line materials and test equipment supplied by the Contractor, at no cost to NPC.
- 2.0.12.1.4 The Contractor shall notify NPC sixty (60) days in advance of the date when the service engineer or technician should commence the installation, stringing, tests and commissioning of the transmission line at the site in order for NPC to prepare his personnel in participating such activities.
- 2.0.12.1.5 The service engineer or technicians shall not be considered employee of NPC for all legal intents and purposes and the Contractor shall be responsible for the payment to said service engineer or technician of all indemnities accruing of any labor accident which may occur in the course of the work and for which the Contractor maybe responsible either under the Philippine Laws or any foreign laws.

2.0.12.2 Training of NPC Personnel**2.0.12.2.1 General**

- 2.0.12.2.1.1 If required in the Technical Data Sheets of the equipment, the Contractor shall provide overseas and local training courses for NPC's personnel in English language.
- 2.0.12.2.1.2 Training shall be geared towards the technical engineers and maintenance personnel of NPC through the transfer of technical knowledge.
- 2.0.12.2.1.3 Training overseas, if required in the Technical Data Sheets shall include classroom instruction courses conducted on the Contractors premises during manufacture of the transmission line components and hands-on training to enable NPC personnel to manage, install, test, commission, maintain, operate and service the transmission line component on completion of the works in accordance with maintenance and operating procedures established

by the Contractor. All expenses in the overseas training shall be borne by the Contractor including airfares, accommodation, transportation and allowances.

- 2.0.12.2.1.4 The training overseas shall not be more than one (1) month and shall commence at the latest, two (2) months before the date of the main shipment of the transmission line components to be supplied. NPC shall dispatch the required number of engineers specified in the Technical Data Sheets of the equipment where training is required to attend the training at the factory sites. They should be able to see and study the transmission line components to be supplied to NPC.
- 2.0.12.2.1.5 Local training shall also be conducted for ten (10) NPC personnel for not more than one (1) month. The Contractor shall provide similar training documentation and local meals to NPC personnel. NPC shall provide training room and any available test facilities.
- 2.0.12.2.1.6 Training selected from among NPC maintenance staff will be qualified electrical and/or electronic personnel. Their experience will be of a broad and general technical nature, including general familiarity with electronic systems and testing facilities.
- 2.0.12.2.1.7 The cost of performing the training course shall be included in the Contract Price for the equipment.

2.0.12.2.2 Training Objectives

- 2.0.12.2.2.1 The training courses shall be designed to:
- a. Enable maintenance staff to perform maintenance of the transmission line components by teaching principle of operation trouble-shooting methods and procedures leading to the identification and replacement of faulty piece of equipment, modules, units and components, with the objective that NPC personnel will become capable of carrying out repair and maintenance without outside assistance.
 - b. Enable maintenance staff to perform routine maintenance of the transmission line components by way of electrical and mechanical adjustments, lubrication and/or replacement of parts subject to wear or with a limited life.
 - c. Provide an understanding of the software and a working knowledge of the database for additions, modifications, and deletions and the practical use of diagnostic programs.

2.0.12.2.3 Course Content

- 2.0.11.2.3.1 The training course shall consist of formal courses given on the Contractor's premises including classroom training, instruction and explanation during shop tests and/or Factory Acceptance Tests and practical work sessions with the Contractor's specialists during the implementation of requirements of the Contract. Training shall be on the same hardware and software supplied under the contract.

2.0.12.2.4 Course Documentation

- 2.0.12.2.4.1 The Contractor shall submit a daily schedule for the entire training period and a syllabus for each course with a listing of course documentation, not later than thirty (30) days prior to the start of training.
- 2.0.12.2.4.2 Documentation shall be provided covering each course to a level of detail so that the text is self-explanatory and sufficient as future reference.
- 2.0.12.2.4.3 Prior to the start of a course, each trainee shall receive at least one (1) set of documentation covering that course. The Contractor shall submit to NPC one (1) set of course documentation per trainee not later than fifteen (15) days prior to start of each course.

PART I – TECHNICAL SPECIFICATIONS

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E.2.1: GENERAL TECHNICAL REQUIREMENTS

2.1.0 SCOPE

2.1.0.1 General

This Section specifies the minimum set of requirements applicable to the materials and equipment included in the scope of works under this Project. Supplementary requirements of a special nature are contained in subsequent sections.

2.1.1 WORKMANSHIP

2.1.1.1 Workmanship shall be of first-class quality and in accordance with the best modern practice for the manufacture, installation/erection, testing and commissioning of high grade transmission line structures, conductors, insulators and hardware, notwithstanding any omissions from these specification and drawings.

2.1.1.2 Contractor's own personnel or personnel subcontracted for the erection/installation of poles, stringing of conductors, terminations, etc. shall be specially trained and educated by the Contractor in order to be fully capable to perform the work to the highest possible technical standard.

2.1.1.3 The personnel shall be completely aware of the necessity to fully follow the technical quality assurance requirements established by the Contractor. Local foreman and installation personnel shall be able to explain to NPC the quality requirements applicable to a specific work location and for the particular steps in the assembly procedure.

2.1.2 MATERIALS

2.1.2.1 Requirements to Materials

2.1.2.1.1 All materials to be used under this specification shall be unused, of recent manufacture free of defects or irregularities and the best available considering durability, strength and intended service suitability and best engineering practice. All parts shall conform to the dimensions shown on, and shall be built in accordance with approved drawings. The surface finish of all parts and components shall be in conformity with the respective strength, fit and service requirements. Like parts and spare parts shall be interchangeable whenever possible. Machining of renewable parts shall be accurate and in accordance with the specified dimensions so that replacement of those parts fabricated or made according to dimensions so indicated in the drawings could be readily installed.

2.1.2.1.2 All materials shall comply with the latest revisions or edition of the specified standards for each of the transmission line component specification unless otherwise specified or permitted by NPC. When other standards are used, Contractor shall indicate the equivalence between the materials used and the corresponding materials following the specified standards in the equipment

specification and shall obtain the approval of NPC before starting the manufacture of the equipment and materials.

2.1.2.1.3 The names of manufacturers of transmission line component contemplated for incorporation in the work together with performance capacities and other significant information pertaining to the equipment shall be furnished for approval. Any transmission line component installed or used without such approval shall be at the risk of subsequent rejections.

2.1.2.1.4 It is the full responsibility of the Contractor for draining, taking care and disposal, in an approved manner, of all contaminated water or other kinds of materials dangerous to the environment.

2.1.2.2 Test of Material

2.1.2.2.1 Materials, parts and assemblies thereof entering into the work shall be tested, unless otherwise directed, according to the best commercial method for particular type and class of work. When the Contractor desires to stock material not manufactured specifically for the equipment furnished, satisfactory evidence that such material conforms to the requirements herein stated shall be furnished, in which case tests on these materials may be waived. Certified mill tests reports of materials will be acceptable.

2.1.2.2.2 Certified copies of test reports shall be furnished in triplicate as soon as possible after the tests are made and shall be in the manufacturer's possession prior to incorporating that material in the work. The reports shall be in such form as to enable determining compliance with the applicable specification for the material tested. When requested, tests shall be made in the presence of a duly authorized inspector.

2.1.3 CODES AND STANDARDS

2.1.3.1 Prescribed Standards

2.1.3.1.1 Unless specified otherwise in the various sections of this technical specifications for equipment, the design, materials, manufacture and testing of all works under this Contract shall comply with the latest revision or edition of the various standards specified for each equipment section of the specification.

2.1.3.1.2 The latest edition of each standard shall mean the latest edition available at the date of Contract signing.

2.1.3.1.3 In addition to the codes and standards mentioned in the technical specification for each equipment, the Contractor shall comply with all National and local laws, codes, regulations, statutes and ordinances.

2.1.3.1.4 Equipment or materials meeting other internationally accepted standards, which ensure an equal or higher quality than the standards mentioned, will also be accepted.

2.1.3.1.5 In the event of any apparent conflict among standards, codes or this specification, the Contractor shall refer the conflict to NPC for written resolution before start of fabrication. Final decision regarding the acceptance of proposed standards is the prerogative of NPC.

- 2.1.3.1.6 No deviation from the accepted standards shall be made subsequent to the Contract without the written approval of NPC.
- 2.1.3.1.7 Standards listed in individual technical specification are used mainly for NPC's references. Other internationally known standards however, shall also apply, provided such standards are equivalent in all respect to the standard prescribed and to the specific requirements described in the individual transmission line component specification. Contractor shall submit copies of such standards for NPC's review and approval.
- 2.1.3.2 Designation of Trade Name or Catalog Name and Number**
- 2.1.3.2.1 For convenience in designation in the Specification, certain components of the transmission line or processes are designated by trade name or catalog name and number. Such designations shall be deemed to be followed by the words "or equivalent" whether such words are shown or not, and the Contractor may offer any material or process which shall be equal in every respect to that so indicated or specified. The burden of proof of acceptability to NPC, as to the comparative quality and suitability of alternative shall be upon the Contractor. If the Contractor's request is not approved, the Contractor shall not ask or be permitted to use the same alternative materials or equipment in modified form.
- 2.1.4 INTERCHANGEABILITY AND STANDARDIZATION OF SMALL COMPONENTS**
- 2.1.4.1 All like parts shall be fully interchangeable with no requirement for alteration or adjustment.
- 2.1.4.2 The Contractor shall be responsible for the standardization of all small equipment, materials and devices he would supply. He shall arrange and perform the necessary coordination work with his manufacturers for the purposes of such standardization.
- 2.1.4.3 All transmission line components, parts and elements of mass production shall be standardized. Such items of equipment, parts and elements shall include, but shall not be limited to the following;
- Bolts and nuts
 - Spacers
 - Dampers
 - Clamps (Dead End Compression Type or Bolted Type Strain Clamp
 - Cotter pins, keys
 - All other hardware and materials necessary for a complete insulator
- 2.1.4.4 In order to achieve standardization with the transmission line component or elements to be supplied under other contracts, NPC reserves the right to impose upon the Contractor the type and brand of preferred component or element.

2.1.5 TESTS AND INSPECTION

2.1.5.1 General

2.1.5.1.1 The Contractor shall provide a test specification covering all tests on Contractor's premises. Successful completion, as deemed by NPC, of Inspection and Tests on Contractor's premises shall be a prerequisite to shipment of all materials, structures, conductors, insulators and hardware. Following successful completion of inspection and tests on his premises, the Contractor shall obtain the approval to proceed with the delivery of the materials, structures, conductors, insulators and hardware from NPC in accordance with the Technical Specification for the said items.

2.1.5.1.2 The objective of the test specification shall be to set forth the means, manner and circumstances in which to verify compliance with the Contract requirements including all functional and operation performance claims for the material, components, equipment, software or system made by the Contractor and/or the original equipment manufacturer.

2.1.5.1.3 The test specification shall include a program for Factory Acceptance Test (FAT) and detail the following:

- a. Requirements to be tested;
- b. Step-by-step method of testing;
- c. Expected results of tests

2.1.5.1.4 Approval of the test specification/procedure will not prejudice NPC's right to order additional tests, should NPC deem, following approval but before his acceptance of the materials, transmission line structures, conductors, insulators, software of system(s) for shipment, that certain conditions or combination of conditions were not foreseen in the test specification, in order to demonstrate that performance requirements of this Specification have been met.

2.1.5.1.5 Tests shall only be conducted with the aid and in accordance with test specification(s) and standards clearly identified as approved for use by NPC, and, where applicable, employ test instruments of suitable quality calibrated to manufacturer's recommendations by a reputable agency within the previous Four (4) months.

2.1.5.2 Inspection on Contractor's Premises

2.1.5.2.1 NPC reserves the right to inspect all shop and assembly work associated with the Works, verify quantities consigned to stores and inspect quality control and assurance records as well as shop and purchase order records. When scheduled, and as often as NPC deems appropriate, progress will be monitored with respect to Key Dates in the Contract Schedule and the sequence of events and activities on the Contractor's Details Contract Schedule.

2.1.5.2.2 The Contractor shall demonstrate and furnish evidence that general progress is being maintained so that no activities are in danger of becoming the critical path and that specific progress of those activities on the critical path meet all target dates set by the Contractor as well as Key Dates in the Detail Contract Schedule.



- 2.1.5.2.3 The Contractor shall furnish NPC, a list of Contractor and the components, materials, equipment or software to be furnished by them for use in the Works, in sufficient time to permit inspection and testing of all components, materials, equipment and software. Purchase Orders shall clearly indicate level of inspection to which purchased items will be subject.
- 2.1.5.2.4 All shop orders or instructions to production and manufacturing departments shall quote the pertinent requirements of the Specification and shall bear a suitable notation advising quality control inspection requirements. A system for advising the quality control department of same shall exist. If so requested by NPC, the Contractor shall furnish triplicate copies of the designated internal orders and instructions.
- 2.1.5.3 Tests on Contractor's Premises**
- 2.1.5.3.1 Routine Tests**
- 2.1.5.3.1.1 The Contractor shall perform routine tests in accordance with requirements of the Specification and the Contractor's test specification approved by NPC. The Contractor shall give NPC access to Works to determine or assess compliance with the provisions of this Specification or to witness Contractor's routine shop tests. The Contractor shall submit results of routine tests within fifteen (15) days after performance of the tests.
- 2.1.5.3.2 Type Tests**
- 2.1.5.3.2.1 The Contractor shall carry out all type tests called for in this Specification and such tests in the Standard in accordance with criteria and to the extent specified in the Specification and on custom manufactured items as called for by NPC to obtain required performance data.
- 2.1.5.3.2.2 Upon submission of relevant test certificates from an independent testing agency approved by NPC, and proof that the equipment to be tested is identical to that covered by the test certificates, NPC will waive the requirements for corresponding type tests called for in this Specification and/or specified in the Standards.
- 2.1.5.3.3 Factory Acceptance Tests**
- 2.1.5.3.3.1 Prior to shipping and final inspection, tests hereinafter referred to as Factory Acceptance Tests (FAT) shall be conducted by the Contractor at his plant and will be witnessed by NPC.
- 2.1.5.3.3.2 The Contractor shall carry out tests, as may be required by the specified Standards and the Quality Control and Assurance Program, as well as the entire test program, approved by NPC, prior to the witnessed FAT, remove all faults found and correct all failures so that to the best of his knowledge, no functional or procedural errors will occur during the witness FAT.
- 2.1.5.3.3.3 At the commencement of the witness FAT, all equipment shall be brought together in one place, integrated and the configuration/set-up at the factory site shall be identical to that to be installed at the site and any equipment and software necessary for the proper operation of the equipment shall have reached its final form, not to be changed during the FAT and until commencement of commissioning at site.



- 2.1.5.3.3.4 The Contractor shall immediately advise NPC should failures occur, take remedial action subject to NPC's approval and proceed with the FAT as and when directed by NPC. It shall be NPC's prerogative to order a repeat of all such tests that he deems may have been affected by the failure.
- 2.1.5.3.3.5 The Contractor shall ensure that during the test, all hard copy from output devices is retained and that no outside parties interfere in any way with testing, equipment or test instruments, fixtures and jigs for the entire duration of the FAT. Only Contractor's personnel who are needed on the testing of the equipment shall be allowed in the test area. The Contractor shall appoint a chief-tester who shall be responsible for conducting the test, ensuring at all times that the test instruments, fixtures, jigs and extender cards, and those of the Contractor's personnel who in any way may contribute to the test, including testers, specialists and maintenance personnel are available prior to scheduled commencement of each test or as and when instructed by NPC.
- 2.1.5.3.3.6 The chief-tester shall also be responsible that an accurate record of tests are kept and each individual test is duly initialed and dated by the tester and marked either passed or failed with annotations of antecedents and observations concerning the test. For each day of testing, the chief-tester shall submit to NPC the proposed disposition of each criterion that failed during the previous day of testing, prior to commencement of the tests scheduled for that day. Tests witnessed by NPC will be initialed accordingly by him on the test record. The test record and dispositions, and any other pertinent supporting data and documents shall form part of a test report to be submitted in accordance with the specification.
- 2.1.5.3.3.7 Material, equipment, software or system(s) shall be required to pass one complete run of functional tests with satisfactory results and shall have all faults and failures corrected, if any. At completion of all tests, as well as at any time during the test at NPC's discretion, test results, except for the parts comprising dynamic data, shall be compared with the reference copy. If no differences are detected and all tests have demonstrated compliance with the requirements of this Specification, then the FAT will be deemed successful.
- 2.1.5.4 Field Test**
- 2.1.5.4.1 Field tests and acceptance tests shall be performed by the Contractor and witnessed by NPC's representative on the various components of the transmission line to determine whether requirements of the specification have been fulfilled. The Contractor shall provide instructions and acceptance criteria for field testing for NPC's review and approval prior to conduct of such tests and commissioning the transmission line system. No field tests shall be performed unless approved and witnessed by NPC's representative.
- 2.1.5.5 Test Reports/Certificates**
- 2.1.5.5.1 Four (4) certified copies of the reports of all NPC's specified tests and other manufacturer standard tests shall be furnished to NPC immediately within a maximum of fifteen (15) days following the completion of the tests. For equipment and materials which had the required type test already, the type test certificates shall be submitted by the Contractor together with his proposal.

- 2.1.5.5.2 For the routine tests, acceptance tests and field tests, the test certificates shall include, in addition to the test results, the following information:
- a. Date for the test certificate
 - b. Equipment data
 - c. NPC's reference number
 - d. The equipment serial number
- 2.1.5.5.3 Certified test data submitted to NPC shall also include copies of oscillographic and other essential records made in conjunction with the tests, and certification that all equipment furnished are suitable, when energized at continuous voltage, and for manual washing using a single-stream high pressure nozzle.
- 2.1.5.5.4 The Contractor shall bear the cost of furnishing these records and reports.
- 2.1.5.6 Waiver of Factory Acceptance Tests Witnessing / Inspection by NPC**
- 2.1.5.6.1 If NPC opted not to witness the Factory Acceptance Tests, NPC will issue a Certificate of Waiver of Tests Witnessing/Inspection for the equipment and materials. In such case, the Contractor shall proceed with the Factory Tests in accordance with the requirement of the specification and the manufacturer's test specification as approved by NPC.
- 2.1.5.6.2 Where Factory Tests are not required to be witnessed by NPC's representative(s) as indicated in the Technical Data Sheets of the equipment, a Certificate of Waiver of Tests Witnessing/ Inspection will be issued also by NPC.
- 2.1.5.7 Test Failures**
- 2.1.5.7.1 If any of the transmission line component i.e. poles, conductors insulators, hardware, etc. fail to pass any test, NPC may, at his own judgment, direct the Contractor to make any necessary corrections or alterations to it for minor defects or to replace it forthwith for major defects. Any and all expenses that might result by the supply and installations of new parts or by modification of existing parts and any and all expenses resulting in additional tests made necessary by failure of the transmission line component to meet the guarantees and other requirements of the specification shall be borne by the Contractor. The costs of witnessing the Factory Acceptance Tests by NPC or his representative(s) as a result of re-test to be conducted on the equipment shall also be borne by the Contractor.
- 2.1.6 WELDING**
- 2.1.6.1 Welding Procedure**
- 2.1.6.1.1 All welding shall be performed in accordance with a procedure which shall be in accordance with standards equal to those required by the "Standard Qualification Procedure" of the American Welding Society.

2.1.6.2 Acceptance of Welded Structures

2.1.6.2.1 The acceptance of the welded work shall depend upon correct dimensions and alignment and absence of distortion in the structure, upon satisfactory results from the examination and testing of the joints in accordance with the instructions given on the drawings and the soundness of the welds and upon general good workmanship.

2.1.6.3 Cleaning

2.1.6.3.1 All excess weld materials, slag, splatter and flux residues shall be removed from the steel work.

2.1.7 TROPICAL SERVICEABILITY**2.1.7.1 General**

2.1.7.1.1 In choosing materials and their finishes, due regard is to be given to the humid tropical conditions under which equipment is to work. Some relaxation of the following provisions may be permitted only when equipment is hermetically sealed but it is preferred that tropical grade materials should be used wherever possible.

2.1.7.1.2 The Contractor shall supply NPC with detailed descriptions of all design characteristics necessary to fulfill the requirements in connection with the tropical conditions under which the transmission line components will be operated.

2.1.8 ENVIRONMENTAL REQUIREMENT AND OPERATING ENVIRONMENTAL CONDITIONS**2.1.8.1 General**

2.1.8.1.1 All materials, hardware, equipment and other transmission line components to be furnished shall conform with the environmental requirements and conditions applying to the location where it is to be used.

2.1.8.1.2 All materials, hardware, equipment and other transmission line components to be furnished shall meet the performance and rating requirements of this specification and all Contractor's guarantees shall be based on operation within the environment specified in the Technical Data Sheets of Section E.2.1. This also applies during storage and if susceptible to moisture absorption the equipment and materials shall be adequately tropicalized as specified in Paragraph 2.1.7.

2.1.8.1.3 Special measures shall be taken such as the use of chemically inert parts and proper surface preparation and paint application in accordance with this Specification for equipment installed at Site(s) with a corrosive atmosphere, to protect exposed metal parts and other materials susceptible to chemical reaction.

2.1.8.1.4 Transmission line components susceptible to deterioration from climatic conditions must be permanently protected.



2.1.9 SEISMIC REQUIREMENTS

2.1.9.1 The transmission line structures and its components shall be designed to withstand and maintain their structural integrity when exposed to seismic loading/seismic factor specified in the Technical Data Sheets of Section E.2.1. It shall be designed to resist a lateral seismic force and remain in place in accordance with the requirements of the latest issue of Uniform Building Code (UBC), Section 2312g.

2.1.9.2 The Contractor shall demonstrate the structure's capability to withstand and maintain its structural integrity when subjected to the forces resulting from the seismic conditions specified herein. This can be accomplished in one or a combination of the following methods:

- a. Predict the structure's performance and response to a seismic force by mathematical static analysis;
- b. Test the structures and its components under simulated seismic conditions (static or dynamic testing); or
- c. Utilize previous seismic qualification of the structure and demonstrate applicability under the seismic conditions specified herein.

2.1.9.3 The seismic loading on the structures and its components shall be obtained by multiplying the weight of components by the horizontal seismic acceleration factor. The force shall be assumed to act in any lateral direction.

Where: Acceleration Factor (horizontal) = what is stated in the
Technical Data Sheets

2.1.9.4 Support design shall not include friction in resisting the lateral shear load.

2.1.9.5 The maximum stresses, under seismic loading combined with all other load effects, shall be within the normal allowable material working stress limits as set forth in the appropriate design standards and codes listed in this specification.

2.1.9.6 Deformations resulting from the combined influence of normal operating loads and seismic loads shall be investigated to verify that they will not impair structural integrity.

2.1.9.7 The Contractor shall submit a certification stating that the equipment can resist the forces resulting from the seismic conditions specified herein and remain in place. The Contractor shall submit the following data and documents for NPC's information:

- a. Outline arrangement drawing showing all pertinent dimensions and support locations
- b. Analytical method and procedures in a step-by-step form which is readily auditable by persons knowledgeable in such analysis
- c. Results of analysis and conclusions

2.1.10 CLEANLINESS

2.1.10.1 At time of shipment, the structures (e.g. towers, poles) and its components such as hardware, conductors, insulators, etc., shall be thoroughly clean and ready for export shipment.



- 2.1.10.2 All waste such as metal chips or filings, welding stubs, dirt, rags, debris and any other foreign material shall be removed from the interior of each component. All mill scale, rust, oil, grease, chalk, crayon or paint marks and other deleterious materials shall be removed from all interior or exterior surfaces.
- 2.1.10.3 Solvent cleaning, if required, shall be performed in accordance with the specification.
- 2.1.10.4 Heavy cleaning, if required, shall be performed in accordance with the specification.
- 2.1.10.5 Cleaning of stainless steel surfaces shall be performed with solvents, cloths and abrasive that do not contain halide. Only stainless steel, clean, iron-free, hand or power tools and aluminum oxide abrasive shall be used on stainless steel components. Materials used to clean carbon steel or cast iron shall not be used to clean stainless steel surfaces.

2.1.11 SURFACE TREATMENT AND CORROSION PROTECTION

2.1.11.1 General

- 2.1.11.1.1 Structures and all steel parts (except for SUS 316 stainless steel surfaces) shall be painted, hot-dip galvanized (if and where required) or treated with protective coatings to prevent corrosion and provide a smart and pleasing appearance. This work shall comprise the surface treatment, priming and application of paint or metallic coatings in the workshop and at the site, including all paint repair works that may be necessary. Corrosion protection shall include the first 600 to 800 mm of steel surfaces of structures cast into concrete. All welding and drilling of steel parts shall be performed prior to galvanizing and painting.
- 2.1.11.1.2 The works of corrosion protection shall include all equipment and installations for sand blasting and paintings.
- 2.1.11.1.3 The Contractor shall furnish, with his proposal, a complete description of the corrosion protection he intends to provide. After purchase order, the Contractor shall submit applicable cleaning and coating procedures and specific description of coating material to be used.
- 2.1.11.1.4 Where possible, equipment shall be designed such that all surfaces can be finish-coated or recoated after erection at the site.

2.1.11.2 Requirements to the Finished Coating

- 2.1.11.2.1 All finished surfaces shall be level and free of tears, burrs, clots and impurities. The coat of paint shall be of even thickness, also in corners and on edges. Moreover, all finished surfaces shall be uniform in respect of color and gloss.
- 2.1.11.2.2 The paint film, under visual examination, must in any case present the appearance of an accurate application and be free of lesions, porosity, cracks or bubbles.

2.1.11.2.3 Any damage during transport, mounting, welding, etc. shall be repaired by Contractor. Repair methods shall be submitted for approval of NPC. This also applies to damages to components supplied by a sub-Contractor.

2.1.11.3 Guarantees

2.1.11.3.1 The guarantee period of the paint work shall be eighteen (18) months. During this period, it will be the responsibility of the Contractor to repair or replace without charge all paintwork showing defects (such as discoloration, peeling, wrinkles, bubbles, flakes or rust, etc.) where it may be proven that the deterioration arises from:

- a. Poor quality paint;
- b. Insufficient cleaning of the surface before painting;
- c. Incorrect choice of paint for the service required; and
- d. Incorrect application of paint itself to the surface.

2.1.11.3.2 In such cases, the Contractor shall take charge of restoration of all parts which have shown defects.

2.1.11.3.3 For the guarantee against corrosion penetration, NPC requires an eighteen (18) months guarantee period. The rust penetration shall be measured according to ISO 4628/3-1982. After eighteen (18) months, the rust penetration shall not exceed Ri 2. Ri 3 penetration shall entitle NPC to repair the surface at the expense of the Contractor.

2.1.11.3.4 The guarantee shall commence on the day of the issuance of the Certificate of Provisional Acceptance.

2.1.11.4 Reference Standard

2.1.11.4.1 Except otherwise specified elsewhere in the specification, the surface treatment and corrosion protection for all metal parts shall be in conformity with the latest revision of the standards listed below:

ASTM 123	Zinc (hot-dip galvanized) coating on Iron and Steel products
DIN 55928	Protective painting of steel structure instructions
DIN 55945	Painting Materials – Notions
DIN 18363	Paint work – Buildings
DIN 18364	Surface Protection Work for Steel
DIN 53210	Determination of Rust Degree
DIN 55151	Determination of Adhesion
ISO 4628/3	Determination of Rust Penetration

2.1.11.4.2 Other internationally known standards however, shall also apply provided such standards are equivalent in all respect with the reference standards prescribed above. The Contractor shall submit copies of such standards for NPC's review and approval.

2.1.12 SPARE PARTS AND SPECIAL TOOLS

2.1.12.1 A list of mandatory spare parts and special tools to be supplied by the Contractor is specified in the Technical Data Sheets for each of the transmission line component and materials under this specification. If in case any of the mandatory spare parts or tools are not applicable to his supplied



materials, the Contractor is required to provide an alternative spare parts and tools that are applicable to his supplied transmission line component with the same quantities as required. NPC has the option to choose in the list of the recommended spare parts and tools given by the Contractor the replacement for the mandatory spare parts and tools, which the Contractor failed to offer or provide an alternative replacement.

- 2.1.12.2 In addition to the above, the Contractor shall also include with his Proposal, a list of recommended spare parts and special tools which he considers necessary for the safe and reliable operation and maintenance of the transmission line component. The Contractor shall indicate the expected life of the parts requiring replacements and the minimum recommended inventory of the spare parts for installation, start-up, continuous operation and maintenance. Contractor shall state whether the recommended spare parts is a stock item or a special item, and shall furnish name and location of the nearest Contractor, and approximate lead time required for delivery. NPC has the option to consider or not to consider the recommended spare parts and tools as given by the Contractor with the corresponding price.
- 2.1.12.3 All spare parts shall be readily interchangeable with the ones which they are to replace. They shall be of the same material, of identical size and manufacture and shall have the same properties as the corresponding parts of the installed equipment. Specified conditions relating to tests, treatment of surfaces and painting, etc. of the installed equipment shall also apply to spare parts.
- 2.1.12.4 All spare parts shall be properly packed (and where necessary treated) in such a manner as to allow prolonged storage at the Site, considering the ambient conditions prevailing there. In due time, the Contractor shall inform NPC of the eventual precautions to be taken for the proper storage of the spare parts.
- 2.1.12.5 The Contractor shall provide a spare parts list containing at least the following information:
- Name and address of manufacturer and other identification no.
 - Item description, drawing no., material designation, units to be ordered.
 - List of for which the respective spare parts can be used.
 - Item price.

2.1.13 GENERAL ELECTRICAL REQUIREMENTS

2.1.13.1 General

- 2.1.13.1.1 The supply of the transmission line hardware for high and low voltage installation shall be complete to the extent required to put the transmission line in satisfactory operating conditions, with all the requirement completely connected and interconnected.
- 2.1.13.1.2 The Contractor must supply all minor items (fittings, terminal connectors and other accessories, etc.) which are necessary although not expressly described in the Technical Specifications, in order to guarantee the trouble free operation and ease in the maintenance of the supplied transmission line equipment and its components (or parts of transmission line system) with particular reference to the provisions to be taken in order to avoid dangerous or wrong operations.



2.1.13.1.3 The transmission line components shall be designed in such a way as to bear without damage and permanent deformation the consequences of over-voltage of internal or atmospheric origin and of the short circuit currents within the limits stated in the Technical Specification.

2.1.13.1.4 The steel poles and other transmission line hardwares shall be securely connected to the general earthing system in compliance with accepted Standards.

2.1.13.2 Insulation Levels

2.1.13.2.1 The insulation levels for different system voltages shall be as follows unless otherwise indicated on the particular Technical Data Sheets of the equipment and materials.

Nominal System Voltage, kV	Highest voltage for equipment, kV	Lightning Impulse Withstand (peak), kV	Rated power frequency short duration withstand voltage, kVrms	Switching Impulse Withstand Level (SWIL)
69	72.5	325	140	-
115	121	550	230	-
138	145	650	275	-
230	242/245	900	395	-
500	550	1550	620	1175

2.1.13.3 Minimum Clearances

2.1.13.3.1 The center-center line spacing and clearances above ground level of the conductors shall be as shown on the bid drawings, or in the absence of such information, shall match the ANSI or equivalent IEC Standards.

2.1.13.4 Creepage Distances

2.1.13.4.1 Creepage distance of string of insulators, line post insulators and rigid support insulators shall comply with the requirements stipulated in Paragraph 2.1.13.4.3.

2.1.13.4.2 The creepage distance shall be expressed in terms of mm, nominal distance creepage, per kV, highest system voltage.

2.1.13.4.3 Depending on the degree of pollution, the nominal values of the creepage distance have been categorized into four classes, namely: light, medium, heavy and very heavy. The qualitative description of the different pollution level is listed below and must be observed by the Contractor in their design and supply of various types of insulators unless otherwise indicated in the Technical Data Sheets.



Pollution Level	Minimum Nominal Specific Creepage Distance between phase & earth, mm/kV
Light	16
Medium	20
Heavy	25
Very heavy	31

2.1.13.4.4 Contractor may supply bushing and insulators with creepage distance higher than the values obtained from the above table when multiplied with the highest system voltage in consideration. NPC, however will not accept insulators and bushings with creepage distance below the nominal values obtained from the above table.

2.1.14.4.5 The degree of pollution level is mentioned in the Technical Data Sheets of Section E.2.1.

2.1.13.5 Levels of Equivalent Salt Deposit Density (mg/cm²)

2.1.13.5.1 The level of equivalent salt deposit density for different pollution levels are as follows:

Pollution Level	Equivalent Salt Deposit Density (mg/cm ²)
Light	0.02 – 0.04
Medium	0.04 – 0.10
Heavy	0.10 – 0.15
Very heavy	0.15 - up



PART I – TECHNICAL SPECIFICATIONS

E.2.3: STEEL POLE

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E.2.3: STEEL POLE

2.3.0 SCOPE

2.3.0.1 General

2.3.0.1.1 This specification covers the technical and associated requirements for tubular steel pole used in electric power transmission lines rated 69 kV. The poles shall be supplied with the required holes, rigging accessories, insulator attachment plates, lugs for bolted steps, guying attachments, ground clamps complete with bolts, nuts, washers and miscellaneous fittings, whenever necessary.

2.3.0.1.2 It is not NPC's intent to outline all the technical requirements or to set forth those requirements adequately covered by applicable codes and standards. Contractor shall furnish high quality work and materials meeting the requirements of this specification and industry standards.

2.3.0.1.3 The Contractor shall bear full responsibility that the steel poles have been fabricated in accordance with NPC design and all codes and the standards specified herein.

2.3.0.1.4 No deviation shall be made from this specification and standards unless waived or modified in writing by NPC. Contractor shall obtain from its sub-contractors, if any, a statement as to compliance with this specification without exception and/or if there are any exceptions, these shall be described in detail and included in Contractor's proposal. Contractor shall add a statement that no other exceptions are taken to this specification.

2.3.0.1.5 Contractor shall furnish a complete set of reproducible fabrication drawings to NPC after the drawings are approval by NPC.

2.3.0.2 Works to be Provided by Contractor

2.3.0.2.1 Contractor shall provide the materials, work and services specified in this Specification, drawings and as listed in the Technical Data Sheets.

2.3.0.3 Works to be Provided by NPC

2.3.0.3.1 NPC shall evaluate and approve fabrication drawings and test procedures, assist and witness the tests required in this Specifications and Technical Data Sheets.

2.3.1 CODES AND STANDARDS

2.3.1.1 General

2.3.1.1.1 The specified material and services shall be furnished in accordance with, but not limited to, the following codes and standards or to applicable equivalent standards of the country of the manufacturer, including all addenda, in effect at the time of purchase order, unless otherwise stated in this specification:

ASTM - American Society for Testing and Materials

A36/A36M	Standard Specification for Structural Steel
A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A143-89	Recommended Practice for Safeguarding Against Embrittlement of Hot Dip Galvanized Structural Steel Product and Procedure for Detecting Embrittlement
A153	Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
A239-89	Standard Test Method for Locating the Thinnest Spot in a Zinc (Galvanized) Coating of Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
A307	Standard Specification for Carbon Steel Bolts and Studs, 60ksi Tensile
A325	Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A354	Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners
A370	Test Methods and Definitions for Mechanical Testing of Steel Products
A384	Recommended Practice for Safeguarding against Warpage and Distortion during Hot-dip Galvanizing of Steel Assemblies
A394	Standard Specification for Galvanized Steel Transmission Tower Bolts and Nuts
A449	Specification for Quench and Tempered Steel Bolts and Studs
A490	Specification for Heat Treated, Steel Structural Bolts, 150 ksi (1035 Mpa) Tensile Strength
A563	Specification for Carbon and Alloy Steel Nuts
A572/A573M	Specification for High-Strength Low Alloy Columbium-Vanadium Steels of Structural Quality
A588/A588M	Specification for High Strength Low-Alloy Structural Steel with 50 ksi (345 Mpa) Minimum Yield Point to 4 in. (100mm) Thick
A633/A633M	Specification for Normalized High Strength Low Alloy Structural Steel
A673/A673M	Specification for Sampling Procedure for Impact Testing of Structural Steel
A687	Specification for High Strength Non-Headed Steel

bolts and Studs

A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

A871/A871M Specification for High Strength Low Alloy Structural Steel Plate with Atmospheric Corrosion Resistance

F436-82 Standard Specification for Hardened Steel Washers

AWS - American Welding Society

D1.1-92 Structural Welding Code – Steel

A5.1-91 Specification for Carbon Steel Covered Arc-Welding Electrodes

A5.17-89 Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc-Welding

AZI - American Zinc Institute

Inspection Manual for Hot - Dip Galvanized Products (Latest Edition)

ASCE - American Society of Civil Engineers

ASCE/SEI 48-05, Design of Steel Transmission Pole Structures

ISO - International Standards Organization

9001 Quality System Model for Quality Assurance in Design/Development, Manufacture and Testing

9002 Quality System Model for Quality Assurance in Production, Installation and Servicing

2.3.1.1.2 These codes and standards set forth the minimum requirements which may be exceeded by Contractor if, in Contractor's judgment and with NPC's acceptance, superior or more economical materials are available for successful and continuous operation of Contractor's equipment as required by this specification.

2.3.2 TECHNICAL REQUIREMENTS

2.3.2.1 Design

2.3.2.1.1 General

2.3.2.1.1.1 All outline dimensions in the drawing are fixed but where no dimensions are given, may be modified, subject to compliance with the requirements of the specification.

2.3.2.1.1.2 The direct buried poles shall be manufactured for the configuration and limitations provided elsewhere in the tender documents.

2.3.2.1.1.3 For buried steel pole, the butt plate cover shall be fully welded to the bottom shaft.

- 2.3.2.1.1.4 Depending on the requirements, columns shall be dodecagonal in cross section and shall be tapered from top to the base.
- 2.3.2.1.1.5 Cross arm member, if required in the Bid Drawings, shall be of the same material as columns and shall conform to NPC's general arrangement drawings. The strength of the attachment of cross arms to the columns shall be sufficient to develop the full capability of the cross arm.
- 2.3.2.1.1.6 Minimum yield strength of rolled steel plate used in the design is 450 MPa (65 ksi).
- 2.3.2.1.1.7 Poles requiring more than one length of tubular section shall be spliced using telescopic joint (slip joint) with sufficient overlap to develop the full strength of the member. Minimum overlap shall be 1.5 times the inside butt diameter of the upper section. The length of each section shall be proposed by the Supplier subject to NPC's approval.
- 2.3.2.1.1.8 Rigging accessories, insulator attachment plates, ladder, lugs for bolted steps and lighting brackets, and hand line attachment shall be welded to the structure.
- 2.3.2.1.2 Allowable Stresses**
- 2.3.2.1.3.1 The allowable stresses for tubular members, guys and connection bolts shall comply with the requirements of ASCE/SEI 48-05, Design of Steel Transmission Pole Structures.
- 2.3.2.2 Materials**
- 2.3.2.2.1 General**
- 2.3.2.2.1.1 All materials shall comply with the requirements of an ASTM specification unless otherwise specified.
- 2.3.2.2.1.2 Material to be welded shall comply with the requirements of ANSI/AWS D1.1.
- 2.3.2.2.2 Structural Plate**
- 2.3.2.2.2.1 Plate used to produce load carrying components shall be considered structural plate. Plates used for other purposes may not be classified as structural plates.
- 2.3.2.2.2.2 Structural plate less than or equal to 31.75 mm (1.25 in.) in thickness shall conform to ASTM A572.
- 2.3.2.2.2.3 Structural plate greater than 31.75 mm (1.25 in.) in thickness shall conform to ASTM A633.
- 2.3.2.2.2.4 Structural plate material shall meet the Charpy impact requirements in accordance with ASTM A370 and A673.

2.3.2.2.2.5 The silicon content of plate to be galvanized shall be limited to the following:

Shaft material : $Si \leq 0.06\%$

Other : $Si \leq 0.06\%$ or $0.15\% < Si < 0.40\%$

2.3.2.2.3 Bolts, Nuts and Washers

2.3.2.2.3.1 Material for headed bolts shall conform to: ASTM A307, ASTM A325, ASTM A490 or ASTM A449 when bolt diameter exceeds 38.1 mm (1.5 in.) and shall be galvanized in accordance with ASTM A153.

2.3.2.2.3.2 Nuts shall conform to ASTM A563.

2.3.2.2.3.3 Washers shall conform to ASTM F436.

2.3.2.2.4 Charpy Impact Requirements

2.3.2.2.4.1 Charpy impact properties shall be determined in accordance with ASTM A370 and A673.

2.3.2.2.5 Weld Material

2.3.2.2.5.1 The material used for making welds shall be compatible with the parent material, as defined by ANSI/AWS D1.1 and shall meet the impact requirements specified in clause 2.3.2.2.4 for the lowest toughness requirements of the plates being joined.

2.3.2.3 Detailing

2.3.2.3.1 Typical Details

2.3.2.3.1.1 Telescopic joints (slip joints) shall have the minimum lapping of 1.5 times the inside butt diameter of the upper section.

2.3.2.3.2 Circumferential Welds

2.3.2.3.2.1 Shaft-to-shaft, pole shaft-to-base plate, and pole shaft-to-flange shall be full penetration welds.

2.3.2.3.2.2 Arm shaft-to-arm bracket shall be partial penetration groove weld with fillet overlay, sized to develop the full strength of the shaft.

2.3.2.3.2.3 Other accessories (lugs and plates for grounding, jacking, climbing and identification) shall be fillet and/or groove welds sized to develop the loading requirements of the attachment. The top cover plate shall be convex in shape having the same material as the pole shaft and shall be fully welded thereon.

2.3.2.3.3 Longitudinal Welds

2.3.2.3.3.1 Longitudinal welds in outer section of slip joints and within 76.2 mm (3") shall be full penetration weld.

- 2.3.2.3.3.2 Longitudinal welds shall be a minimum of 80% penetration in other locations.
- 2.3.2.3.3.3 Conductor plate attachment weld shall be full penetration weld.
- 2.3.2.3.3.4 Maximum diameter of bolt holes shall be equal to bolt diameter plus 3.3 mm (0.13").

2.3.2.3.4 Plate Bends

- 2.3.2.3.4.1 The minimum inside radius of plate bends shall be such that cracking does not occur. Care must be taken to prevent the steel from cracking especially at the free ends of the bend either during the bending operation or subsequently due to residual stresses.

2.3.2.4 Fabrication

2.3.2.4.1 General

- 2.3.2.4.1.1 Fabrication shall be performed in strict compliance with NPC's approved shop detail drawings. Material substitution or deviations from the final approved drawings shall not be made without written approval from NPC.
- 2.3.2.4.1.2 The manufacturer shall accurately identify all material to assure proper usage.

2.3.2.4.2 Pole Shaft

- 2.3.2.4.2.1 The pole shaft appearance shall be smooth and consistent with the strength requirements in the specification and drawings. Pole shall be tapered continuously from top to bottom with a uniform slope. No multi-ply steel plates will be allowed for the pole structure fabrication. Shaft shall be made with number of sections specified in the Bid Drawings or Manufacturers standards.
- 2.3.2.4.2.2 The cross section and dimension of the pole shall be as specified in the bid drawings. Shaft diameter of a fabricated section should not be less than the design diameter.

2.3.2.4.3 Pole Splicing

- 2.3.2.4.3.1 Poles with two or more sections, the sections shall be spliced by telescopic joints (slip joint) for easy assembly at the site. Overlapping shall not be less than 1.5 times the inside butt diameter of the female/upper section.
- 2.3.2.4.3.2 The taper of one section should match the taper of the other section to provide proper splice and to develop the full strength of the member. No circumferential weld or other type of connection within the joint section shall be permitted.

2.3.2.4.4 Other Pole Attachments**2.3.2.4.4.1 Step Bolts or Climbing Device**

2.3.2.4.4.1.1 Each pole shall be provided with the required sets of step bolts or climbing device where at least two (2) maintenance personnel can climb together on opposite sides of the pole face. The step bolts shall be approximately 2.5m. above ground level to the pole cross-arm and from thereon to the ground wire peak as hereunder enumerated:

- a. *For poles with less than 0.50m base diameter, steps bolted to permanent lugs shall be provided. Easily detachable step bolts attached to the pole by hooking or by any other similar scheme shall not be permitted.*
- b. *For poles with more than 0.50m base diameter, detachable step ladders shall be provided from 2.5 m above ground level to the lowest cross-arm and from thereon to the ground wire peak, step bolts shall be provided as required under Item "a" above. Ladders shall be secured in place to prevent accidental lifting by handling, etc.*

2.3.2.4.4.1.2 The step bolts shall be not less than 16 mm or $\frac{3}{4}$ "diameter, 18 cm or 7" long with 35 mm diameter, symmetrical head, spaced not more than 45 cm apart. The bolts and ladder rungs shall withstand without permanent deformation, a vertical load of at least 137 kg or 300 pounds applied at the bolt head and at the center of the ladder rung.

2.3.2.4.4.2 Grounding Provision

2.3.2.4.4.2.1 Grounding clamps or nuts shall be provided near the top and base of each pole. The wire lug shall be welded to the exterior of tubular column sections near the top and the base for grounding, in addition to any other ground wire requirements shown on NPC's general arrangement drawing.

2.3.2.5 Material Preparation

2.3.2.5.1 Edges shall be in accordance with ANSI/AWS D1.1. Burrs or sharp notches that may be detrimental to the structure or that pose a safety hazard shall be removed. Reentry cuts shall be rounded.

2.3.2.5.2 Care shall be taken to prevent separation of the outer surface and reduction of the cross sectional properties below those required by design. If separation occurs during bending, it shall be repaired in accordance with ANSI/AWS D1.1. Mill scale shall not be considered as the surface.

2.3.2.5.3 When hot bending is required, heating shall be done evenly over the entire bend area and shall be of sufficient temperature to minimize separation and necking down of the cross section. The temperature used in hot bending shall be such that the physical properties of the steel are not diminished.

2.3.2.6 Welding

- 2.3.2.6.1 Unless otherwise specified herein, or note on NPC's design drawings, welding shall be in accordance with the AISC Specification and AWS D1.1 latest editions.
- 2.3.2.6.2 Care shall be taken in assembling and fitting and welding shall be controlled to minimize shrinkage stresses and distortion. All finished work shall be of good quality and have a neat appearance without warpage.
- 2.3.2.6.3 Caution shall be exercised to obtain full penetration welds where specified on NPC's design drawings.
- 2.3.2.6.4 When inspection of a weld zone is called for on NPC's design drawings, procedures shall be in accordance with non-destructive testing procedures of AWS D1.1 and the following additional requirements:
- 2.3.2.6.4.1 Circumferential and longitudinal welds within the slip joint area of tubular sections shall be shear wave ultrasonically inspected.
- 2.3.2.6.4.2 Longitudinal welds in tubular sections, which do not meet the acceptance criteria of visual inspection, shall be magnetic particle or dye penetrant tested.
- 2.3.2.6.4.3 Attachment welds shall be examined by magnetic particle or dye penetrant testing.
- 2.3.2.6.4.4 Contractor shall furnish a shop test report indicating complete test results of all nondestructive testing and inspection conducted.
- 2.3.2.6.4.5 The final weld of a component designated for stress relief on NPC's design drawings shall be subjected to ultrasonic inspection prior to and after stress relieving.

2.3.2.7 Surface Preparation and Painting**2.3.2.7.1 Galvanizing**

- 2.3.2.7.1.1 Unless otherwise specified, all structural steel shall be hot-dip galvanized after fabrication in accordance with ASTM A123 with minimum zinc thickness of 85 microns. Exposed welds shall be mechanically cleaned prior to galvanizing.
- 2.3.2.7.1.2 Fabrication and preparation of material for galvanizing shall conform to the requirements of ASTM A143. When specified in the drawings or specification, embrittlement test of designated galvanized material shall be performed in accordance with ASTM A143.
- 2.3.2.7.1.3 Bolts, nuts and washers shall be galvanized in accordance with ASTM A153. Bolts and nuts shall be assembled after galvanizing and shall fit with finger pressure only and nuts shall be interchangeable on any bolts without shake. Wrench tightness or spinning fit shall be caused for rejection.
- 2.3.2.7.1.4 Repair of damaged hot dip galvanized surfaces shall be in accordance with ASTM A780.

- 2.3.2.7.1.5 Only virgin zinc shall be used in galvanizing, and the used of remelted zinc is prohibited. Inspection of galvanizing shall follow the procedures of the AZI Inspection Manual.
- 2.3.2.7.1.6 Heavy runs or lumps of excess zinc will not be acceptable in any area where they will interfere with bolt hole alignment (such as the "drip end" of punched angle braces, etc.), with matching flat surfaces which are to be bolted together, or are of such size and location that normal handling or erection may cause them to be dislodged. Sharp, pointed, "stickers" of zinc which could cause injuries in handling shall be removed.
- 2.3.2.7.1.7 Straightening of steel after galvanizing shall be accomplished without the use of heat. Steel so straightened shall be inspected to assure no deformation or cracking of galvanizing layer.
- 2.3.2.7.1.8 The zinc coating shall withstand the minimum number of dips of the Preece Test, according to ASTM A239-89.
- 2.3.2.7.1.9 Bolts shall be spun-galvanized and re-chasing of bolts threads after galvanizing shall not be permitted. Nut threads shall be tapped after galvanizing but not to cause appreciable rocking of the nuts to the bolts.
- 2.3.2.7.1.10 All materials shall be cleaned and washed after galvanizing to remove traces of flux, flux inclusions, pre-flux slats, acid ash, dross or other extraneous materials. The presence of wet storage stain (White Rust) shall be caused for rejection.
- 2.3.2.7.1.11 Pipe, tubing or box sections shall not be double-dipped.
- 2.3.2.7.2 Painting**
- 2.3.2.7.2.1 When a painted finish is specified, the paint shall be environmentally friendly, with high solids content, low Volatile Organic Compounds, and within toxic acceptable levels.
- 2.3.2.7.2.2 Only the following materials will be acceptable in the formulation of the paint system:
- Triglycidyl Isocyanurate (TGIC) or Urethane polyester powder
 - two-component Organic Zinc-Rich Urethane liquid
 - Zinc Rich Epoxy powder
 - two-component Polyamidoamine Epoxy liquid
 - two-component Acrylic Aliphatic Poly -Urethane liquid
 - two-component Tar-Extended Polyurethane Liquid with Pre-catalyzed one component Polyurethane resin (touch-up)
- 2.3.2.7.2.3 The paint system formulation shall be agreed upon between NPC and the Contractor.
- 2.3.2.7.2.4 The Contractor shall furnish as part of the scope of supply for the poles touch-up material with each type of pole structure.

2.3.2.8 Preparation for Shipping and Storage

- 2.3.2.8.1 Each shipment shall include a detailed packing list identifying all items by part number, including hardware. Special care shall be exercised in the handling, packaging and shipping of the materials to prevent denting, bending, or any other damage of the sections, crossarms and anchor bolt cages. Suitable cushioning, protective padding, dunnage or nonmetallic spacers shall be used to prevent fangs and flanges welded to the tubular sections from damaging other tubular parts and to prevent damage and shifting during transit.
- 2.3.2.8.2 Small parts and fasteners shall be carefully boxed, crated, bagged or otherwise containerized and protected for shipment. Small pieces shall be bundled, with all the pieces in any bundle having the same mark and shall be packed in boxes of not over 68 kilograms (150 pounds) gross weight each. Bolts of different size or length shall be wrapped in separate sacks before boxing. Description, quantity and marks or description of contents shall be shown on the outside.
- 2.3.2.8.3 All identifications shown on bundles, boxes or other containers shall be included on Contractor's shipping and packaging lists.
- 2.3.2.8.4 All materials shall be arranged to allow safe unloading at site.
- 2.3.2.8.5 Shop painted or galvanized steel will be stored in the field pending erection. Contractor shall provide storage and handling instructions to minimize damage to painted or galvanized surfaces.

2.3.2.9 Marking

- 2.3.2.9.1 All parts of poles shall be appropriately marked or numbered. All markings shall be indelible and clearly visible after galvanizing. The pole and its parts shall bear the marking "NPC" to identify the same as the property of the National Power Corporation then followed by the structure type, its length in feet and section number. The poles shall also bear the manufacturer's marking for easy reference.

Example: NPC HT 50 S1 MW (Pole Type HT, 50ft, upper section 1 and manufacturer's markings)

- 2.3.2.9.2 Letterings shall have a minimum height of thirty (30) mm. Special care shall be taken to see that all markings are made in such manner as not to be obliterated in transit, or in any way damage the galvanizing or affect the strength of the structure.
- 2.3.2.9.3 Identification marks shall be located conspicuously for easy reading.
- 2.3.2.9.4 Identification marks shall be applied by stamping into the steel a 1.58 mm (1/16 inch) deep identification mark before galvanizing using 30 mm minimum height, steel die letters and numerical. After galvanizing, a straight line with minimum width of 6.35 mm (1/4 inch) shall be stenciled to underline the identification marks. The stenciled line shall be made with durable paint or ink that will adhere to the galvanized surface, and be legible. All small items that

are not adaptable to die marking and are not boxed shall be identified by either attaching die stamped steel tags or standard white cloth shipping tags. The tags shall be attached with non-corrosive wire.

2.3.3 INSTALLATION

2.3.4.1.1 Erection/installation works will be done by the Contractor in accordance with the provisions on transmission line erection/installation.

2.3.4.1.2 Proper storage, handling and transport to various poles sites shall be carried out to ensure that steel poles are not damaged prior to erection.

2.3.4 TESTS

2.3.4.1 General

2.3.4.1.1 All materials shall comply with test criteria, and NPC's acceptance of the steel poles and its components and shall not relieve the Contractor of his responsibility for meeting all the requirements of this specification.

2.3.4.1.2 The Contractor shall carry out at his own expense all tests necessary to ensure the satisfactory manufacture/fabrication of steel poles and its components in accordance with the applicable standards mentioned herein in the specification.

2.3.4.1.3 The steel poles shall be given quality conformance tests and shall be witnessed by NPC Design Engineers. Tests results shall be submitted to NPC. No steel poles shall be shipped until released for shipment by NPC.

2.3.4.1.4 The Contractor shall make all preparation for the tests and shall notify NPC, the date of the tests to be witnessed, forty five (45) days in advance.

2.3.4.2 Material

2.3.4.2.1 Contractor shall furnish six (6) copies of certified mill test reports covering chemical and mechanical properties of the structural steel. Stock material may be used with NPC's concurrence where Contractor's stock can be satisfactorily identified with the specified ASTM specification.

2.3.4.2.2 Plate material shall be subjected to Charpy V-notch impact testing in accordance with ASTM A370 Type A Figure II, and ASTM A 673. The absorbed energy of the steel plate materials using Charpy V-notch test shall be no less than 2.07 m-kg (15 ft-pound) at ambient temperature.

2.3.4.2.3 All welded electrode material shall also meet the Charpy V notch impact test requirements and shall have the physical properties equal to the steel to be welded.

2.3.4.3 Shop

- 2.3.4.3.1 Contractor shall furnish a shop test report for NPC's review and records showing the results of all tests made during fabrication.

2.3.4.4 Quality Conformance Inspection

- 2.3.4.4.1 This is intended to eliminate defective materials and components of the steel poles. Each component shall be inspected for the conformance to the fabrication drawings. This inspection shall include, but not limited to:

- a. ultrasonic inspection of all plate material prior to welding for laminations;
- b. visual inspection of dimensions to assure that tolerances are met;
- c. visual inspection of cut edges to ANSI/AWS D.1.1 criteria;
- d. visual inspection of bent surfaces for surface separations (supplemented by magnetic particle in questionable areas);
- e. visual inspection of bolt holes to assure that they are cylindrical, perpendicular, free of burrs and without torn or ragged edges;
- f. visual inspection of all welds to ANSI/AWS D1.1 Section 8 criteria;
- g. ultrasonic inspection of all full penetration welds after galvanizing (maybe waived if routine audits show no history of defects);
- h. magnetic particle inspection of all structural partial penetration or fillet welds to ANSI/AWS D1.1 Section 8 criteria;
- i. visual inspection of finish;
- j. magnetic measurement of finish coatings thickness.

2.3.4.5 Proof Load Test

- 2.3.4.5.1 If required in the Technical Data Sheets, the Supplier shall carry out a proof load test of the galvanized steel pole at the manufacturer's workplace to be witness by NPC representatives to assure that proper manufacturing/fabricating procedures have been carried out.
- 2.3.4.5.2 Poles to be subjected to testing shall be tension poles, as much as possible. The number of samples to be tested need not exceed two (2) for each contract selected from two (2) tension pole types and lengths with largest number of pole requirements.
- 2.3.4.5.3 The pole shall be erected on a rigid foundation and the vertical axis through the center of gravity shall not be out of plumb by more than two tenths percent (0.2%) of the height at any level.
- 2.3.4.5.4 The pole structure shall sustain the designed load. These loads shall be applied in increments and shall be held constant for a period of two (2) minutes before increasing or removing the loads up to 95% of the load and five (5) minutes for the 100% load.

- 2.3.4.5.5 The Contractor shall submit for NPC's approval his proposed method and facilities of applying and measuring the loads on the steel poles. The load measuring devices with appropriate capacity shall be suitably calibrated prior to and following the test in accordance with the manufacturer's recommendation at the presence of NPC representatives.
- 2.3.4.5.6 Steel poles deflection shall be measured and recorded. Deflection readings shall be recorded for the "before-load", "under-load" and "load-off" conditions.
- 2.3.4.5.7 The Contractor shall submit, forty five (45) days prior to the performance of the tests, his testing programs to NPC for review and approval. These shall include test procedures, diagrams or test arrangements showing the points of location and magnitude of the loads to be applied, the designated points for deflection measurements, etc.
- 2.3.4.5.8 The pole to be tested shall be inspected by NPC representative and actual proof load test shall be carried out in the presence of NPC representatives who shall conduct a visual check and evaluate all parts of the structure for sign of failure following the completion of each test.
- 2.3.4.5.9 After completion of test, the steel pole can be considered a failure if the pole experienced any of the following:
- a. After the loads have been removed, the pole does not return to its original position within reasonable tolerance;
 - b. Failure (i.e. bending, yielding, breaking, etc.) of the material or weld is detected; and
 - c. Tested pole does not pass all physical and dimensional checks as required in the test specified in this specification.
- 2.3.4.5.10 In case of failure, necessary corrections, modifications and retesting shall be undertaken by the supplier at no cost to NPC.
- 2.3.4.6 Galvanizing Tests**
- 2.3.4.6.1 Galvanizing tests shall be carried out according to the latest ASTM Specifications A123, A143, A153 and A239 on the structural shapes, bolts, nuts and other small miscellaneous hardwares.
- 2.3.4.7 Trial Assembly of Prototype Pole**
- 2.3.4.7.1 Trial assembly of poles with two (2) or more sections shall be carried out in horizontal position on the ground to determine that the tapering of each section are proper to provide snug-fit splice and the required minimum overlap for slip joints are met.
- 2.3.4.8 Test Report**
- 2.3.4.8.1 The Contractor shall furnish six (6) copies of a test report that shall include:
- a) The designation and description of the pole tested;

- b) The name “NPC”;
- c) The name of the person or organization (responsible engineer) that specified the loading, electrical clearances, technical requirements and general arrangement of the prototype;
- d) The name of the Engineer of Record;
- e) The name of the fabricator;
- f) A brief description and the location of the test facilities;
- g) The names and affiliations of the test witnesses;
- h) The dates of each test load case;
- i) Detailed drawings of the pole, including any changes made during the testing program;
- j) A rigging diagram with details of the points of attachment to the pole;
- k) Calibration records of the load-measuring devices;
- l) A loading diagram for each load case tested;
- m) A tabulation of deflections for each load case tested;
- n) In case of failure; Photographs of failure; Loads at the time of failure; a brief description of the failure; The remedial action taken; The dimension of the failed members; and Test coupon reports of failed members;
- o) Photographs of the overall testing arrangement and rigging;
- p) Air temperature, wind speed and direction, any precipitation and any other pertinent meteorological data;
- q) Mill test reports of poles used in the test report;
- r) Test result of the test coupons taken following the completion of test.

2.3.5 DATA AND DOCUMENTATION REQUIREMENTS

2.3.5.1 General

2.3.5.1.1 Contractor furnished data and information shall be the performance data, predicted performance, interface requirements and construction features of all Contractor's furnished steel poles and materials. The accuracy of such information and its compatibility with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

2.3.5.1.2 All information submitted as part of the Proposal Data will become part of contract data for successful bidder. Any deviation from such data requires NPC's approval.

2.3.5.2 Data and Information to be Submitted with the Bid

2.3.5.2.1 Together with the bid, the bidder shall submit:

- a. The duly signed and completely Filled-in Technical Data Sheets.

2.3.5.3 Data and Information to be Submitted After Award of Contract

2.3.5.3.1 The following shall be submitted after award of contract;

- b. Pamphlets/Brochures and literature of the proposed manufacturer of steel poles;
- c. Brochures of the proposed steel poles and components to be furnished;
- d. ISO Certification of the manufacturer, at least 9001;
- e. Certified mill test reports;
- f. List of Drawings and schedules of submittals;
- g. Shop detailed assembly and fabrication drawings;
- h. Weights of each section and components of each type of pole including summary of total weight for each type of pole;
- i. Test Reports;
- j. Certificate of Origin from the Manufacturer. This is to be submitted during delivery.

2.3.5.3.2 Shop detail drawings shall show each individual member's dimensions and tolerances, welding requirements, connections, identification mark, quantities, material designation, surface treatment, and a bill of material.

2.3.5.3.3 The Contractor shall furnish six (6) copies of each type of steel pole drawing to NPC for approval.

PART I – TECHNICAL SPECIFICATIONS

E.2.5: POWER CONDUCTOR

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E.2.5: POWER CONDUCTOR

2.5.0 SCOPE

2.5.0.1 General

2.5.0.1.1 This specification covers the technical and associated requirements for Aluminum Conductors and their respective splice materials and splice installation tools, for use in electric power switchyards, substations and overhead transmission lines rated 69 kV and above.

2.5.0.1.2 It is not NPC's intent to specify all technical requirements nor to set forth those requirements adequately covered by applicable codes and standards. Contractor shall furnish high quality materials meeting the requirements of this specification and industry standards.

2.5.0.1.3 The Contractor shall bear full responsibility that the power conductors have been designed and manufactured in accordance with all codes, standards and applicable governmental regulations and perform under the condition and to the standards specified herein.

2.5.0.1.4 No departure shall be made from this specification and standards unless waived or modified in writing by NPC. The Contractor shall obtain from its sub-Contractor a statement as to compliance with this specification without exception and/or if there are any exceptions, these shall be described in detail and included in Contractor's proposal. The Contractor shall add a statement that no other exceptions are taken to this specification.

2.5.0.2 Works to be Provided by the Contractor

2.5.0.2.1 The Contractor shall provide the equipment, accessories and services delineated in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.5.0.3 Works to be Provided by NPC

2.5.0.3.1 NPC shall provide the materials and services listed in Paragraph A.2, Section E.2.1 of the Technical Data Sheets

2.5.1 CODES AND STANDARDS

2.5.1.1 General

2.5.1.1.1 The conductors furnished shall be in accordance with, but not limited to, the latest issues of the following applicable standards, including all addenda, in effect at time of purchase order unless otherwise stated in this specification.

ASTM - American Society for Testing Materials

B230	Aluminum Wire, 1350-H19 for Electrical Purposes
B231	Aluminum Conductors, Concentric-Lay-Stranded
B232	Aluminum Conductors, Concentric-Lay-Stranded Steel Reinforced (ACSR)
B341	Aluminum-Coated (Aluminized) Steel Core Wire for Aluminum Conductors, Steel Reinforced
B398	Aluminum Alloy 6201-T81 Wire for Electrical Purposes
B399	Concentric-Lay-Stranded Aluminum-Alloy 6201-T81 Conductors
B498	Zinc-Coated (Galvanized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)
B500	Zinc-Coated (Galvanized) and Aluminum-Coated (Aluminized) Stranded Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR/AZ)
B502	Aluminum-Clad Steel Core Wire For Aluminum Conductors, Aluminum-Clad Steel-Reinforced (ACSR/AW)
B524	Concentric-Lay-Stranded Aluminum Conductors, Aluminum-Alloy Reinforced (ACAR, 1350/6201)
E-139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

IEC - International Electrotechnical Commission Publications

60104	Aluminum-Magnesium-Silicon Alloy Wire for Overhead Line Conductors
60888	Zinc-Coated Steel Wires for Stranded Conductors
60889	Hard-Drawn Aluminum Wire for Overhead Lines
1089	Round Wire Concentric Lay Overhead electrical Stranded Conductors

ISO International Standards Organization

9001	Quality System Model for Quality Assurance in Design/ Development, Manufacture and Testing
9002	Quality System Model for Quality Assurance in Production, Installation and Servicing

2.5.1.1.2 These codes and standards set forth minimum requirements which may be exceeded by Contractor if, in Contractor's judgment and NPC's acceptance, superior or more economic designs or materials are available for successful and continuous operation of Contractor's materials as required by this specification.



2.5.2 TECHNICAL REQUIREMENTS**2.5.2.1 Design Requirements****2.5.2.1.1 General**

2.5.2.1.1.1 The type(s) of conductor(s) to be furnished and its/their detailed characteristics is/are specified in the Technical Data Sheets of Section E.2.5. The standard design requirement for the basic conductor types are:

ASTM - American Society for Testing Materials

ACSR/GA ACSR conductor with outer layer(s) of hard-drawn aluminum wire type 1350-H19 per ASTM B230 and core layer(s) of Class A zinc-coated (galvanized) steel wires per ASTM B498, fabricated according to ASTM B232.

ACSR/GB ACSR conductor with outer layer(s) of hard-drawn aluminum wire type 1350-H19 per ASTM B230 and core layer(s) of Class B zinc-coated (galvanized) steel wires per ASTM B498, fabricated according to ASTM B232.

ACSR/GC ACSR conductor with outer layer(s) of hard-drawn aluminum wire type 1350-H19 per ASTM B230 and core layer(s) of Class C zinc-coated (galvanized) steel wires per ASTM B498, fabricated to meet ASTM B232 requirements.

ACSR/AZ ACSR conductor with outer layer(s) of hard-drawn aluminum wire type 1350-H19 per ASTM B230 and core layer(s) of aluminum coated (aluminized) steel wires per ASTM B500, fabricated to meet ASTM B232 requirements.

ACSR/AW ACSR conductor with outer layer(s) of hard-drawn aluminum wire type 1350-H19 per ASTM B230 and core layer(s) of aluminum clad steel wires per ASTM B502, fabricated to meet ASTM B549 requirements.

IEC - International Electro-technical Commission Publications

A1/S1A ACSR conductor with outer layer(s) of hard-drawn aluminum wire type A1 per IEC60889 and core layer(s) of regular strength, Class A zinc-coated steel wires per IEC 60888, fabricated to meet IEC 1089 requirements.

A1/S1B ACSR conductor with outer layer(s) of hard-drawn aluminum wire type A1 per IEC 60889 and core layer(s) of regular strength, class B zinc-coated steel wires per IEC 60888, fabricated to meet IEC 1089 requirements.

A1/S2A	ACSR conductor with outer layer(s) of hard-drawn aluminum wire type A1 per IEC 60889 and core layer(s) of high strength, class A zinc-coated steel wires per IEC 60888, fabricated to meet IEC 1089 requirements.
A1/S2B	ACSR conductor with outer layer(s) of hard-drawn aluminum wire type A1 per IEC 60889 and core layer(s) of high strength, class B zinc-coated steel wires per IEC 60888, fabricated to meet IEC 1089 requirements.
A1/S3A	ACSR conductor with outer layer(s) of hard-drawn aluminum wire type A1 per IEC 60889 and core layer(s) of extra high strength, class A zinc-coated steel wires per IEC 60888, fabricated to meet IEC 1089 requirements.
A1/S3B	ACSR conductor with outer layer(s) of hard-drawn aluminum wire type A1 per IEC 60889 and core layer(s) of extra high strength, class B zinc-coated steel wires per IEC 60888, fabricated to meet IEC 1089 requirements.

Special Conductor Types

Special conductor types if required, shall be indicated in the Technical Data Sheets of Section E.2.5. These may include, but are not limited to the following types:

SD -	Self-damping conductors, i.e., some or all aluminum layers consist of trapezoidal-shaped wires.
T2 -	Two single conductors twisted together. For example, a 954 kcmil ACSR/GA/T2 "Hawk" 52/14 consists of two regular 477 kcmil/GA "Hawk" 26/7 conductors.
ZTACIR-	Extra Heat Resistant Increased Capacity Galvanized Invar-Reinforced Aluminum Alloy Conductor
XTACIR-	Extremely Low Sag Invar Reinforced Increased Capacity Extra Heat Resistant Aluminum Alloy Conductor
GTACSR-	Gap Type Heat Resistant Increased Capacity Aluminum Alloy Steel Reinforced Conductor

2.5.2.1.2 Corrosion Inhibitor

2.5.2.1.2.1 When so specified in the Technical Data Sheets of Section E.2.5, the conductor shall be protected by a high melting point (e.g., dropping point of approximately 380°F [193°C], neutral, organic inhibitor. This inhibitor shall be applied as specified in the Technical Data Sheets of Section E.2.5.

- (1) Steel core only. The inhibitor shall be applied to fully fill the inner and outer interstices of the conductor steel wire core only.
- (2) Full conductor. The inhibitor shall be applied to fully fill all interstices of the complete conductor (steel core and aluminum layer(s)).

2.5.2.2 Manufacturing Requirements

2.5.2.2.1 Stranding

- 2.5.2.2.1.1 All wires of the conductor shall be concentrically stranded. The wires in each layer shall be evenly and closely stranded around the underlying wire(s). The tension in individual wires in a layer shall be sufficient to hold each wire firmly in place with only enough strand separation to prevent crowding at the time of stranding and during installation. All steel and aluminum wires shall lie naturally in their position in the stranded conductor and, when the core and/or the aluminum wires are cut, the wire ends shall remain in position or be readily replaced by hand and then remain approximately in position.

2.5.2.2.2 Joints

- 2.5.2.2.2.1 For permissible joints during manufacture, the provisions of ASTM B232 (or B549, if applicable) apply to conductors manufactured to U.S. Standards, and the provision of IEC 1089 to conductors manufactured to IEC Standards.

2.5.2.2.3 Surface Condition

- 2.5.2.2.3.1 The completed conductor shall be smooth, free from nick, burrs, aluminum or steel particles, dirt and excessive die grease. The conductor shall be absolutely free of copper dust and copper particles. If so specified, the outer conductor surface shall receive an additional treatment to make it non-specula (non-reflective).

2.5.2.3 Materials and Workmanship

- 2.5.2.3.1 The materials shall conform to the applicable Standards, of recent manufacture and unused. Workmanship shall conform to industry standards and good practices.

2.5.2.4 Stress-Strain and Creep Data

- 2.5.2.4.1 Contractor shall supply Stress-Strain and Creep data for the specified conductor(s) in Paragraph D, Section E.2.5 of the Technical Data Sheets. The data shall be in the form of coefficients and, additionally, in form of stress-strain curves. Contractor's Stress-Strain and Creep data shall be obtained from stress-strain tests on the conductor(s) produced under this contract, if so required in the Technical Data Sheets of Section E.2.5.

2.5.2.4.2 Stress-Strain and Creep tests shall be performed according to ASTM E-139, IEC 1089 or NPC-approved equivalent.

2.5.2.4.3 If no stress-strain test is required by NPC in the Technical Data Sheets, the Contractor shall provide the stress-strain data based on his own new tests, or based on previous tests on a conductor identical to the specified or based on a conductor constituted of the same outer/core materials and number of strands as specified, approximately the same lay (in function of conductor outer diameter) and, for other than monometallic conductors, the same cross-sectional area ratio of outer layers to total conductor.

2.5.2.4.4 The required stress-strain coefficients apply to a polynomial of 4th order (which describes the applicable initial and creep stress-strain curves) of the form

$$Y = A0 + A1*X + A2*X^2 + A3*X^3 + A4*X^4,$$

Where: Y is the stress in N/mm² times HA or HS, as applicable, and X is the percent elongation. (HA and HS are the cross-sectional area ratios of outer layers and core layers, respectively, to the total conductor). For the final stress-strain curve Y is a straight line in function of X and a slope of the corresponding A1.

$$Y = A1*X$$

2.5.2.5 Compression Dead End and Splices

2.5.2.5.1 General

2.5.2.5.1.1 Compression dead ends and splice materials (where required) shall be provided by the Contractor suitable for the specified conductors, and pertinent instructions.

2.5.2.5.1.2 The complete conductor splice and compression dead-end, when installed according to Contractor's instructions, shall have a minimum mechanical strength equal to 95 percent of the rated tensile strength (RTS) of the conductor.

2.5.2.5.1.3 The electrical resistance of the installed splices and dead-end shall be no less than that of an equal length of bare conductor.

2.5.2.5.1.4 The filler compound shall be per Contractor's recommendation, except that a compound based on zinc chromate is not acceptable.

2.5.2.5.1.5 Contractor shall provide drawings for the splices and compression dead-ends, including the length(s) before and after compression.



- 2.5.2.5.1.6 Contractor shall provide his recommended procedures for making splices, one instruction and procedures in each splice material box.
- 2.5.2.5.2 Sleeves for Conductor**
- 2.5.2.5.2.1 All of the joint sleeves and repair sleeves shall be of compression type and suitable for the specified conductor.
- 2.5.2.5.3 Mid-Span Joint Sleeves**
- 2.5.2.5.3.1** The joint sleeve for mid-span shall consist of steel compression sleeve for the core, and aluminum compressed sleeve for the overall conductor for ACSR and single aluminum sleeve for all aluminum conductor. The aluminum sleeve shall be made of aluminum alloy and the steel sleeve shall be made of carbon steel.
- 2.5.2.5.4 Jumper Sleeve**
- 2.5.2.5.4.1 Jumper sleeve shall be made of aluminum alloy. The tensile strength of the finished joint must be no more than 30 percent of the ultimate breaking strength of the conductor.
- 2.5.2.5.5 Repair Sleeve**
- 2.5.2.5.5.1 Repair sleeve shall be made of aluminum alloy.
- 2.5.2.6 Additional Requirements**
- 2.5.2.6.1 The Contractor shall supply initial and final Sag Tension Charts for the specified conductor based on the Stress-Strain and Creep test conducted under this specification. The cost of preparing the sag and tension charts shall be included in the bid unit price for the conductor.
- 2.5.2.6.2 Information relative to the preparation of the charts is given in Paragraph E, Section E.2.5 of the Technical Data Sheets for reference.
- 2.5.2.7 Tools**
- 2.5.2.7.1 The Contractor shall provide all tools and appliances necessary for the proper installation and stringing of the power conductors.
- 2.5.2.7.2 If maintenance tools are specified in the Technical Data Sheets of Section E.2.5, for NPC's use during operation of the line, Contractor shall supply such tools and pertinent information.
- 2.5.2.7.3 If, in the opinion of the Contractor, the quantities of the specified tools are not adequate to make the necessary maintenance in the supplied conductors, the Contractor shall offer the appropriate quantities of tools and provide an explanation in the Technical Data Sheets of Section E.2.5

2.5.3 INSTALLATION

2.5.3.1 Installation will be by the Contractor as specified in Paragraph A.2, Section E.2.1 of the Technical Data Sheets and monitored by NPC representative(s)..

2.5.3.2 The complete details and stringing methods, proper handling and storage, stringing methods and performance guarantees, etc. shall be furnished by the Contractor for NPC's review and approval.

2.5.4 TESTS**2.5.4.1 General**

2.5.4.1.1 All materials shall comply with test criteria, and NPC acceptance of the conductors and accessories shall not relieve the Contractor of his responsibility for meeting all the requirements of this specification.

2.5.4.1.2 The Contractor shall carry out at his own expense all tests necessary to ensure the satisfactory design and manufacture of conductors in accordance with ASTM or equivalent IEC Standards.

2.5.4.1.3 Conductors shall be given the manufacturer's routine shop tests and quality conformance tests and shall be witnessed by NPC or his authorized representative unless waived in writing. No conductors shall be shipped until released for shipment by NPC.

2.5.4.1.4 The Contractor shall make all preparation for tests and provide the test apparatus and personnel and shall notify NPC the date of the tests to be witnessed forty five (45) days in advance.

2.5.4.2 Shop Tests**2.5.4.2.1 General**

2.5.4.2.1 The power conductors shall be subjected to the design (or Type) tests, if specified, and quality conformance (or Sample) tests in accordance with IEC 1089 or equivalent ASTM Standards. Even though NPC or his representative performs or witnesses the required tests and the conductors meet the acceptance criteria, Contractor shall not be relieved of the responsibility of providing power conductors conforming to all requirements of the specification.

2.5.4.2.2 Design Tests

2.5.4.2.2.1 Contractor shall perform a stress-strain test and provide a certified test report for the specified conductors, if so required by NPC in Section E.2.5 of the Technical Data Sheets.



2.5.4.2.2.2 Contractor shall perform breaking strength tests, and provide a certified test report, for the specified conductors.

2.5.4.2.2.3 If applicable to the specified conductor, Contractor shall perform tests, or provide recent (approximately 1 year) prior test results, to demonstrate that the jointing of individual aluminum wires meets the requirements of IEC 1089, Paragraph 5.5.5.

2.5.4.2.3 Quality Conformance Tests

2.5.4.2.3.1 Quality conformance tests are required in accordance with IEC 1089 paragraph 6.2.2 'Sample Tests' and paragraph 6.3 'Sample Size'. Test reports are required.

2.5.5 DATA AND DOCUMENTATION REQUIREMENTS

2.5.5.1 General

2.5.5.1.1 Contractor's furnished data and information shall be the guaranteed performance data, predicted performance interface requirements and installation/stringing features of all Contractor's furnished materials. The accuracy of such information and its compatibility with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

2.5.5.1.2 All information submitted as part of Proposal Data will become part of contract data for successful bidder. Any deviation from such data requires NPC's approval.

2.5.5.2 Data and Information to be Furnished with Proposal

2.5.5.2.1 The Contractor shall furnish the following information with his bid:

- a. Filled-in data sheets of Section E.2.5 of the Technical Data Sheets;

2.5.5.3 Data and Information to be Furnished After Award of Contract

2.5.5.3.1 The Contractor shall submit as a minimum, the following drawings and information after award of Contract for NPC's review, comments and approval:

- a. Design Test and Quality Conformance Test reports;
- b. Brochures and catalogues to support the filled-in Technical Data Sheets and to allow NPC to evaluate the conductors being offered;
- c. Drawings, instructions and other reference material for the specified splicing materials and installation tool and materials;
- d. Drawings, instructions and other reference material for the stringing/installation methods of conductors;
- e. ISO 9001 Certification/QA Program;

- f. Details of Conductor reels;
- g. List of Drawings and its submittal; and
- h. As-built drawings as finally approved.

2.5.5.3.2 The Contractor shall furnish in the manner, number of copies and within the time set forth in the Contract.

PART I – TECHNICAL SPECIFICATIONS

E.2.6: OVERHEAD GROUND WIRE

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E.2.6: OVERHEAD GROUND WIRE

2.6.0 SCOPE

2.6.0.1 General

2.6.0.1.1 This specification covers the technical and associated requirements for galvanized and aluminum-clad steel Overhead Ground Wires and their respective splice materials and splice installation tools, for use in electric power switchyards, substations and overhead transmission lines rated 69 kV and above.

2.6.0.1.2 It is not NPC's intent to specify all technical requirements or to set forth those requirements adequately covered by applicable codes and standards. The Contractor shall furnish high quality materials meeting the requirements of this specification and industry standards.

2.6.0.1.3 The Contractor shall bear full responsibility that the overhead ground wires have been designed and manufactured in accordance with all codes, standards and applicable governmental regulations and perform under the condition and to the standards specified herein.

2.6.0.1.4 No departure shall be made from this specification and standards unless waived or modified in writing by NPC. The Contractor shall obtain from its sub-Contractor a statement as to compliance with this specification without exception and/or if there are any exceptions, these shall be described in detail and included in Contractor's proposal. The Contractor shall add a statement that no other exceptions are taken to this specification.

2.6.0.2 Works to be Provided by the Contractor

2.5.0.2.1 The Contractor shall provide the equipment, materials, accessories and services delineated in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.6.0.3 Works to be Provided by NPC

2.6.0.3.1 NPC shall provide the services listed in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.6.1 CODES AND STANDARDS

2.6.1.1 General

2.6.1.1.1 The wires furnished shall be in accordance with, but not limited to, the latest issues of the following applicable standards, including all addenda, in effect at time of purchase order unless otherwise stated in this specification.



ASTM - American Society for Testing Materials

- A363 Zinc-Coated (galvanized) Steel Overhead Ground Wire Strand
- A474 Aluminum-coated Steel Wire Strand
- B341 Aluminum-Coated (Aluminized) Steel Core Wire for Aluminum Conductors, Steel Reinforced
- B415 Hard-Drawn Aluminum-clad Steel Wire
- B416 Concentric-Lay-Stranded Aluminum-Clad Steel Conductors
- E-139 Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
- B500 Zinc-coated (Galvanized) and Aluminum-Coated (Aluminized) Stranded Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR/AW)

IEC - International Electro-technical Commission Publications

- 60888 Zinc-Coated Steel Wires for Stranded Conductors
- 1089 Round Wire Concentric Lay Overhead electrical Stranded Conductors

ISO - International Standards Organization

- 9001 Quality System Model for Quality Assurance in Design/Development, Manufacture and Testing
- 9002 Quality System Model for Quality Assurance in Production, Installation and Servicing

2.6.1.1.2 These codes and standards set forth minimum requirements which may be exceeded by Contractor if, in Contractor's judgment and NPC's acceptance, superior or more economic designs or materials are available for successful and continuous operation of Contractor's materials as required by this specification.

2.6.2 TECHNICAL REQUIREMENTS

2.6.2.1 Design Requirements

2.6.2.1.1 General

2.6.2.1.1.1 The type(s) of overhead ground wire(s) to be furnished and its/their detailed characteristics is/are specified in Section E.2.6 of the Technical Data Sheets.

2.6.2.1.2 Corrosion Inhibitor

2.6.2.1.2.1 When so specified in Section E.2.6 of the Technical Data Sheets, the overhead ground wires shall be protected by a high melting point (e.g., dropping point of approximately 380°F [193°C], neutral, organic inhibitor. This inhibitor shall be applied as specified in Section E.2.6 of the Technical Data Sheets.



2.6.2.2 Manufacturing Requirements**2.6.2.2.1 Stranding**

2.6.2.2.1.1 All wires of the conductor shall be concentrically stranded. The wires in each layer shall be evenly and closely stranded around the underlying wire(s). The tension in individual wires in a layer shall be sufficient to hold each wire firmly in place with only enough strand separation to prevent crowding at the time of stranding and during installation.

2.6.2.2.2 Joints

2.6.2.2.2.1 For permissible joints of overhead ground wires during manufacture, the provisions of ASTM B341, B416, B498 or equivalent IEC Standards shall apply.

2.6.2.2.3 Surface Condition

2.6.2.2.3.1 The completed overhead ground wire shall be smooth, free from nick, burrs, aluminum or steel particles, dirt and excessive die grease. The conductor shall be absolutely free of copper dust and copper particles.

2.6.2.3 Materials and Workmanship

2.6.2.3.1 The materials shall conform to the applicable Standards, of recent manufacture and unused. Workmanship shall conform to industry standards and good practices.

2.6.2.4 Stress-Strain and Creep Data

2.6.2.4.1 Contractor shall supply Stress-Strain and Creep data for the specified cable(s) in Section E.2.6 of the Technical Data Sheets. The data shall be in the form of coefficients and, additionally, in form of stress-strain curves. Contractor's Stress-Strain and Creep data shall be obtained from stress-strain tests on the cable(s) produced under this contract, if so required in Section E.2.6 of the Technical Data Sheets.

2.6.2.4.2 Stress-Strain and Creep tests shall be performed according to ASTM E-139, IEC 1089 or NPC-approved equivalent.

2.6.2.4.3 If no stress-strain test is required by NPC in the Technical Data Sheets, Contractor shall provide the stress-strain data based on his own new tests, or based on previous tests on a cable identical to the specified or based on a cable constituted of the same materials and number of strands as specified, approximately the same lay (in function of cable outer diameter).

- 2.6.2.4.4 The required stress-strain coefficients apply to a polynomial of 4th order (which describes the applicable initial and creep stress-strain curves) of the form

$$Y = A_0 + A_1 \cdot X + A_2 \cdot X^2 + A_3 \cdot X^3 + A_4 \cdot X^4,$$

where Y is the stress in N/mm² times HA or HS, as applicable, and X is the percent elongation. (HA and HS are the cross-sectional area ratios of outer layers and core layers, respectively, to the total cable). For the final stress-strain curve Y is a straight line in function of X and a slope of the corresponding A1.

$$Y = A_1 \cdot X$$

2.6.2.5 Compression Dead End and Splices

2.6.2.5.1 General

- 2.6.2.5.1.1 Compression dead ends including splice materials (where required) shall be provided by the Contractor suitable for the specified cables, and pertinent instructions including instruction for the proper operation, maintenance and calibration of the compressor(s) and the use and storage of die(s).
- 2.6.2.5.1.2 The complete cable splice and compression dead-end, when installed according to Contractor's instructions, shall have a minimum mechanical strength equal to 95 percent of the rated tensile strength (RTS) of the cable.
- 2.6.2.5.1.3 The electrical resistance of the installed splices and dead-end shall be no less than that of an equal length of bare conductor.
- 2.6.2.5.1.4 The filler compound shall be per Contractor's recommendation, except that a compound based on zinc chromate is not acceptable.
- 2.6.2.5.1.5 Contractor shall provide drawings for the splices and compression dead-ends, including the length(s) before and after compression.
- 2.6.2.5.1.6 Contractor shall provide his recommended procedures for making splices, one instruction and procedure in each splice material box.

2.6.2.5.2 Joint Sleeves

- 2.6.2.5.2.1 All of the joint sleeves and repair sleeves shall be of compression type and suitable for the specified overhead ground wire.

2.6.2.5.3 Mid-Span Joint Sleeves

2.6.2.5.3.1 For zinc coated (galvanized) overhead ground wire, the joint sleeve for mid-span shall consist of a galvanized steel compression sleeve, while for aluminized and aluminum clad overhead ground wire the joint sleeve shall be made of aluminum compression sleeve. The aluminum sleeve shall be made of aluminum alloy and the steel sleeve shall be made of carbon steel.

2.6.2.5.4 Jumper Sleeve

2.6.2.5.4.1 Jumper sleeve shall be made of aluminum alloy. The tensile strength of the finished joint must be no more than 30 percent of the ultimate breaking strength of the conductor.

2.6.2.5.5 Repair Sleeve

2.6.2.5.5.1 Repair sleeve shall be made of aluminum alloy.

2.6.2.6 Additional Requirements

2.6.2.6.1 The Contractor shall supply initial and final Sag Tension Charts for the specified conductor based on the Stress-Strain and Creep test conducted under this specification. The cost of preparing the sag and tension charts shall be included in the bid unit price for the conductor.

2.6.2.7 Tools

2.6.2.7.1 The Contractor shall provide all tools and appliances necessary for the proper installation and stringing of the overhead ground wires.

2.6.2.7.2 If maintenance tools are specified for NPC's use in Section E.2.6 of the Technical Data Sheets, Contractor shall supply such tools and pertinent information.

2.6.2.7.3 If, in the opinion of the Contractor, the quantities of the specified tools are not adequate to make the necessary maintenance in the supplied cable(s), Contractor shall offer the appropriate quantities of tools and provide an explanation in Section E.2.6 of the Technical Data Sheets.

2.6.3 INSTALLATION

2.6.3.1 Installation will be by Contractor as specified in Paragraph A.2, Section E.2.1 of the Technical Data Sheets and monitored by NPC representative(s).

2.6.3.2 The complete details of installation, proper handling, transport and storage, stringing methods and performance guarantees, etc. shall be furnished by the Contractor in time for NPC's review and approval.

2.6.4 TESTS**2.6.4.1 General**

- 2.6.4.1.1 All materials shall comply with test criteria, and NPC acceptance of the conductors and accessories shall not relieve the Contractor of his responsibility for meeting all the requirements of this specification.
- 2.6.4.1.2 The Contractor shall carry out at his own expense all tests necessary to ensure the satisfactory design and manufacture of the overhead ground wires in accordance with ASTM or equivalent IEC Standards.
- 2.6.4.1.3 The overhead ground wire shall be given the manufacturer's routine shop tests and quality conformance tests and shall be witnessed by NPC or his authorized representative(s) unless waived in writing. No overhead ground wires shall be shipped until released for shipment by NPC.
- 2.6.4.1.4 The Contractor shall make all preparation for tests and provide the test apparatus and personnel and shall notify NPC the date of the test to be witnessed forty five (45) days in advance.

2.6.4.2 Shop Tests

- 2.6.4.2.1 Overhead ground wire shall be subjected to the design (or Type) tests, if specified, and quality conformance (or Sample) tests in accordance with applicable standards. Even though Contractor or his representative performs or witnesses the required tests and the cables meet the acceptance criteria, Contractor shall not be relieved of the responsibility of providing cables conforming to all requirements of the specification.

2.6.4.2.2 Design Tests

- 2.6.4.2.2.1 Contractor shall perform a stress-strain test and provide a certified test report for the specified cables, if so required by the NPC in Section E.2.6 of the Technical Data Sheets.
- 2.6.4.2.2.2 Contractor shall perform breaking strength tests, and provide a certified test report, for the specified cables, if so required by NPC in Section E.2.6 of the Technical Data Sheets.
- 2.6.4.2.2.3 If applicable to the specified cable, Contractor shall perform tests, or provide recent (approximately 1 year) prior test results, to demonstrate that the jointing of individual wires meets the requirements of the applicable standards.

2.6.4.2.3 Quality Conformance Tests

- 2.6.4.2.3.1 Quality conformance tests are required in accordance with IEC 1089 paragraph 6.2.2 'Sample Tests' and paragraph 6.3 'Sample Size'. Test reports are required.

2.6.5 DATA AND DOCUMENTATION REQUIREMENTS**2.6.5.1 General**

2.6.5.1.1 Contractor furnished data and information shall be the guaranteed performance data, predicted performance interface requirements and installation/stringing features of all Contractors' furnished materials. The accuracy of such information and its compatibility with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

2.6.5.1.2 All information submitted as part of Proposal Data will become part of contract data for successful Contractor. Any deviation from such data requires NPC's approval.

2.6.5.2 Data and Drawings to be Furnished with Proposal

2.6.5.2.1 The Contractor shall furnish the following information with his bid:

- a. Filled-in Technical Data Sheets of Section E.2.6;

2.6.5.3 Drawings and Data to be Furnished After Award of Contract

2.6.5.3.1 The Contractor shall submit as a minimum, the following drawings and information after award of Contract for NPC's review and approval:

- a. Design Test and Quality Conformance Test reports;
- b. Brochures and catalogues to support the filled-in Technical Data Sheets and to allow NPC to evaluate the OHGW being offered;
- c. Drawings, instructions and other reference material for the specified splicing materials and installation tool and materials;
- d. Drawings, instructions and other reference material for the stringing/installation methods of OHGW;
- e. ISO 9001 Certification/QA Program;
- f. List of Drawings and its submittals; and
- g. As-built drawings as finally approved.

2.6.5.3.2 The Contractor shall furnish in the manner, number of copies and within the time set forth in the Contract.

PART I – TECHNICAL SPECIFICATIONS

E.2.7: INSULATORS

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E.2.7: INSULATORS

2.7.0 SCOPE

2.7.0.1 General

2.7.0.1.1 This specification covers the technical and associated requirements for insulator units (wet processed porcelain, toughened glass or composite) for used in electric power switchyards, substations and overhead transmission lines.

2.7.0.1.2 It is not NPC's intent to specify all technical requirements nor to set forth those requirements adequately covered by applicable codes and standards. Contractor shall furnish high quality insulator units meeting the requirements of this specification and industry standards.

2.7.0.1.3 The Contractor shall bear full responsibility that the insulators have been designed and manufactured in accordance with all codes, standards and applicable governmental regulations and perform under the condition and to the standards specified herein.

2.7.0.1.4 No departure shall be made from this specification and standards unless waived or modified in writing by NPC. The Contractor shall obtain from its sub-Contractors a statement as to compliance with this specification without exception and/or if there are any exceptions, these shall be described in detail and included in Contractor's proposal. The Contractor shall add a statement that no other exceptions are taken to this specification.

2.7.0.2 Works to be Provided by the Contractor

2.7.0.2.1 The Contractor shall provide the works and services delineated in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.7.0.3 Works to be Provided by NPC

2.7.0.3.1 NPC shall provide the services listed in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.7.1 CODES AND STANDARDS

2.7.1.1 General

2.7.1.1.1 The insulators furnished shall be in accordance with, but not limited to, the latest issue of the following codes and standards, including all addenda, in effect at time of purchase order unless otherwise stated in this specification:

ANSI/IEEE - AMERICAN NATIONAL STANDARDS INSTITUTE

C29.1-88	Test Methods for Electrical Power Insulators
C29.2	Wet Process Porcelain and Toughened Glass Insulators - Suspension Type
C29.9	Wet Process Porcelain Insulators- Apparatus, Post Type
C29.11-89	Tests for Composite Suspension Insulators for Overhead Transmission Line
IEEE 4-78	Standard Techniques for High Voltage Testing
IEEE 957	Guides for Cleaning Insulators
IEEE 987	Guides for Application of Composite Insulators

ASTM American Society for Testing and Materials

A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A239-89	Standard Test Method for Locating the Thinnest Spot in Zinc (galvanized) Coating of Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
B499	Method for Measurement of Coating Thickness by Magnetic Method; Non- Magnetic Coatings on Magnetic Basis Metals
D750	Recommended Practice for Operating Light and Weather Apparatus (Carbon Arc Type) for Artificial Weather Testing of Rubber Compounds
D1499	Recommended Practice for Operating Light and Water Exposure Apparatus (Carbon Type) for Exposure of Plastics
D2240	Rubber Properties - Durometer Hardness
D25	Recommended Practice for Operating Xenon-Arc Light Water Exposure Apparatus for Plastics
G23	Recommended Practice for Operating Light and Water Exposure Apparatus (Carbon Type) for Exposure of Non-metallic Materials
G26	Recommended Practice for Operating Light Exposure Apparatus (Xenon Arc Type) with or without Water for Exposure of Non-metallic Materials.
G53	Recommended Practice for Operating Light Exposure and Water Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Non-metallic Materials

IEC - International Electro-technical Commission

60060-1	General Definitions & Test Procedures
60120	Dimensions of Ball and Socket Couplings of String Insulator Units
60305	Characteristics of String Insulator Units of the Cap and Pin Type
60372	Locking Devices for Ball and Socket Couplings of String Insulators
60383	Tests on Insulators of Ceramic Material or Glass for Overhead Lines with a Nominal Voltage greater than 1000 V

60433	Characteristics of String Insulators Units of the Long Rod Type
60437	Radio Interference Test on High Voltage Insulators
60438	Tests and Dimensions for High Voltage D.C. Insulators
60471	Dimensions of Clevis and Tongue Coupling of String Insulator Units
60506	Switching Impulse Tests on High Voltage Insulators
60507	Artificial Pollution Tests on High Voltage Insulators to be used on A.C. Systems
60575	Thermal-mechanical Performance Test and Mechanical Performance Test on String Insulator Units
60591	Sampling Rules and Acceptance Criteria when Applying Statistical Control Methods for Mechanical or Glass for Overhead Lines with a Nominal Voltage Greater than 1000 V
60815	Guides for Selection of Insulators in Respect of Polluted Conditions
1109-92	Composite Insulators for AC Overhead Lines with Nominal Voltage Greater than 1000V - Definitions, test methods and acceptance criteria.

CEA Canadian Electrical Association

LWIWG-01
and -02 Design and Type Test Methods for Composite Insulators

ISO International Standards Organization

9001 Quality System Model for Quality Assurance in Design/ Development, Manufacture and Testing
9002 Quality System Model for Quality Assurance in Production, Installation and Servicing

2.7.1.1.2 These codes and standards set forth minimum requirements which may be exceeded by Contractor if, in Contractor's judgment and with NPC's review, superior or more economical design or materials are available for successful and continuous operation of Contractor's supplied materials as required by this specification.

2.7.2 TECHNICAL REQUIREMENTS

2.7.2.1 Description of Services

2.7.2.1.1 The insulators covered by this specification are for use in transmission lines rated 69 kV and above. Depending on the requirements stated in the Technical Data Sheets of Section E.2.7, the insulator unit can be wet-processed porcelain or toughened glass suspension unit, a horizontal line post insulator unit or long rod insulator unit, or a composite type insulator unit.

2.7.2.1.2 The insulator unit shall be supplied complete with the required attachment and hardware to receive the conductor required for the transmission line as specified in the Technical Data Sheets of Section E.2.7. The characteristics of the various attachments or hardware shall be as required in the Technical Specification of Section E.2.8 and its corresponding Technical Data Sheets.

2.7.2.2 Suspension Type Insulators

2.7.2.2.1 Design Requirements

2.7.2.2.1.1 The insulator design, fabrication and resultant characteristics shall be in accordance with the codes and other particular requirements specified herein.

2.7.2.2.1.2 Insulator shells shall be made of commercial quality wet-processed porcelain or of toughened glass in accordance with ANSI C29.2. The color of toughened glass shells shall be manufacturer's standard color. The color of the glaze of porcelain shells shall be as specified in Section E.2.7 of the Technical Data Sheets. When units are coupled together, there shall be no contact between the shell of one unit and the metal parts of the next adjacent unit when strings are in their service position. Design of the head shall be cylindrical and shall be made such that it will produce uniform mechanical and electrical stress distribution.

2.7.2.2.2 Metal Parts

2.7.2.2.2.1 General

2.7.2.2.2.1.1 Pins and caps shall be designed to transmit the mechanical stresses to the shell by compression and to develop uniform mechanical strength of the insulator. The metal parts shall retain their rated mechanical strength even when the porcelain skirts are partially or completely broken off.

2.7.2.2.2.1.2 Pins shall be made of drop-forged, upset-forged, or machined-steel. The insulator pins, if specified in Section E.2.7 of the Technical Data Sheets, shall be protected against electrolytic corrosion by the use of a sleeve of pure zinc, zinc alloy or a corrosion intercepting sleeve. The sleeve shall be fused to the pin so that no gap exists between pin and sleeve and shall be so positioned on the pin as to intercept the cement line.

2.7.2.2.2.1.3 Caps shall be of copper-bearing drop-forged steel or heat-treated malleable cast iron. The hole for the cotter key in a socket type cap shall be on the side of the cap opposite the socket opening. The hole shall be counter-sunk in such a manner that the eye of the cotter key when in the locked position maybe engaged by a hot-line key puller, to provide for disengagement of insulator units under energized conditions.

2.7.2.2.2.1.4 All ferrous parts, except stainless steel, shall be galvanized in accordance with ASTM A153.

- 2.7.2.2.2.1.5 Insulator units shall be furnished with the size and type of connection specified in Section E.2.7 of the Technical Data Sheets. The dimensions and tolerances of ANSI (IEC) type ball and socket connections and tongue- clevis connections shall be in accordance with ANSI C29.2 (IEC 120).
- 2.7.2.2.2.1.6 Insulator units with ball-socket connection shall be furnished with a locking device of the split cotter key type installed in the socket hole of the insulator cap. The cotter key shall be of such design and size to meet the tests specified herein. The cotter key shall provide positive locking against unintentional disengagement of insulator units during use and handling to provide easy connection to other units or hardware. Cotter keys shall be made from cold-drawn bronze, brass or stainless steel wire of approximately half-round section having the following properties:
- i. Stainless steel shall be of American Iron and Steel Institute Type 301, 302 and 304, shall have a minimum elongation of 20 percent in a two inch gage and shall have a surface hardness of Rockwell B88 to C30.
 - ii. Brass shall contain a minimum of 80 percent copper and have a minimum tensile strength of 80,000 psi.
 - iii. Bronze shall contain 88 percent minimum, 98 percent maximum copper and shall have a minimum tensile strength of 80,000 psi.
- 2.7.2.2.2.1.7 Pins for tongue-clevis type connection shall be of drop-forged, upset-forged or machined steel. Locking device of split cotter key type shall be used to prevent disengagement of insulator units. Cotter keys shall allow easy connection to other units or hardware. Cotter key materials shall comply with above Paragraph 2.7.2.2.2.1.6.
- 2.7.2.2.2.2 **Assembly**
- 2.7.2.2.2.2.1 Neat Portland cement (in accordance with ASTM C150) or a Portland cement and sand mixture shall be used in making the assembly of porcelain insulators.
- 2.7.2.2.2.2.2 Neat aluminous cement or an aluminous cement and sand mixture shall be used in making the assembly of toughened glass insulators.
- 2.7.2.2.2.3 **Materials and Workmanship**
- 2.7.2.2.2.3.1 Material shall be free of defects, of recent manufacture, and unused. Workmanship shall conform to industry standards and practices.
- 2.7.2.2.2.3.2 Metal caps shall be free from cracks, seams, shrinks, air holes, burrs, and rough edges. Metal pins shall be free from laps, folds, seams, burrs, and rough edges. Surfaces of metal parts shall be smooth with no projecting points or irregularities which may cause corona.

2.7.2.2.2.3.3 Insulator units after assembly shall be concentric and coaxial.

2.7.2.3 Horizontal Line Post and Long Rod Insulator Units

2.7.2.3.1 Design Requirements

2.7.2.3.1.1 The horizontal mounted line post and/or long rod insulators shall be made of high-grade, wet-process high strength porcelain, suitable for the type of pole or structure specified in the Technical Data Sheets of Section E.2.7. Depending on the requirements stated in the Technical Data Sheets of Section E.2.7, the porcelain body shall be made of either two or single unit solid core insulator.

2.7.2.3.1.2 The insulator shall conform to the requirements of ANSI C29.7.

2.7.2.3.2 Metal Parts

2.7.2.3.2.1 General

2.7.2.3.2.1.1 Clamp brackets shall be made of ductile iron.

2.7.2.3.2.1.2 All ferrous parts, except stainless steel, aluminum shall be galvanized in accordance with ASTM A153.

2.7.2.3.2.1.3 Top clamp for the conductor to be used for the transmission line as specified in the Technical Data Sheets of Section E.2.7, shall be made of aluminum.

2.7.2.3.2.1.4 Mounting bolts shall be made of steel complete with accessories suitable for the type of structure specified in the Technical Data Sheets of Section E.2.7.

2.7.2.3.3 Assembly

Neat Portland cement (in accordance with ASTM C150) or a Portland cement and sand mixture shall be used in making the assembly of the post type insulators.

2.7.2.4 Composite Insulators

2.7.2.4.1 General

2.7.2.4.1.1 The polymer or composite insulator described in this specification consists of the following components:

- a. a fiberglass reinforced resin rod;
- b. a chemically bonded polymer sheath to protect the fiberglass rod from hydrolysis;
- c. polymer weather sheds to provide adequate leakage distance; and
- d. metal end fittings.

2.7.2.4.2 Design Requirements

- 2.7.2.4.2.1 The insulator design, fabrication and resultant characteristics shall be in accordance with the codes and standards and other particular requirements specified herein.
- 2.7.2.4.2.2 The reinforced fiberglass core shall be electrical grade epoxy or made with corrosion (acid) resistant glass fibers to achieve maximum tensile strength. The insulator core shall be mechanically and electrically sound, free from voids, foreign substances and manufacturing flaws. The rod shall have a uniform diameter throughout the entire length.
- 2.7.2.4.2.3 A protective polymer material shall be extruded or injection molded on the reinforced fiberglass to a thickness not less than 3.0 mm. The polymer material shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and be seamless and free from imperfections. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. Weather sheds shall be located at intervals to provide optimum electrical performance. The base polymer shall be 100% silicone rubber prior to the addition of reinforcing fillers.
- 2.7.2.4.2.4 Grading rings shall be provided when system voltages are equal to or greater than 230 kV. The size and placement of the metallic grading rings shall be designed to eliminate dry band arcing in the vicinity of the end fittings and shield the end fittings preventing corona inception at 115% of nominal line-to-ground voltage.
- 2.7.2.4.2.5 The design of the grading rings shall be such that the ring can only be mounted with its orientation towards the weather sheds for maximum RIV and corona control. Grading rings shall be capable of installation and removal with hot line tools without disassembling any other part of the insulator assembly.
- 2.7.2.4.2.6 The sheath material shall be continuous and shall extend inside the end fitting collar. No joints shall be permitted for greater assurance against the formation of electrical discharge or stress erosion points.
- 2.7.2.4.2.7 The full insulator string unit shall contain equal leakage distance as that of an electrically equivalent standard string of porcelain insulators. Insulator having reduced leakage design will not be accepted.
- 2.7.2.4.2.8 The completed insulator shall have a permanent seal at the interface between the metal end fittings and the housing to insure that no moisture or foreign materials shall enter.
- 2.7.2.4.2.9 The polymer insulator shall be of the type specified in the Technical Data Sheets of Section E.2.7.

2.7.2.4.3 Galvanizing

- 2.7.2.4.3.1 All ferrous items, other than stainless steel, shall be galvanized to ASTM A-123 or A 153-82.
- 2.7.2.4.3.2 The insulator's end fittings shall be connected to the rod core by means of a controlled compression technique which provides the required SML.
- 2.7.2.4.3.3 The zinc coating shall be uniform, and adhere to the surface of the base metal. The coating shall be free from blisters, flux, black spots, dross, tear drop edges, flaking zinc, rough appearance and in general shall be smooth, clean and unblemished when received.

2.7.2.5 Insulator Marking

- 2.7.2.5.1 For a suspension type of insulator unit, each insulator unit shall be marked in accordance with ANSI C29.2. Marking shall be either on the shell or cap prior to galvanizing. Additional marking, such as production record code, if customarily provided by Contractor, are acceptable. In addition, all shells of insulator units shall be marked with official NPC logo to identify the same as the property of National Power Corporation. Marking shall be on the opposite side of the usual trademark by the manufacturer of the insulator units.
- 2.7.2.5.2 For a long rod or post type insulator units, each insulator unit shall be marked in accordance with ANSI C29.7. Marking shall be either on the shell or cap prior to galvanizing. In addition, the shell at the topmost portion of the post or long rod insulator unit shall be marked with official NPC logo to identify the same as the property of National Power Corporation. Marking shall be on the opposite side of the usual trademark by the manufacturer of the insulator units.
- 2.7.2.5.3 For a composite type of insulator unit, the insulator shall be marked per ANSI C29.11, Section 6, 1988 with additional marking of NPC logo only at the uppermost weather shed of the complete insulator unit.

2.7.2.6 Preparation for Shipping and Storage

- 2.7.2.6.1 For suspension type of insulator unit, packing shall comply with ANSI C29.2, and the following:
- a. Insulators, unless otherwise specified, shall be packed for shipment in crates with closed ends of sufficient strength to prevent injury to the contents, withstand pelletizing and resist failure during transit, storage, and subsequent handling in the field.
 - b. Unless otherwise specified, each crate of insulators with a unit spacing of from 127 mm to 165 mm (5 inches to 6-1/2 inches) shall consist of a string of six assembled and connected units or each crate shall consist of two parallel strings of six units each, with each string of six units assembled and connected.

- c. Each crate of insulators with a unit spacing of up to 200 mm (7-3/4inches) shall consist of a string of five assembled and connected units.
- d. In addition each crate shall be marked on the sides and on each end with a distinguishing code for insulators of different type. The Contractor shall submit a description of marking he proposes for each type, for NPC's review. Prominent weather-resistant colored marking will be acceptable.

2.7.2.6.2 For composite insulator unit, the insulator unit shall be carefully packed and crated so that no part of the weather shed will be damaged or scratched during handling.

2.7.2.6.3 For long rod or post type insulator unit, adequate support shall be provided to prevent breakage of the long rod during shipment and transport.

2.7.2.6.4 Each box or container of insulator unit shall be marked with the number of pieces contained therein, the catalog number or class number or description of the contents and the manufacturer's name.

2.7.3 INSTALLATION

2.7.3.1 Installation will be by NPC as specified in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.7.3.2 When the installation is by NPC, complete details of installation, proper handling, transport and storage, testing, performance guarantees, etc. shall be furnished by the Contractor in time for NPC's installation of insulator strings.

2.7.4 TESTS

2.7.4.1 General

2.7.4.1.1 The Contractor shall carry out, at his own expense, all tests necessary to ensure the satisfactory design and manufacture of the insulator units in accordance with ANSI or IEC Standards.

2.7.4.1.2 All tests required in the Technical Data Sheets shall be witnessed by NPC or his authorized representative unless waived in writing, and no insulator units shall be shipped until released for shipment by NPC or his authorized representative.

2.7.4.1.3 The Contractor shall make all preparation for tests and provide the test apparatus and personnel and shall notify NPC the date of the test forty five (45) days in advance.

2.7.4.1.4 Actual test procedures to be used shall be subject to NPC's acceptance and approval.

2.7.4.2 Shop Tests

2.7.4.2.1 Insulator units shall be subjected to the design, quality conformance, and routine tests in accordance with ANSI C29.2 for wet process porcelain and toughened glass suspension insulator unit, C29.7 for line post insulator and long rod insulator unit and C29.11 for composite insulator unit and all other applicable tests mentioned herein this Section. Even though Contractor performs the required tests and the insulators meet the acceptance criteria, Contractor shall not be relieved of the responsibility of providing insulators conforming to all requirements of the specification.

2.7.4.3 Design Tests**2.7.4.3.1 General**

2.7.4.3.1.1 Design tests in accordance with applicable ANSI or IEC standards and corresponding certified test reports are always required, when the insulator type is Supplier's new design or Supplier's previous design with significant design changes (i.e. prototype). For this, the Contractor shall submit the test procedures he intends to use for NPC's review and acceptance.

2.7.4.3.1.2 If insulator unit to be supplied is not a prototype, a certified design test reports of duplicated production type following the prescribed tests mentioned in Paragraph 2.7.4.2 shall be submitted as specified in Paragraph B.4, Section E.2.7 of the Technical Data Sheets.

2.7.4.3.1.3 Certificates of all design or type tests required for all types of insulator units under ANSI and/or IEC Standard shall be of the latest supply conducted by an internationally known, reputable and independent testing laboratory. Certificates of design tests or type tests conducted at the manufacturer's own testing laboratory will not be accepted.

2.7.4.3.2 Suspension Type Insulator Unit

2.7.4.3.2.1 The insulator units to be supplied shall comply with the Design Test specified in ANSI C29.2 and the following additional tests:

a. **Steep front-of-wave test**

Steep front-of-wave test shall be performed on ten (10) insulator units selected at random from the first production lot offered for inspection:

1. The insulator units shall be subjected to five successive positive and negative impulse flashovers with a wave having an effective rate of rise of 2,500 kV per microsecond. The insulator units shall be tested singly.
2. Each unit shall then be verified to be electrically intact by applying low-frequency voltage. The rated wet-low frequency withstand voltage shall

be applied to each unit and no electrical puncture shall occur.

Failure of any one unit either in the front-of-wave or subsequent low frequency withstand voltage test shall be cause for testing another twenty (20) units.

Failure of more than one unit from the total so tested shall constitute failure to meet the requirements of this specification.

b. Thermal-Mechanical Performance Test

A Thermal-Mechanical Performance Test shall also be performed in accordance with IEC Publication 383-1:1993 with the acceptance criteria as follows:

1. The result of this performance test shall match the result of the ordinary M & E failing load test.
 - i. Mean value and standard deviation of the performance test shall not change.
 - ii. Fracture pattern shall not change.
2. Acceptance constant, K, should be equal to or greater than 3, when the sample size is ten.

$$\text{That is, } 3 \leq K = \frac{R - R_s}{S}$$

where R : Mean value
Rs : M & E rated value
S : Standard deviation

3. Each value measured should not be lower than the specified M & E strength.
4. Electrical puncture should not occur before the ultimate fracture.

2.7.4.3.3 Horizontal Line Post /Long Rod Insulator

- 2.7.4.3.3.1 The insulator units to be supplied shall comply with all the design tests specified in ANSI C29.7.

2.7.4.3.4 Composite Insulators

- 2.7.4.3.4.1 The insulator unit to be supplied shall comply with all design tests specified in ANSI C29.11 and the following additional tests:
- a. Water Penetration Test in accordance with CEA-LWIWG-01 and/or CEA-LWIWG-02.
 - b. Power Arc Test in accordance with CEA-LWIWG-01 and/or IEEE 1024.
 - c. Tracking Wheel Test in accordance with CEA-LWIWG-01 and/or

IEEE 1024

- d. Ageing Test for 5000 hours, climatic conditions in accordance with IEC 1109.
- e. Cantilever Bending in accordance with CEA-LWIWG-01
- f. Thermal Mechanical, in accordance with IEC 1109.

2.7.4.4 Routine Tests

2.7.4.4.1 Routine tests shall be witnessed by NPC unless otherwise waived in writing and shall be in accordance with ANSI C29.2 for wet process porcelain and toughened glass insulator unit, C29.7 for line post insulator unit and C29.11 for composite insulator unit.

2.7.4.5 Quality Conformance Tests

2.7.4.5.1 Quality conformance tests together with the routine tests shall be witnessed by NPC unless otherwise waived in writing and shall be in accordance with ANSI C29.2 for wet process porcelain and toughened glass suspension insulator unit, except for the acceptance criteria for the combined Mechanical and Electrical Strength test which shall be as stated in Paragraph 2.7.4.5.2, C29.7 for line post insulator unit and C29.11 for composite type insulator unit.

2.7.4.5.2 For the wet process and toughened glass insulator unit, the acceptance criteria for the combined Mechanical and Electrical strength test shall be as follows:

$$\bar{X} \geq \text{rating} + 3S$$

where: \bar{X} = average value obtained on the sample of the ten insulator units tested

S = standard deviation for the ten insulator units tested

Each value measured shall not be lower than the specified mechanical and electrical strength. Electrical puncture shall not occur before reaching ultimate failure.

2.7.5 DATA AND DOCUMENTATION REQUIREMENTS

2.7.5.1 General

2.7.5.1.1 Contractor-furnished data and information shall be the performance data, predicted performance and installation features of all Contractors' finished materials. The accuracy of such information and its compatibility with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

2.7.5.1.2 All information submitted as part of the Proposal Data will become part of contract data for successful contractor. Any deviation from such data requires NPC's approval.



2.7.5.2 Data and Information to be Furnished with Proposal

2.7.5.2.1 Together with the bid, the Contractor shall submit the following information:

- a. Filled-in Technical Data Sheets of Section E.2.7;

2.7.5.3 Data and Information to be Furnished After Award of Contract

2.7.5.3.1 The Contractor shall submit but not limited to the following drawings and information after award of Contract for NPC's review, comments and approval:

- a. Certified Quality Conformance and Routine Test Reports;
- b. Brochures and catalogues to support the filled-in Technical Data Sheets and to allow NPC to evaluate the insulators being offered;
- c. Certified type test reports performed by an independent testing laboratory;
- d. Parts list or identifying sketch showing components;
- e. Detailed insulator outlines drawing;
- f. Installation procedures;
- g. ISO 9001 Certification/QA Program;
- h. List of Drawings and its submittals; and
- i. Final drawings as approved.

2.7.5.3.2 The Contractor shall furnish in the manner, number of copies and within the time set forth in the Contract.

PART I – TECHNICAL SPECIFICATIONS

E.2.8: LINE HARDWARES

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E.2.8: LINE HARDWARES

2.8.0 SCOPE

2.8.0.1 General

2.8.0.1.1 This specification covers the technical requirements for transmission line hardware and accessories for power conductor and ground wire used in overhead power transmission rated 69 kV and above. The hardware assemblies and components shall be complete and shall include all the necessary clamps, links, yoke plates, clevises, shackles, pins, bolts, hold down weights and locking devices.

2.8.0.1.2 It is not NPC's intent to specify all technical requirements nor to set forth those requirements adequately covered by applicable codes and standards. The Contractor shall furnish high quality hardware and accessories made by either or both the open hearth and electrical furnace processes. All hardware and accessories shall be free of audible and visible corona when subjected to the maximum operating line to line voltage.

2.8.0.1.3 The Contractor shall bear full responsibility that line hardware and accessories have been designed and fabricated in accordance with all codes, standards, and applicable governmental regulations and performs under the conditions and to the standards specified herein.

2.8.0.1.4 No deviation shall be made from this specification and standards unless waived or modified in writing by NPC. The Contractor shall obtain from its sub-Contractors a statement as to compliance with this specification without exception and/or if there are any exceptions, these shall be described in detail and included in Contractor's proposal. The Contractor shall add a statement that no other exceptions are taken to this specification.

2.8.0.2 Works to be Provided by the Contractor

2.8.0.2.1 The Contractor shall provide the materials, works and services listed in Paragraph A2, Section E.2.1 of the Technical Data Sheets.

2.8.0.3 Works to be Provided by NPC

2.8.0.3.1 NPC shall provide the works and services listed in Paragraph A2, Section E.2.1 of the Technical Data Sheets.

2.8.1 CODES AND STANDARDS

2.8.1.1 General

2.8.1.1.1 The materials furnished shall be in accordance with, but not limited to the latest issue of the following codes and standards, including all addenda in effect at time of purchase order unless otherwise stated in this specification.

ASTM - American Society For Testing And Materials

A 90	Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
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ISO International Standards Organization

9001	Quality System Model for Quality Assurance in Design/Development, Manufacture and Testing
9002	Quality System Model for Quality Assurance in Production, Installation and Servicing

2.8.1.1.2 These codes and standards set forth minimum requirements which may be exceeded by Contractor if, in Contractor's judgment and with NPC's review, superior or more economical design or materials are available for successful and continuous operation of Supplier's equipment as required by this specification.

2.8.2 TECHNICAL REQUIREMENTS**2.8.2.1 General****2.8.2.1.1 Workmanship**

2.8.2.1.1.1 All parts shall be new and highest class and shall be furnished uniformly in quality and smoothly on the surface in conformity to the best commercial practice without any harmful defects such as flaws, ruts, air holes, cracks, burrs and rough edges, etc.

2.8.2.1.1.2 Filling or plugging of any defective parts shall not be permitted. The design shall avoid sharp corners or projections which will produce high electrical stress in normal operation.

2.8.2.1.1.3 The design of adjacent metal parts and contacting surfaces shall be so made as to prevent corrosions of the contact surfaces and to maintain good electrical contact under service conditions.

2.8.2.1.2 Zinc Coating

2.8.2.1.2.1 All the iron and steel parts and members shall be zinc coated upon completion of the fabrication. The zinc coating is to be uniform, clean, smooth and free from burrs, sharp edges, lumps and dross so that interconnecting parts will fit properly and parts may be assembled and disassembled readily. The zinc coating shall be carried out by hot dip process for all parts.

2.8.2.1.2.2 Threaded parts shall be coated after being threaded and excessive zinc shall be removed from the threads. Nuts and locknuts shall be re-tapped after being coated and shall be capable of being threaded the entire length of threads without use of tools. The minimum weight of zinc coating and number of immersions in uniformity test shall be as per ASTM A153.

2.8.2.2 Specific Requirements

2.8.2.2.1 Accessories for Conductor

2.8.2.2.1.1 Suspension Clamp for Conductor

2.8.2.2.1.1.1 Depending on the requirements stated in the Technical Data Sheets, the body of the suspension clamp shall be made either of aluminum alloy, malleable iron or ductile iron and shall be so made as not to deform conductor and loosen the individual strands of the conductor. The materials of the clamp and its fittings shall conform to the following:

Clamp body, keeper pieces	High strength and heat treated cast aluminum alloy
Cotter bolts, U-bolts and Other Ferrous metals	Galvanized mild steel
Cotter pins	Stainless steel

2.8.2.2.1.2 Tension Clamp for Conductor

2.8.2.2.1.2.1 The tension clamp for conductor shall be as specified in the Technical Data Sheets. The wedge and bolted type tension clamps, if required in the Technical data Sheets, shall consist of a clamp body, a wedge or keeper, a doubling plate and other necessary metallic fittings. The materials of the wedge and bolted type tension clamp shall conform to the following or equivalent and all ferrous materials shall be hot-dip zinc coated.

Clamp body, keeper pieces	High strength and heat treated cast Aluminum alloy wedge, jumper fitting
Eye-bolt, nut, bolt, locknut U-bolt, cotter bolt, spring washer connecting bar	Galvanized mild steel
Cotter pins	Stainless steel

2.8.2.2.1.2.2 After clamped, the electrical resistance of the tension clamp must be less than that of the conductor joined thereby with the same length as the tension clamp.

2.8.2.2.1.3 Preformed Armor rods

2.8.2.2.1.3.1 The preformed armor rods are used at all suspension points of the conductor. The shape of the preformed armor rods shall be terminated with rounded ends and shall be of corona-free design at voltage levels 69 kV and above. Each rod shall be made of heat-treated aluminum alloy wires. The characteristics of the preformed armor rods shall be as specified in E.2.8, Technical Data Sheets.

2.8.2.2.1.4 Conductor Spacer/Damper (If required)

2.8.2.2.1.4.1 The spacer for the specified conductor and bundled arrangement of conductors with 457 mm sub-conductor spacing shall consist of an interlinking body and clamps for gripping the sub-conductors as shown on the specified drawings and/or Technical Data Sheets. The spacer body frame shall be made of zinc coated hot rolled steel, carbon steel pipe for pressure tube, or aluminum-alloy and the clamps of the line spacer shall be hinge type made of aluminum alloy. Clamp fastener shall be aluminum alloy breakaway bolt. When necessary, welding of steel shall be carried out before galvanizing in accordance with the ISO or JIS standard. The spacer shall have the following performance and durability's:

- (i) The conductor spacer shall allow movement in all directions and shall fatigueless withstand against repeated compressive loads and tensile loads in vertical, horizontal transverse and horizontal longitudinal directions.
- (ii) The spacers shall be installed at spacing not exceeding 75m with unequal spacing in the same span within 10% variation. Shorter spacing for the first spacer away from the suspension points shall be applied. Contractor shall recommend the spacer spacing application.
- (iii) The conductor damper shall not be deformed by impulsive loads due to electro-magnetic attraction of short circuit current of 50 kA through the bundled conductors.
- (iv) The clamps of the conductor spacer shall not slip relative to the conductor when being turned by 180 degrees.
- (v) The corona noise from the conductor spacers shall not exceed that of the bundled conductors.

2.8.2.2.1.5 Jumper Device (If Required)

2.8.2.2.1.5.1 The jumper device shall have the following performances:

- (i) The clamps of the reinforcement and jumper spacers shall not slip relative to the jumper conductors and the reinforcing galvanized steel wire strands when the jumper conductors and the jumper device are swung together to the side way.

- (ii) The reinforcement and jumper spacers shall not deform by impulsive load due to electro-magnetic attraction of short-circuit current of 50 kA throughout the conductor.
- (iii) The clamps of the reinforcement and jumper spacers shall not slip and the jumper device shall not deform when subjected to the assumed load during the construction work.
- (iv) After the assembly of jumper device, each reinforcing galvanized steel wire strand shall withstand the tensile load of 1,500 kg or more.
- (v) The corona noise from the jumper device shall not exceed that of the bundled conductors.

2.8.2.2.1.6 Damper for Power Conductor

2.8.2.2.1.6.1 The conductor vibration damper shall be suitable for the specified conductor and shall be of the Stockbridge type. The damper shall be modern, highly efficient and multi-resonant type and designed to control Aeolian vibration and to prevent fatigue damage to the conductor. The vibration damper for the conductor shall consist of the damper weights which are resiliently supported from a galvanized strand wire by a suitable clamp.

2.8.2.2.1.6.2 The nominal weight of the damper shall be specified by the Contractor.

2.8.2.2.1.7 Conductor Come along

2.8.2.2.1.7.1 Conductor come along shall have an ultimate tensile strength of not less than 5,000 lbs.

2.8.2.2.2 Accessories for Shield Wire

2.8.2.2.2.1 Suspension Ground Wire Assembly

2.8.2.2.2.1.1 The ground wire suspension assembly for the specified wire size and type shall consist of a free-center type suspension clamp, a link, a U-clevis and a preformed armor rod as shown in the attached drawings and/or Technical Data Sheets, so as to be supplied as a complete set. The suspension clamp shall be made of aluminum alloy or galvanized steel. The characteristics of the clamp for the ground wire suspension assembly shall be as specified in the Technical Data Sheets of Section E.2.8.

2.8.2.2.2.2 Tension Ground Wire Assembly

2.8.2.2.2.2.1 The tension ground wire assembly for the specified wire size and type shall consist of two tension devices and a jumper clamp as shown in the attached drawings and/or Technical Data Sheets, so as to be supplied as a set. The tension device shall consist of a wedge, bolted or compression type tension clamp, a link and two U-clevises as shown in the attached drawings or specified in the Technical Data Sheets. The tension clamp shall be made of aluminum alloy or galvanized steel. The characteristics of the clamp for the tension assembly shall be as specified in the Technical Data Sheets of Section E.2.8.

2.8.2.3 Marking

- 2.8.2.3.1 Individual items of the hardware and accessories shall carry identification marks so as to facilitate assembling and sorting in warehouse or at the site. Marking, such as production record code, as customarily provided by Contractor are acceptable.

2.8.3 INSTALLATION

- 2.8.3.1 Installation of hardware and accessories will be by NPC as specified in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.
- 2.8.3.2 When the installation is by NPC, complete details of installation, proper handling, transport and storage, testing, performance guarantees, etc. shall be furnished by the Contractor in time for NPC's installation of line hardware.

2.8.4 TEST**2.8.4.1 General**

- 2.8.4.1.1 Line hardware and accessories shall comply with test criteria, and NPC's acceptance of hardware and accessories shall not relieve the Contractor of his responsibility for meeting all the requirements of this specification.
- 2.8.4.1.2 The Contractor shall carry out, at his own expense all tests necessary to ensure the satisfactory design and manufacture of the line hardware and accessories in accordance with the applicable ASTM or IEC Standards.
- 2.8.4.1.3 All routine tests required in the applicable standards shall be witnessed by NPC's authorized representative unless otherwise waived in the Technical Data Sheets of Section E.2.8 and no hardware and accessories shall be shipped until released for shipment by NPC.
- 2.8.4.1.4 The Contractor shall make all preparations for tests and provide the test apparatus and personnel and shall notify NPC the date of the test forty five (45) days in advance.
- 2.8.4.1.5 Actual test procedures to be used shall be subject to NPC's acceptance and approval.

2.8.4.2 Type Tests

- 2.8.4.2.1 These tests are intended to establish design characteristics of line hardware and accessories. They are normally made once and repeated only when the design or the material of the fittings is changed. Design tests or type tests can be omitted, if a design record of the same materials can be submitted.

2.8.4.3 Quality Conformance Tests (Sample Test) and Routine Tests

2.8.4.3.1 Quality Conformance Tests are intended to verify the quality of materials and workmanship. They are to be made on fittings taken on random from the various lots offered for acceptance. Routine tests on the other hand, are intended to eliminate defective materials. They are also to be made on every fitting of the type to which they are applicable.

2.8.4.3.2 In general, the following quality conformance and routine tests shall be performed as a minimum:

2.8.4.3.2.1 For the Suspension and Tension Clamp for the conductor.

The following inspection and tests shall be carried out:

Visual and Dimensions
Slip Strength
Breaking Strength
Zinc Coating: coating weight and uniformity

2.8.4.3.2.2 For the Preformed Armor Rods.

The following inspection and tests shall be carried out:

Visual and Dimensions
Assembling
Slip Strength

2.8.4.3.2.3 For the Conductor Spacer/Damper

a. In order to confirm the performances and durability's of the conductor spacer/damper mentioned in Paragraph 2.8.2.2.1.4.1, the following inspection and tests shall be carried out:

Visual and Dimensions
Wear Resistance
Twist Withstand
Slip Strength of clamp
Compression Withstand
Zinc Coating: Coating weight and uniformity

b. The above mentioned tests of wear resistance, twist withstand, slip strength of clamp and compression withstand for the conductor spacer shall be carried out and the spacer shall prove to exceed the following requirements:

(1) Wear Resistance .The spacer shall withstand the following conductor motions without loss of function due to wear and production of harmful strain on the conductor.

(i) Vertical Vibration (Aeolian Vibration):

Amplitude	± 1 mm
Repetition	1×10^8
Frequency	40 Hz
Tension of Conductor	3,500 kg
Vertical Load	2×10 kg

(ii) Horizontal Transverse (Sub-span Oscillation):

Loading	± 50 kg
Repetition	1×10^5
Frequency	2 - 5 Hz
Tension of Conductor	3,500 kg
Vertical Load	2×10 kg

(iii) Horizontal Longitudinal:

Amplitude	± 50 mm
(Coupling with two horizontal and two vertical conductors)	
Repetition	7×10^6
Frequency	2 - 5 Hz
Tension of Conductor	3,500 kg
Vertical Load	2×10 kg

- (2) Twist Withstand. Under this condition, the spacer shall be twisted by 180 degrees and then returned to the initial position. The twist of 180 degrees shall be repeated ten times. During and after ten times of twists, no slips shall occur between clamps of the spacer and conductors clamped thereby, and no conductor damage shall be found.
- (3) Slip Strength of Clamp. Under this condition, the spacer shall be twisted until the clamp of spacer begins to slip relative to the conductor clamped thereby. The twisting torque when the clamp begins to slip relative to the conductor clamped thereby shall not be less than 5 kg-m for the spacer.
- (4) Compression Withstand. The spacer shall withstand ten applications of the impulsive compression of 1,250 kg. During and after ten times of impulsive compression, no slip shall occur between clamps of the spacer and conductors clamped thereby, no distortion of the spacer shall be found.

2.8.4.3.2.4 For the Jumper Device:

The following inspection and tests shall be carried out:

- a. Visual and Dimensions
- b. Wear resistance, twist withstand, slip strength of clamps and compression withstand for reinforcement and jumper spacers
- c. Tensile withstand of reinforcing galvanized steel wire strand
- d. Zinc coating: Coating weight and uniformity

2.8.4.3.2.5 For the Vibration Damper:

The following inspection and tests shall be carried out:

- a. Visual and Dimensions
- b. Wear Resistance
- c. Twist Withstand
- d. Slip Strength of Clamps
- e. Compression Withstand
- f. Zinc Coating: Coating Weight and Uniformity

2.8.4.3.2.6 For the Suspension and Tension Ground Wire Assembly:

The following inspection and tests shall be carried out to the ground wire suspension assembly:

- a. Visual
- b. Construction and Dimensions
- c. Slip and Breaking Strength
- d. Zinc Coating: coating weight and uniformity

2.8.4.3.2.7 For Miscellaneous Hardware:

The following inspection and Tests shall be carried out:

- a. General Inspection
- b. Slip and Breaking strength
- c. Zinc Coating: coating weight and uniformity

2.8.5 DATA AND DOCUMENTATION REQUIREMENTS**2.8.5.1 General**

2.8.5.1.1 Contractor furnished data and information shall be the guaranteed performance data, predicted performance interface requirements and installation features of all Contractors' furnished materials. The accuracy of such information and its compatibility with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

2.8.5.1.2 All information submitted as part of Proposal Data will become part of contract data for the successful Contractor. Any deviation from such data requires NPC's approval.

2.8.5.2 Data and Drawings to be Furnished with Proposal

2.8.5.2.1 The Contractor shall furnish the following information with his bid:

- a. Filled-in Technical Data Sheets of Section E.2.8;

2.8.5.3 Data and Drawings to be Furnished After Award of Contract

2.8.5.3.1 The Contractor shall furnish as a minimum, the following drawings and information after award of Contract for NPC's review, comments and approval:

- a. Certified Quality Conformance and Routine Test Reports;
- b. Material brochures, drawings and other reference material to support the filled-in Technical Data Sheets to allow the NPC to properly evaluate the various line hardware being offered;
- c. Certified type test reports;
- d. Parts list or identifying sketch showing components;
- e. Detailed hardware outline drawing;
- f. Installation procedures;
- g. ISO 9001 Certification/QA Program;
- h. List of Drawings and its submittals; and
- i. Final drawings as approved.

2.8.5.3.2 The Contractor shall furnish in the manner, number of copies and within the time set forth in the Contract.

PART I – TECHNICAL SPECIFICATIONS

E.2.9: GROUNDING MATERIALS

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E.2.9: GROUNDING MATERIALS

2.9.0 SCOPE

2.9.0.1 General

2.9.0.1.1 This specification covers the technical requirements for grounding materials for use in electric power switchyards, substations and overhead power transmission rated 69 kV and above.

2.9.0.1.2 It is not NPC's intent to specify all technical requirements nor to set forth those requirements adequately covered by applicable codes and standards. The Contractor shall furnish high quality materials made by either or both the open hearth and electrical furnace processes.

2.9.0.1.3 The Contractor shall bear full responsibility that the grounding materials and accessories have been designed and fabricated in accordance with all codes, standards, and applicable governmental regulations and performs under the conditions and to the standards specified herein.

2.9.0.1.4 No deviation shall be made from this specification and standards unless waived or modified in writing by NPC. The Contractor shall obtain from its sub-Contractors a statement as to compliance with this specification without exception and/or if there are any exceptions, these shall be described in detail and included in the Contractor's proposal. The Contractor shall add a statement that no other exceptions are taken to this specification.

2.9.0.2 Works to be provided by the Contractor

2.9.0.2.1 Contractor shall provide the materials, work and services listed in Paragraph A.2, Section E.2.1 of the Technical Data Sheets (General Technical Requirements).

2.9.0.3 Works to be provided by NPC

2.9.0.3.1 NPC shall provide the work and services listed in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.

2.9.1 CODES AND STANDARDS

2.9.1.1 General

2.9.1.1.1 The materials furnished shall be in accordance with, but not limited to the latest issue of the following codes and standards, including all addenda in effect at time of purchase order unless otherwise stated in this specification.

ASTM - American Society for Testing and Materials

A 90	Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles
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A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
A 143	Safeguarding against Embrittlement of Hot Galvanized Structural Steel products and Procedure for Detecting Embrittlement
A 153	Zinc-Coating (Hot-Dip) on Iron and Steel Hardware
A 239	Test for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
A 394	Galvanized Steel Transmission Tower Bolts and Nuts
A 370	Mechanical Testing of Steel Articles
A 435	Straight-Beam Ultrasonic Examination of Steel Plates
A 475	Zinc- Coated Steel Wire Strand
E 8	Methods of Tension Testing of Metallic Materials

ISO International Standards Organization

9001	Quality System Model for Quality Assurance in Design/Development, Manufacture and Testing
9002	Quality System Model for Quality Assurance in Production, Installation and Servicing

2.9.1.1.2 These codes and standards set forth minimum requirements which may be exceeded by Contractor if, in Contractor's judgment and with NPC's review, superior or more economical design or materials are available for successful and continuous operation of Contractor's equipment as required by this specification.

2.9.2 TECHNICAL REQUIREMENTS

2.9.2.1 General

2.9.2.1.1 Grounding materials shall be constituted of counterpoise wires and earth rods made of materials specified in the Technical Data Sheets of Section E.2.9 and accessories such as compression and/or bolted terminals and connectors, corrosion protective vinyl tapes, bolts and nuts as shown in NPC's drawings.

2.9.2.1.2 The proposed assembly items in the bid shall consist of a combination of counterpoise wire and earth rod with the associated connectors and accessories as follows:

- a) Earth Rod: Type G-1 consisting of a ground rod and adequate length of ground conductor of the type specified in the Technical Data Sheets of Section E.2.9 and one terminal connector.
- b) Counterpoise Wire: Type G-2 consisting of a ground rod and 40m length of ground conductor of the type specified in the Technical Data Sheets of Section E.2.9, one terminal connector and vinyl tape.

2.9.2.1.3 Workmanship

2.9.2.1.3.1 All parts shall be new and highest class, and shall be furnished uniformly in quality and smoothly on the surface in conformity to the best commercial practice without any harmful defects such as flaws, ruts, cracks, etc.

2.9.2.1.3.2 All wires of the counterpoise wire shall be concentrically stranded. The wires in each layer shall be evenly and closely stranded around the underlying wire(s). The tension in individual wires in a layer shall be sufficient to hold each wire firmly in place with only enough strand separation to prevent crowding at the time of stranding and during handling and installation.

2.9.2.1.3.3 The design of adjacent metal parts and contacting surfaces shall be so made as to prevent corrosions of the contact surfaces and to maintain good electrical contact under service conditions.

2.9.2.1.4 Zinc Coating

2.9.2.1.4.1 All the iron and steel parts and members shall be zinc coated upon completion of the fabrication. The zinc coating is to be uniform, clean, smooth and free from burrs, sharp edges, lumps and dross so that interconnecting parts will fit properly and parts may be assembled and disassembled readily. The zinc coating shall be carried out by hot dip process for all parts.

2.9.2.1.4.2 Threaded parts shall be coated after being threaded and excessive zinc shall be removed from the threads. Nuts and locknuts shall be re-tapped after being coated and shall be capable of being threaded the entire length of threads without use of tools. The minimum weight of zinc coating and number of immersions in uniformity test shall be as per ASTM A153.

2.9.2.2 Specific Requirements**2.9.2.2.1 Galvanized Iron Wire**

2.9.2.2.1.1 The galvanized iron wire for the counterpoise shall conform to the requirements of ASTM A475, JIS G3534 or equivalent. The characteristics of the galvanized iron wire are indicated in E.2.9, Technical Data Sheets.

2.9.2.2.2 Copper Ground Conductor

2.9.2.2.2.1 Ground conductor made of copper either soft drawn or hard drawn concentric stranding copper conductor shall be used, if required in the Technical Data Sheets of Section E.2.9. The copper conductor shall be in accordance with the latest revision of ASTM B3 and manufactured in accordance with ASTM Specification B8 (class B). The copper conductor shall have the characteristics specified in the Technical Data Sheets of Section E.2.9.

2.9.2.2.3 Ground Rod

2.9.2.2.3.1 The length, diameter and technical features of the ground rods are specified in the Technical Data Sheets of Section E.2.9.

- 2.9.2.2.3.2 For galvanized ground rods, it shall be provided with a galvanized rod clamp of compression type to attach and electrically connect the counterpoise wire to the earth rod.
- 2.9.2.2.3.3 For copper ground rod, the ground rod shall have a conical swaged point at one end and shall have a continuous smooth copper covering of at least 0.254 mm thickness molten or copper bonded (electro-deposit) to a steel core. The copper clad or pressed type will not be accepted.
- 2.9.2.2.4 Terminal Connector**
- 2.9.2.2.4.1 Each terminal for connecting the counterpoise wire or wire from the ground rod to the tower leg shall be as stated in the Technical Data Sheets of Section E.2.9 and shall be of the make suited for the type of ground conductor that will be applied and to the galvanized tower leg. If copper grounding will be used, the terminal connector for the tower leg should be provided with bimetal insert which will be suitable to both the tower leg and the ground conductor. The shape of the terminal and the sectional shape shall be as shown in NPC's drawings.
- 2.9.2.2.5 Vinyl Tape**
- 2.9.2.2.5.1 The vinyl tape for protection against corrosion of the counterpoise wire shall be supplied in an adequate quantity by the Supplier, and the amount shall be submitted by the Supplier together with the bid proposal.
- 2.9.2.3 Marking**
- 2.9.2.3.1 Individual items of the hardware and accessories shall carry identification marks so as to facilitate assembling and sorting in warehouse or at the site. Marking, such as production record code, as customarily provided by Contractor are acceptable.
- 2.9.2.4 Other Technical Requirements for the Grounding Materials**
- 2.9.2.4.1 Other features for the grounding materials, if required by NPC are stated in the Technical Data Sheets of Section E.2.9.
- 2.9.3 INSTALLATION**
- 2.9.3.1 Installation of grounding materials and accessories will be by NPC as specified in Paragraph A.2, Section E.2.1 of the Technical Data Sheets.
- 2.9.3.2 When the installation is by NPC, complete details of installation, proper handling, transport and storage at site, testing, performance guarantees, etc. shall be furnished by the Contractor in time for NPC's installation of grounding materials.

2.9.4 TEST**2.9.4.1 General**

2.9.4.1.1 Grounding materials and accessories shall comply with test criteria, and NPC's acceptance of grounding materials and accessories shall not relieve the Contractor of his responsibility for meeting all the requirements of this specification.

2.9.4.1.2 The Contractor shall carry out, at his own expense all tests necessary to ensure the satisfactory design and manufacture of the grounding materials and accessories are in accordance with the applicable ASTM or IEC Standards.

2.9.4.1.3 All routine tests required in the applicable standards shall be witnessed by NPC's authorized representative unless otherwise waived in the Technical Data Sheets of Section E.2.9 and no grounding materials and accessories shall be shipped until released for shipment by NPC.

2.9.4.1.4 The Contractor shall make all preparations for tests and provide the test apparatus and personnel and shall notify NPC the date of the test forty five (45) days in advance.

2.9.4.1.5 Actual test procedures to be used shall be subject to NPC's acceptance and approval.

2.9.4.2 Type Tests

2.9.4.2.1 These tests are intended to establish design characteristics of grounding materials and accessories. They are normally made once and repeated only when the design or the material of the grounding system is changed. Design tests or type tests can be omitted, if a design record of the same materials can be submitted.

2.9.4.3 Quality Conformance Tests (Sample Test) and Routine Tests

2.9.4.3.1 Quality Conformance Tests are intended to verify the quality of materials and workmanship. They are to be made on materials taken on random from the various lots offered for acceptance. Routine tests on the other hand, are intended to eliminate defective materials. They are also to be made on every material of the type to which they are applicable.

2.9.4.3.2 In general, the following quality conformance and routine tests shall be performed as a minimum:

2.9.4.3.2.1 For the ground wire:

The following inspection and tests shall be carried out on the stranded wire and individual wires:

- a) Individual wire
Visual and Dimensions
Tensile strength, elongation and twisting
Zinc coating: Coating weight, uniformity and wrapping (if galvanized earth conductor is required)

- b) Stranded wire
Visual and Construction
Weight
Breaking strength

2.9.4.3.2.2 For the ground rod:

The following inspection and tests shall be carried out on the ground rod and component clamp:

Visual and Dimension
Zinc Coating: Coating weight and uniformity (if galvanized ground rod is used)

2.9.4.3.2.3 For the terminal connector:

The following inspection and tests shall be carried out:

Before Compression
Visual and Dimensions
Zinc Coating: Coating weight and uniformity (if galvanized ground wire and rod are used)

After Compression
Visual and Dimensions
Breaking Strength

2.9.5 DATA AND DOCUMENTATION REQUIREMENTS

2.9.5.1 General

2.9.5.1.1 Contractor furnished data and information shall be the guaranteed performance data, predicted performance interface requirements and installation features of all Contractors' furnished materials. The accuracy of such information and its compatibility with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

2.9.5.1.2 All information submitted as part of Proposal Data will become part of contract data for the successful supplier. Any deviation from such data requires NPC's approval.

2.9.5.2 Data and Information to be submitted with Proposal

2.9.5.2.1 The Contractor shall furnish the following information with his bid:

- a. Filled-in Technical Data Sheets of Section E.2.9;

2.9.5.3 Data and Information to be submitted After Award of Contract

2.9.5.3.1 The following drawings and information shall be submitted as a minimum, by Contractor after award of Contract for NPC's review, comments and approval:

- a. Certified Quality Conformance and Routine Test Reports;
- b. Material brochures, drawings and other reference material to support the filled-in Technical Data Sheets and to allow NPC to properly evaluate the various grounding materials being offered;
- c. Certified type test reports;
- d. Installation procedures;
- e. ISO 9001 Certification/QA Program;
- f. List of drawings and its submittal;
- g. Detailed Contract Schedule Activity for the Grounding Materials;
- h. Final drawings as approved.

2.9.5.3.2 The Contractor shall furnish in the manner, number of copies and within the time set forth in the contract.

PART I – TECHNICAL SPECIFICATIONS

C.2.1 TRANSMISSION LINE ERECTION & INSTALLATION

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C.2.1 TRANSMISSION LINE SUPPLY, ERECTION & INSTALLATION

2.1.0 SCOPE

2.1.0.1 This section covers the supply and erection/installation of 69kV transmission line, single circuit, stand alone (with concrete encasement) and direct burial steel pole structures and accessories.

2.1.0.2 The Contractor shall erect and install the transmission line materials and accessories in accordance with the specifications contained in this section and as shown on NPC drawings.

2.1.1 GENERAL CONSTRUCTION FACILITIES

2.1.1.1 Scope

2.1.1.1.1 This covers the construction and/or maintenance of access roads, culverts and other appurtenant structures; moving-in of the Contractor's construction, erection and installation equipment; setting up of the Contractor's camp facilities and the disposition of the Contractor's various facilities at the end of the contract.

2.1.1.2 Access Road

2.1.1.2.1 The Contractor shall construct and maintain all access roads to suit his construction needs only, and public roads utilized by the Contractor shall be properly maintained by him during the duration of the contract. The flow of public traffic shall not be obstructed in the use and maintenance of public roads.

2.1.1.2.2 During the life of the contract, the Contractor shall observe or comply with all national and local regulations, regarding barricades, detour arrangements, warning signs and other requirements on the usage of existing public roads and that of his own access roads. Permits, if required shall be secured by the Contractor.

2.1.1.3 Contractor's Camp Facilities

2.1.1.3.1 The Contractor shall provide and grade his camp site, employees housing, warehouse, machine and repair shops, fuel storage tanks, and provide such related facilities and sanitary conveniences that are necessary for maintaining health, peace and order in the camp and work areas.

2.1.1.3.2 The areas that may be used by the Contractor within the right-of-way provided will be designated by NPC. Areas that may be needed by the Contractor located outside of the right-of-way shall be negotiated and acquired by the Contractor at his own expense.

- 2.1.1.3.3 The Contractor shall provide, maintain, and operate, under competent supervision, such camps and facilities necessary for the housing, feeding and accommodation of his employees.
- 2.1.1.3.4 The Contractor will be permitted to lease space in the buildings erected by him on land furnished by NPC for conducting such business or services, as, in opinion of NPC, maybe required for the convenience of the residents of the camp, but patronage of such business for the employment of such services shall be optional on the Contractor's employees.
- 2.1.1.3.5 All leases covering business and other concessions in the campsite shall be subject to the approval of NPC and all such leases shall contain provisions making them subject to termination at any time, if, in the opinion of NPC, the lessee is guilty of misconduct, infraction of the law, or of the regulations governing operation of camps.
- 2.1.1.3.6 All leases shall be made subject to termination upon completion or termination of the contract. No concessions or leases shall be granted for the sale of intoxicating liquor or for the operation of public dance halls, games of chance, or gambling of any form.
- 2.1.1.4 Water Supply**
- 2.1.1.4.1 The Contractor shall be responsible for the supply, installation, operation and maintenance of a safe and adequate supply of drinking and domestic water. Whenever there is a possibility of contamination of the water supply for drinking and domestic purpose, chlorination or some other approved method of sterilization shall be carried out. Installation and maintenance of such services shall be subjected to the approval of NPC.
- 2.1.1.5 Power Supply**
- 2.1.1.5.1 The Contractor shall provide his own electric power supply required for construction and erection/installation work.
- 2.1.1.5.2 However, should electric power be available from franchise holders/cooperatives, the Contractor may avail of such power. The Contractor shall pay for the electricity consumed in accordance with the billing rates agreed upon by the Contractor and the supplier.
- 2.1.1.6 Materials Storage**
- 2.1.1.6.1 The Contractor shall put up his own warehouse for the storage of construction materials including cement, rebars, and line materials. Storage facilities and manner of storage shall be subject to the approval of NPC.
- 2.1.1.7 Camp Security**
- 2.1.1.7.1 The Contractor shall provide his own security force to the extent he deems necessary for maintaining peace and order in the camp and work areas and to safeguard materials and equipment, life and property in all areas where he operates.

2.1.1.8 Sewerage Disposal, Sanitation and First Aid Clinic

2.1.1.8.1 The Contractor shall be responsible for the installation, operation and maintenance of an adequate sewerage disposal and sanitation system and shall provide toilet and wash-up facilities for his employees in the camp. Sewerage shall not be disposed in rivers, creeks or other places directly or indirectly affecting the health of residents in the vicinity.

2.1.1.8.1 The Contractor shall also put up a first aid clinic with adequate medicine and facilities for the immediate assistance to accident-stricken employees and sick residents in the camp.

2.1.1.9 Fire Protection

2.1.1.9.1 The Contractor shall observe all necessary precaution against fire, shall provide sufficient portable firefighting equipment and shall comply with all applicable laws of the Philippines relating thereto.

2.1.1.10 Removal of Camp and Construction Facilities

2.1.1.10.1 After the completion of the work but prior to provisional acceptance, the entire camp and construction facilities of the Contractor shall be dismantled and removed by the Contractor. All areas of operation along the entire length of the transmission line shall also be cleaned of rubbish and left-over materials.

2.1.1.10.2 The Contractor shall see to it that these areas shall be left in a clean, neat and orderly appearance satisfactory to NPC.

2.1.1.11 Measurement of Payment

2.1.1.11.1 No separate measurement of payment will be made for the cost of the Contractor's general construction facilities, whether such facilities are mentioned herein or not.

2.1.1.11.2 There will be no separate payment for demobilization and move-out after completion of the contract.

2.1.1.11.3 All costs pertinent thereto shall be included in the various pay items in the Bill of Quantities.

2.1.2 CLEARING OF RIGHT-OF-WAY**2.1.2.1 Scope**

2.1.2.1.1 This covers the clearing of the right-of-way for the transmission line.

2.1.2.2 Clearing Work

2.1.2.2.1 NPC conducted the survey of the entire transmission line route and contacted the affected parties for permission and approval, for clearing the

fifteen (15)-meter right-of-way of the 69 kV transmission line. Contractors are expected to inspect the existing route to familiarize themselves with the clearing work to be done. Clearing shall be for the entire length of the line and/or as required.

- 2.1.2.2.2 Where the transmission line passes through open uncultivated land, bamboo grooves trees and in regions planted with fruit bearing trees and all other trees growth within the right-of-way, such trees and plants shall be cut so as to leave stump extending not more than 15 cm. above the ground, with the exception of bamboo grooves, banana plants, and other trees and plants that can still grow out, which shall have their stumps and roots completely pulled out.
- 2.1.2.2.3 If directed by NPC, clearing shall also include the cutting or trimming of all trees outside of the right-of-way if such trees, upon falling would come within three (3) meters of the nearest conductor of the line.
- 2.1.2.2.4 The cleared materials shall be hauled to designated stockyard as directed or otherwise disposed of as approved in writing by NPC.
- 2.1.2.2.5 Where the line passes through rice fields, sugar cane plantations or other cultivated fields where there are no tall trees or other growths that will interfere with the wires, the Contractor shall clear off only such vegetation as directed by NPC for the convenient handling of materials and equipment during erection of transmission line structures and installation of wires.
- 2.1.2.2.6 In order that the Contractor will not be delayed in the clearing work, NPC will, at its expense provide the necessary number of right-of-way agents to indicate the trees to be cut and see to it that they are properly accounted and paid for to their respective owners. Cutting or trimming shall be done only upon approval of the right-of-way agents and/or other authorized representatives of NPC.

2.1.2.3 Measurement and Payment

- 2.1.2.3.1 Measurement for payment for clearing will be based on the number of kilometers satisfactorily cleared measured along the center line of the right of way as shown in the plan. Payment will be made at the contract unit price per kilometer, but in no case more than five percent (5%) of the total contract amount.

2.1.3 CARE OF WATER DURING CONSTRUCTION

2.1.3.1 Scope

- 2.1.3.1.1 This covers the construction, installation, operation and maintenance of temporary structures and equipment necessary to protect the work from water coming from any source including river, sea and rain and subterranean, so that construction and erection/installation work can be performed on a suitably dry condition.



2.1.3.2 Drainage and Dewatering

2.1.3.2.1 The Contractor shall construct drainage ditches, culverts, and other forms of conveying water away from the site of work. The Contractor shall also construct temporary cofferdams when necessary to protect pole site areas from encroachment of water.

2.1.3.2.2 The Contractor shall furnish, install, operate and maintain all necessary pumps and other dewatering devices to keep all work areas in amply dry condition, especially during excavation works. In addition to the normal number of pumps in operation, the Contractor shall provide standby pumps to take over in case of pump breakdown.

2.1.3.2.3 After the work is completed and before it is accepted by NPC, the Contractor shall remove all temporary protective structures and fill or plug all temporary drainage structures all to the satisfaction of NPC.

2.1.3.3 Measurement and Payment

2.1.3.3.1 No separate measurement and payment will be made for the care of water during construction operations. The cost of furnishing, constructing, maintaining, operating and removing temporary drainage structures, pumping system and other dewatering devices necessary to keep construction operations free from water shall be included in the pay items in the Bill of Quantities.

2.1.4 POLE ERECTION AND LINE MATERIALS/HARDWARES INSTALLATION**2.1.4.1 Scope**

2.1.4.1.1 This covers the complete erection/installation of the 69 kV, single circuit, steel pole transmission lines in accordance with the requirements specified herein.

2.1.4.2 Method of Pole Erection

2.1.4.2.1 The general outline of the pole structures are those indicated on the attached drawings of the Specification. The general dimensions, clearances and distances of conductors/wires must be maintained in accordance with the drawings.

2.1.4.2.2 The Contractor shall use standard and accepted practice and method of erecting the poles depending on their location. Insofar as practicable, the poles shall be selected and matched so that the poles in each structure will be of equal cross-section. Except as otherwise provided in this paragraph or drawings, or otherwise directed by NPC, all poles shall be set in accordance with the following table:

Table 1

Length of Poles		Depth of Pole Setting			
		In Earth		In Rock	
<u>Meter</u>	<u>Feet</u>	<u>Meter</u>	<u>Feet</u>	<u>Meter</u>	<u>Feet</u>
13.72	45	1.98	6.5	1.37	4.5
15.24	50	2.13	7.0	1.52	5.0
16.77	55	2.29	7.5	1.68	5.5
18.29	60	2.44	8.0	1.83	6.0
19.82	65	2.59	8.5	1.98	6.5
21.34	70	2.74	9.0	2.13	7.0
22.86	75	2.90	9.5	2.29	7.5
24.39	80	3.05	10.0	2.44	8.0
25.91	85	3.20	10.5	2.59	8.5
27.44	90	3.35	11.0	2.74	9.0

- 2.1.4.2.3 The Contractor shall excavate holes for pole setting to a depth indicated in Table 1 above. The diameter of the holes shall be 20 cm larger than the pole diameter at ground level. Poles set in holes partly in earth and rock shall be set to a depth shown for earth. Poles at angle and dead end points and at the other points of unbalanced stress shall be set at six (6) inches deeper than shown above, and poles with extra large diameters shall be used at these points whenever possible. Pole structures located in steeply sloping ground shall have their depth of setting measured on the downhill sides and shall be at least as deep as shown in the above tabulation. All poles shall be set to within three (3) inches of the specified setting. All holes shall be dug in the correct locations and shall be large enough to provide for the use of tamping bars all around the poles to the full depth of the holes.
- 2.1.4.2.4 All poles shall be set truly vertical and exact in alignment.
- 2.1.4.2.5 After the poles have been set and aligned properly, the holes shall be backfilled with materials consisting of 80% gravel whose sizes ranges from 7.6cm to 10cm diameter and 20% sand whose sizes ranges from 3 mm to 8 mm by volume. The gravel and sand material shall be filled around the holes and compacted thoroughly at 30 cm (12 inches) layer by tamping tools before placing the next 30 cm layer of gravel and sand, until the backfill material reaches the ground surface level. Materials from the excavated holes shall be placed and tamped around the poles to a height of 30 cm. (12 inches) above ground line and shall be spread sloping radially outward until it intersects with the ground surface. In cases where the poles are located/erected in the rice field areas, excavated materials shall be spread and leveled evenly over the site, subject to the approval of NPC. No spreading and tamping of excavated materials shall be done unless cleared by the inspector or representatives of NPC.
- 2.1.4.2.6 In section of the line where the soil bearing capacity is appreciably reduced or where special conditions so require, the Contractor shall furnish and place concrete foundation subject to the approval of NPC.
- 2.1.4.2.7 The Contractor shall number each structure for ground patrol with the numbering indicated on the Annexes or as indicated. Number shall be in black letters, 100 mm (4") height to be located approximately 3.0 meters



from the ground on the traverse side of the poles. The paint shall be weather resistant approved by NPC.

- 2.1.4.2.8 The cost of labor shall be included in the unit bid price for the erection of different length of poles.

2.1.4.3 Structure Dressing/Insulator Assemblies

- 2.1.4.3.1 The cross-arms and hardware shall be assembled and installed properly in accordance with the drawings. All nuts and locknuts shall be adequately tightened.

- 2.1.4.3.2 Braces such as flat and x-braces, shall be attached where required. The braces shall be attached by the Contractor in accordance with the drawings. All nuts shall be tightened adequately.

- 2.1.4.3.3 The Contractor shall assemble and install the insulator assemblies as shown in the drawing.

- 2.1.4.3.4 The number of suspension insulators to be used for a single string of strain and/or suspension assembly shall be as indicated in the technical data sheet. The suspension clamps shall be placed so that the lock washers, nut and locknut fastening, the socket fitting to the suspension insulator string can be adjusted so as to hang in a vertical plane through the axis of the structure.

2.1.4.4 Guy Assemblies

- 2.1.4.4.1 Guy assemblies shall be installed when required, in accordance with the details shown in the drawings and structure lists. However, NPC reserves the right to direct the Contractor to change the location of the guy assemblies as may be found desirable in the field. The guy assemblies shall be log type. Installing a guy assembly shall consist of excavating earth to a depth of at least 5'-0", installing anchor log in position, backfilling and compacting the backfill and installing the guy wire. The anchor rod shall protrude three (3) inches above the ground line when installed.

2.1.4.5 Storm Guying Assembly

- 2.1.4.5.1 Storm guying assembly shall be installed if required on rice field for selected type B structures.

2.1.4.6 Structure Ground Wires

- 2.1.4.6.1 Structure ground wires shall be installed as required. These shall be installed as shown in the drawings and shall be connected to the shield wires by clamps/connectors.

2.1.4.7 Conductors (Including Compression Joints, Armor Rods, Repair Sleeves and Jumpers)**2.1.4.7.1 Requirement**

2.1.4.7.1.1 The Contractor shall install, join, string and sag the conductor in accordance with the General Design Data and the Plan and Profile.

2.1.4.7.2 Tools and Special Equipment

2.1.4.7.2.1 The Contractor shall furnish all tools and special equipment necessary to install, join, string and sag the conductor in accordance with the best modern practice. NPC reserves the right to approve the tools and equipment to be used by the Contractor.

2.1.4.7.3 Compression Joints

2.1.4.7.3.1 All joints in the conductors shall be in accordance with the recommendations of the conductor manufacturer unless otherwise specified by NPC. All splices in conductors shall be made at least fifty (50) feet (15.24 m.) away from the structure and no joints will be permitted in spans crossing over existing transmission lines or other public utility lines, unless approved by NPC. River crossing spans shall also be free from joints.

2.1.4.7.3.2 The Contractor shall furnish all necessary accessories, special tools, compressors, draw benches, etc., required for making conductor splices. The Contractor shall furnish filler paste for all compression joint consisting of seventy percent (70%) zinc chromate and thirty percent (30%) raw linseed oil by weight. The paste shall be applied in the manner recommended by the manufacturer of the compression joints.

2.1.4.7.4 Armor Rods

2.1.4.7.4.1 The Contractor shall install Armor rods where required at points in accordance with manufacturer's recommendations and as shown on the drawings. Where it becomes necessary to shift the point of attachment after the armor rods are installed, such shift shall not exceed two and a half (2-1/2) feet (63.5 mm.) either way from the center. If the required shift exceeds this limit, the Contractor without additional cost shall reinstall the preformed armor rods.

2.1.4.7.5 Stringing

2.1.4.7.5.1 The stringing operation shall be conducted using method which will not damage the conductor. Particular care shall be exercised to ensure that the conductor is not twisted in any manner. NPC reserves the right to approve the stringing method used by the Contractor. Where the conductor has been damaged as a result of negligence on the part of the Contractor, the Contractor shall repair or remove the damage section including, if necessary, furnishing additional material without additional cost.

2.1.4.7.6 Sagging**2.1.4.7.6.1 General**

2.1.4.7.6.1.1 Transmission line conductors shall be sagged in accordance with the sag and tension chart for specific type of cable. These sag and tension are in accordance with the recommendation of the conductor manufacturer. The loading of the conductor shall be such that the design loadings of the structure shall not be exceeded during stringing.

2.1.4.7.6.2 Checking of Tension and Sag**2.1.4.7.6.2.1 Tension**

2.1.4.7.6.2.1.1 As required by NPC to avoid over-stressing the conductor while stringing, the conductor tension shall be measured by dynamometer to be furnished by the Contractor. The dynamometers used shall be frequently calibrated in order to ensure their accuracy.

2.1.4.7.6.2.2 Sag

2.1.4.7.6.2.2.1 All sags shall be measured by the line of sight method. While the sag in all conductors shall be in accordance with the stringing sags specified, maximum increase of five percent (5%) will be acceptable provided the five percent does not exceed six (6) inches (152 mm.) and provided that all conductors in the same span assume the same sag and the necessary ground clearance is obtained. In any span where five percent (5%) of the specified sag is less than two (2) inches (51 mm.), a maximum increase of two inches will be acceptable. A telescope shall be used for the line-of-sight sagging. The Contractor shall furnish the necessary men for signaling and climbing purposes. The methods for checking sag and the points at which the checks are to be made shall be agreed upon between NPC and the Contractor. It is the intent of these specifications that NPC shall be assured, by means of sufficient and reasonable number of checks and the ground clearances as tabulated in the pertinent drawings are obtain at all points, that the tensions are obtain and the general appearances of the line will be satisfactory.

2.1.4.7.6.2.3 Sagging Information

2.1.4.7.6.2.3.1 The Contractor shall submit to NPC, the following information concerning the sagging of the conductor and shield wire:

- a. Date
- b. Type of conductor or shield wire sagged
- c. Span sagged
- d. Measured sag, in meters
- e. Temperature in °C or °F
- f. Relative elevations of point of supports.

2.1.4.7.7 Jumper Connection

2.1.4.7.7.1 At all dead-end structures or angle structures, where required, the jumper connections shall be formed in a neat and workmanlike manner and to permit the insulator jumper assembly to hang in vertical position.

2.1.4.7.8 Repair Sleeves

- 2.1.4.7.8.1 Compression type repair sleeves may be used to repair minor damage to the conductor provided that:
- a. At the location of the damage on the conductor to be repaired not more than one third (1/3) of the outer aluminum strands are damaged over a length of not more than four (4) inches
 - b. Not more than two (2) strands in the outer layer are broken, no strands in the inner layer of aluminum strands are broken, and the cross-sectional area of any other of the damage strands is not reduced by more than twenty five percent (25%)

2.1.4.7.9 Vibration Dampers

2.1.4.7.9.1 Vibration dampers shall be carefully attached where required and fastened securely so they will hang in vertical planes. The Contractor shall ascertain that the drain holes in the weights are open after the vibration dampers are attached.

2.1.4.8 Shield Wire**2.1.4.8.1 Requirement**

2.1.4.8.1.1 The Contractor shall install, join, string and sag the shield wire in accordance with the scope of work, similar to the provision for the conductors.

2.1.4.8.2 Tools and Special Equipment

2.1.4.8.2.1 The provisions of the Clause 2.1.4.7.2, apply equally to the shield wire.

2.1.4.8.3 Compression Joints

2.1.4.8.3.1 The provisions of Clause 2.1.4.7.3, apply equally to the shield wire.

2.1.4.8.4 Stringing

2.1.4.8.4.1 The provisions of Clause 2.1.4.7.5, apply equally to the shield wire.

2.1.4.8.5 Sagging**2.1.4.8.5.1 General**

2.1.4.8.5.1.1 The provisions of Clause 2.1.4.7.6.1, apply equally to the shield wire.

2.1.4.8.5.2 Checking of Tension and Sag**2.1.4.8.5.2.1 Tension**

2.1.4.8.5.2.1.1 The provision of Clause 2.1.4.7.6.2.1, apply equally to the shield wire.

2.1.4.8.5.2.2 Sag

2.1.4.8.5.2.2.1 In general, the provisions of Clause 2.1.4.7.6.2.2, apply equally to the shield wire.

2.1.4.9 Final Completion of the Work

2.1.4.9.1 After the conductors and ground wires are completely strung, Contractor and NPC shall conduct a joint final inspection from the sending to the receiving end of the line. The Contractor must satisfy NPC that all minimum requirements stated in the General Design Data for 69 kV, Single Circuit, Steel Pole Transmission Line had been met, especially the minimum clearance to ground of the overhead line conductor. A continuity test of the line from the sending to the receiving end must be conducted in order to ensure electrical continuity. Findings on any defects shall be complied by the Contractor upon receipt of the official written communication issued by NPC. Certificate of Final Completion of Work will only be issued after compliance with all the requirements indicated. Final approval/acceptance of the work will be based on the completed line and not on a part or section thereof.

2.1.4.10 Measurement and Payment**2.1.4.10.1 Steel Pole Erection**

2.1.4.10.1.1 Measurement of payment for the supply and erection of Steel pole shall include the following:

- a. Pit excavation
- b. Furnishing, backfilling and compacting of gravel and sand materials.
- c. Installation of structure grounding and numbering.

2.1.4.10.1.2 Payment will be made at the contract unit price for corresponding item under specific height and type of poles supplied & erected as specified in the Bill of Quantities. No separate payment for excavation of holes for pole setting furnishing, backfilling and compacting of gravel and sand material, spreading and tamping of excavated materials. Payment of which shall be included in the unit bid price for the different height and type of poles supplied and erected as indicated in the Bill of Quantities. The unit price shall include all costs of labor, equipment, tools materials, transportation and other incidentals necessary for the completion of work.

2.1.4.10.2 Structure Dressing, Insulator and Ground String Assemblies

2.1.4.10.2.1 Measurement of payment for the dismantling and re-installation of existing structure dressings including insulator and ground string assemblies will be based on the number and type of structure dressing, insulator and ground string assemblies dismantled and re-installed. Payment will be made at the unit bid price for corresponding items under each type of structure dressing, insulator and ground string assemblies dismantled and re-installed as specified in the Bill of Quantities. The unit price shall include all costs of labor, equipment, tools materials, transportation and other incidentals necessary for the completion of work.

2.1.4.10.3 Guy assemblies

2.1.4.10.3.1 Measurement of payment for the supply and installation of guy assemblies including anchor logs (cut-in from extracted wood poles) will be based on the number of each type of assembly supplied and installed. Payment will be made at the unit bid price for each type of guy assembly supplied and installed as specified in the Bill of Quantities. The unit price shall include all costs of labor, equipment, tools, materials, transportation and other incidentals necessary for the completion of work.

2.1.4.10.3.2 Measurement of payment for the dismantling and re-installation of existing guy assemblies will be based on the number of each type of assembly dismantled and re-installed. Payment will be made at the unit bid price for each type of guy assembly dismantled re-installed as specified in the Bill of Quantities. The unit price shall include all costs of labor, equipment, tools, materials, transportation and other incidentals necessary for the completion of work.

2.1.4.10.4 Shield Wire

2.1.4.10.4.1 Measurement of payment for the dismantling and re-installation of shield wire will be based on the linear kilometer of shield wire dismantled and re-installed as shown on the drawings, measured horizontally along the centerline of the right-of- way. Payment will be made at the unit bid price for the corresponding item under Dismantling and Re-installation of 3/8" dia. Ground Shield Wire in the Bill of Quantities. No separate payment for hauling, compression joints, allowances for increased length due to sags or difference of elevation of wire supports, the cost thereof shall be included in the unit bid price per kilometer of shield wire dismantled and re-installed.

Measurement and payment for the supply and installation of shield wire will be based on the linear kilometer of shield wire hauled and installed measured horizontally along the centerline of the right of way. Payment will be made at the unit price for shield wire in the Bill of Materials.

2.1.4.10.5 Power Conductor

2.1.4.10.5.1 Measurement of payment for the dismantling and re-installation/stringing of power conductor will be based on the linear kilometer of power conductor dismantled and re-installed, measured horizontally along the centerline of

the right-of-way. Payment will be made at the unit bid price for the corresponding item under Dismantling and re-installation/Stringing of Power Conductors in the Bill of Quantities. No separate payment for hauling, compression joints, allowances for increased length due to sags or difference of elevation of wire supports, the cost thereof shall be included in the unit bid price per kilometer of conductor dismantled and re-installed.

Measurement of payment for the supply and installation of conductor will be based on the linear kilometers of conductor hauled and installed along the center line of the right-of-way. Payment will be made at the unit bid price per kilometer of conductor, in the Bill of Quantities. No separate measurement for payment will be made for the installation of repair sleeves and armor rods the cost thereof shall be included in the unit bid price per kilometer of conductor.

2.1.4.10.6 Vibration Damper

- 2.1.4.10.6.1 Measurement of payment for the dismantling and re-installation/hauling and installation of vibration damper for power conductor and OHGW will be based on the number of vibration dampers dismantled and re-installed/hauled and installed. Payment will be made at the unit bid price for corresponding item under dismantling and re-installation/hauling and installation of Vibration Damper and OHGW as specified in the Bill of Quantities.

SECTION VI

TECHNICAL REQUIREMENTS

PART II – TECHNICAL DATA SHEETS



PART II – TECHNICAL DATA SHEETS

TO BE SUBMITTED DURING BID EVALUATION “Annex A”

- E.2.1 - GENERAL TECHNICAL REQUIREMENTS**
- E.2.3 - STEEL POLES**
- E.2.5 - POWER CONDUCTOR**
- E.2.7 - INSULATORS**

TO BE SUBMITTED DURING POST- QUALIFICATION) “Annex B”

- E.2.6 - OVERHEAD GROUND WIRE**
- E.2.8 - LINE HARDWARES**
- E.2.9 - GROUNDING MATERIALS**



TO BE SUBMITTED DURING BID EVALUATION

“ANNEX A”

- E.2.1 - GENERAL TECHNICAL REQUIREMENTS**
- E.2.3 - STEEL POLES**
- E.2.5 - POWER CONDUCTOR**
- E.2.7 - INSULATORS**



PART II – TECHNICAL DATA SHEETS

E.2.1: GENERAL TECHNICAL REQUIREMENTS

A. Project Requirements

A.1 All standard accessories, including those not indicated in this Specification, shall be furnished.

A.2 The detailed work to be performed by NPC or Contractor shall be as follows:

	NPC's Data	Contractor's Data
Design & Engineering		X
Fabrication & Manufacture of Transmission Line Materials and its components per Specification		X
Factory Tests (Design and Routine)	X*	X
Packing & Delivery to Port of Loading		X
Delivery from Port of Loading (FOB) to Port of Entry (CIF Port of Entry)		X
Loading & Unloading		X
Delivery from Port of Entry to Site		X
Unloading at Site or NPC Stockyard		X
Checking All Parts (at Delivery Port or Site) **	X**	X
Stripping / Stockpiling		X
Storage, Moving and Care of Goods		X
Foundations (Civil Works)		
Anchor bolts, Nuts and Washers		
Stub Angles		
Templates		
Anti-Climbing Devices		
Climbing Ladders (if required)		
Warning Signs, Numerals		X
Touch-up Paint/Galvanizing		
Installation/Erection	X	
Tools & Equipment for Installation, Erection, Dressing, Stringing and Testing	X	
Field Testing (Pre-Commissioning)	X	
Commissioning	X	
Quality Assurance Control	X	

Note: * - NPC's representative(s) to witness Factory Routine Tests, if required in the Technical Data Sheets of every material.

** - To be done by both NPC and Supplier or their representative(s).

Name of Firm

Name & Signature of Representative

Designation



A.3 Site Conditions and Environment

A.3.1 The expected environmental and meteorological conditions for the location of the transmission line installation are as follows:

	NPC's Data	Contractor's Data
a) Elevation above sea level	Not higher than 1,000 m	_____
b) Material location (indoor, outdoor)	Outdoor	_____
c) Ambient conditions at material location		
1. Temperature range °C	0-40	_____
2. Relative humidity % (range)	75-100 non-condensing	_____
d) Maximum outdoor daily average temperature, °C	30	_____
e) Outdoor air conditions:		
1. Tropical	Yes	_____
2. Salt Laden	Yes	_____
3. Dust Laden	Yes	_____
f) Degree of Contamination	Medium	_____
g) Maximum design wind velocity, kph	240	_____
h) Anticipated Contamination Sources during transport & storage	Dust, moisture, ionic salt	_____
i) Equivalent Salt Deposit Density, mg/cm ²	0.15	_____
j) Other outdoor abnormal conditions:		
1. Typhoon	Yes	_____

Name of Firm

Name & Signature of Representative

Designation



	NPC's Data	Contractor's Data
A.4.2 Design for seismic load	Yes	
A.4.3 Seismic factor (horizontal) Consideration in the area	0.3 G	
A.4.4 Material shall be protected for outdoor storage for a period of: year	One	
A.5 Other General Requirements		
a. As-Built Drawings/Documents for the Project	To be provided	
b. Type	Per specification	
c. No. of copies to be furnished	Six (6)	

Name of Firm

Name & Signature of Representative

Designation



PART II – TECHNICAL DATA SHEETS

Annex “A”

E.2.3: STEEL POLES

1. Technical Requirements

The Bidder is required to provide all the information required under the Column “Contractor’s Data”. Although not given by NPC, the Contractor's Data shall be based on the International Standard.

NPC’s requirements are indicated below. The Contractor shall indicate their data corresponding to the said NPC requirements to facilitate evaluation of Contractor’s compliance to the specifications.

Non-compliance with the requirements shall be ground for disqualification.

2. Manufacturer’s Information	NPC’s Requirements	Contractor’s Data
a) Name of Manufacturer	<u>Any Manufacturer</u>	_____
b) Country of Origin	<u>Any country</u>	_____
c) Manufacturing experience of similar Steel Poles for not less than: (years)	<u>Five (5)</u>	_____

Note: Experience less than what is required will be ground for rejection of steel pole being offered.

3. Steel Pole Physical Features	NPC’s Requirements	Contractor’s Data
a) Structural grade of steel used	<u>ASTM A572 grade 450MPa (65ksi)</u>	_____
b) No. of Pole Sections	<u>2 minimum</u>	_____
	_____	Name of Firm
	_____	Name & Signature of Representative
	_____	Designation



c) Pole Shape	Dodecagonal	
d) Welding Method of Processing Steel Pole	Submerged-Arc Welding and Automatic Shielded Inert Gas Metal-Arched Welding (SIGMA)	
e) Pole Marking	According to technical specs	
4. Anchor Bolt Physical Features	NPC's Requirements	Contractor's Data
a) Structural grade of steel used	ASTM A449 minimum yield strength - 105 ksi for bolt diameter 1.5 inches & below and 90 ksi for bolt diameter 1.75 inches & above	
b) Bolt Template (top & bottom)	ASTM A36 minimum yield strength - 36 ksi	
5. Test Requirements	NPC's Requirements	Contractor's Data
a) Test According to Specs	Yes	
b) Steel Pole Proof Load Test required in the presence of NPC representatives	Yes	
c) Required number of NPC's representative to witness tests	Three (3) min.	
Name of Firm		
Name & Signature of Representative		
Designation		



PART II – TECHNICAL DATA SHEETS

Annex “A”

E.2.5: POWER CONDUCTOR

B.1 Technical Requirements

The Bidder is required to provide all the information required under the Column “Contractor’s Data”. Although not given by NPC, the Contractor’s Data shall be based on the International Standard.

B.2 Quantities

B.2.1 The quantities of power conductor and its accessories required under this contract are indicated in the Bill of Quantities, Section VII of this Specification.

B.3 Manufacturer’s Information

NPC’s Requirements

Contractor’s Data

a) Name of Manufacturer	<u>Any Manufacturer</u>	_____
b) Country of Origin	<u>Any country</u>	_____
c) The manufacturer should have been in the business of manufacturing power conductors for transmission line for not less than: (years)	<u>Ten (10)</u>	_____
d) The materials offered should have been in the actual service for not less than: (years)	<u>Five (5)</u>	_____

Note: Experience less than what is required will be ground for rejection of power conductor being offered.

Name of Firm

Name & Signature of Representative

Designation



B.4 Technical Characteristics and Requirements

NPC's Data are indicated below. The Contractor shall indicate their data corresponding to NPC's Data for the Power Conductor.

	NPC's Data	Contractor's Data
a) Type	336.4 MCM ACSR/AW	_____
b) Code Word	"LINNET"	_____
c) Calculated total cross-sectional area, mm ²	198.21 (approx.)	_____
d) Outer Layers		
1. Material	Aluminum	_____
2. Calculated Cross-sectional Area, mm ²	170.50 (approx.)	_____
3. Stranding No./dia. No./mm	26/2.888	_____
4. Coefficient of Elongation (1°C)	23 X 10 ⁻⁶	_____
e) Core		
1. Material	Aluminum Clad Steel	_____
2. Calculated Cross-sectional Area, mm ²	27.71	_____
3. Stranding, No./Dia. No./mm	7/2.245	_____
4. Zinc coating (Class/g/m ²)	220	_____
5. Coeff. Of Elongation (1°C)	11.5 X 10 ⁻⁶	_____
f) Conductor Overall Diameter, mm.	18.28 (approx.)	_____
g) Ultimate breaking Strength, (kg)	6,110	_____
h) Rated DC Resistance at 20°C, ohm/km	0.1696 (approx.)	_____
i) Initial Modulus of Elasticity, kg/mm ²	By Contractor	_____

Name of Firm

Name & Signature of Representative

Designation



B.5 Tests and Experience Requirements

B.5.1 Test Requirements

- | | | |
|---|----------------|--|
| a) Stress-Strain Test and Report Required | To be provided | |
| b) Breaking Strength Test and Reports Required: | To be provided | |
| c) Certified Stress-Strain Test Reports on a cable identical to the specified conductor are acceptable: | To be provided | |
| d) Factory Acceptance Tests (Routine Tests) to be witnessed by NPC's personnel: | Yes* | |
| e) Required number of NPC Personnel To witness tests: | Three (3) | |

* Included in the cost of Power Conductor

B.6 Spares

B.6.1 Spares are already included in the total quantity indicated in the Bill of Quantities.

B.7 Other Technical Requirements for the Power Conductors

- a) The length given on the Bill of Quantities for the Power Conductors has already taken into account the total sag consumed.
- b) The associated hardware and accessories are also given in the Bill of Quantities for bidding purposes. The Contractor is also required to make his own review of the quantities using the Contractor's standard practice for installation. The Contractor shall give differences in quantities so that corresponding adjustment can be made before award of contract.

Name of Firm

Name & Signature of Representative

Designation



C. Other Technical Data to be filled-in by Supplier

C.1 The Contractor furnished data and information are included in this Specification to indicate the guaranteed performance data, predicted performance, interface requirements and construction features of all Contractor furnished equipment. The accuracy of such information and the compatibility of such information with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

C.2 Environmental Considerations

C.2.1 In accordance with 2.1.12 of the General Technical Requirements and the Technical Data Sheets of Section E.2.1, the operating environment for this installation (will, will not) affect the life expectancy of the components used in this equipment.

If there will be an effect, the following components will be affected as follows:

Component	Effect
_____	_____
_____	_____
_____	_____
_____	_____

C.3 Other Technical Data for the Conductors

**Contractor's
Data**

Conductors:

- 1. Conductor Manufacturer _____
- 2. Reel Manufacturer _____
- 3. Conductor Reel Length & Tolerance, m/% _____
- 4. Outside Diameter over lagging, m _____
- 5. Overall width, mm _____
- 6. Drum Diameter, mm _____
- 7. Shipping weight per reel, kg _____

D. Stress -Strain Curve Coefficients (See Paragraph 2.5.2.4 of the Technical Specification)

Initial A0 A1 A2 A4

Name of Firm

Name & Signature of Representative

Designation



Outer	_____	_____	_____	_____
Core	_____	_____	_____	_____
<u>10-year Creep</u>				
Outer	_____	_____	_____	_____
Core	_____	_____	_____	_____
<u>Final</u>				
Outer	_____	_____	_____	_____
Core	_____	_____	_____	_____

E. Information on the Conductor Relative to the Preparation of the Sag and Tension Charts

- a) Maximum loading condition : 210 kg/sq.m. at 15°C & 240 kph wind
- b) Maximum tension at maximum load (40% UTS) - LINNET : 2,444 kgf (15°C & 240 kph wind)
- c) Temperature Range, °C : 15; 20; 25; 30; 35; 40; 45; 50; 55; 60; 65; 70; 75; 80; 85 and 90
- d) Range of Span, m : Refer to the NPC Std. Drawings Enclosed herein

Name of Firm

Name & Signature of Representative

Designation



PART II – TECHNICAL DATA SHEETS

Annex “A”

E.2.7: INSULATORS

B.1 Technical Requirements

The Contractor is required to provide all the information required under the Column “Contractor’s Data”. Although not given by NPC, the Contractor’s Data shall be based on the International Standard.

B.2 Quantities

B.2.1 The quantities of insulator and its accessories required under this contract are indicated in the Bill of Quantities, Part VII of this Specification.

B.3 Technical Data for the Insulators and Materials Assembly

- a) Country of Origin _____
- b) Insulator Manufacturer _____
- c) Hardware Manufacturer _____
- d) Place of testing and inspection _____

B.4 Technical Characteristics and Requirements

The NPC’s Data are indicated below. The Contractor shall indicate their data corresponding to the said NPC’s Data to facilitate evaluation and to compare Contractor’s compliance to the specifications.

B.4.1 Insulator Characteristics/Unit

	NPC’s Data		Contractor’s Data	
	Susp.	Tension	Susp.	Tension
a) Materials of Insulator Unit	Porcelain	Porcelain	_____	_____
b) Required fittings and hardware to form complete insulator string assembly	To be provided	To be provided	_____	_____

Name of Firm

Name & Signature of Representative

Designation



B.4.1.1 Porcelain Type Insulator Characteristics/Unit

	NPC's Data		Contractor's Data	
	Susp.	Tension	Susp.	Tension
1. Type (specify fog type, standard)	Standard w/ Straight Head	Standard w/ Straight Head	_____	_____
2. Applied Standard	ANSI C29.2	ANSI C29.2	_____	_____
Class and Type	52-3	52-3	_____	_____
3. ANSI/NEMA (ANSI Class of Hardware - Ball & Socket or Tongue Clevis)	(Ball & Socket) Coupling	(Ball & Socket) Coupling	_____	_____
4. Diameter of Shell, mm	254	254	_____	_____
5. Unit Spacing, mm (Tolerance)	146	146	_____	_____
6. Leakage distance Total/Shielded, mm/mm	292	292	_____	_____
7. Dry Arcing distance, mm	By Contractor	By Contractor	_____	_____
8. Flashover Voltages, per unit, kV				
Impulse, Critical, 1.2 x 50 microsec. wave,				
Positive, max.	125	125	_____	_____
Negative max.	130	130	_____	_____

Name of Firm

Name & Signature of Representative

Designation



	NPC's Data		Contractor's Data	
	Susp.	Tension	Susp.	Tension
Low Frequency, 60 Cycles				
Dry, rms	80	80		
Wet, rms	50	50		
9. Radio Influence Voltage				
Test voltage to ground, kV	10	10		
Max. RIV at 1,000 kHz (Std. Atmospheric Cond.), microvolt	50	50		
10. Low frequency Puncture Voltage (if applicable), kV	110	110		
11. <u>Strength Rating</u>				
a) Combined M & E Strength, lbs.	15,000	15,000		
b) Mech'l. Impact Strength, in.- lb.	55	55		
c) Tension Proof Load, lbs.	7,500	7,500		
12. Protection against electrolytic Corrosion (Yes, No)	Yes	Yes		
13. Color of Shell	Brown	Brown		

Name of Firm

Name & Signature of Representative

Designation



B.4.1.2 Design and Operation Conditions of Complete Insulator String

	NPC's Data		Contractor's Data	
	Susp.	Tension	Susp.	Tension
1. Frequency, Hz	60	60		
2. Max. Services (Line Voltage) kV, rms	72.50	72.50		
3. Rated Lightning Impulse Withstand Level (BLIL), kV	350	350		
4. Low Frequency Average Flashover Dry/kV rms	325	380		
Wet/kV rms	215	255		
5. Critical Impulse Average Flashover Positive/kV	525	610		
Negative/kV	495	585		
6. Dry Arcing distance, mm	197	197		
7. Leakage Distance, Total Shielded, Mm	1,450	1,752		
Number of units in string	5	6		
Number of units in parallel	1	1		

Name of Firm

Name & Signature of Representative

Designation



8. M & E Strength of the String Assembly, incl. Hardwares, kN	<u>Refer to Bid Drawings</u>	<u>Refer to Bid Drawings</u>		
9. Insulator String Configuration	<u>I-Config.</u>	<u>I-Config.</u>		
10. Maximum Line to Ground Fault Current Duration, kA/Cycle	<u>By Contractor</u>	<u>By Contractor</u>		

B.5 Tests and Experience Requirements

B.5.1 Test Requirements (Disc Insulator Unit)

	NPC's Data	Contractor's Data
a) Design Test Reports Required	<u>To be provided</u>	
b) Factory Acceptance Tests and Reports required	<u>To be provided</u>	
c) Quality Conformance test and Report Required	<u>To be provided</u>	
d) Certified Design Test Reports on the insulator identical to the specified insulator are acceptable	<u>Yes, but certification shall be from a reputable, internationally known & independent testing Laboratory.</u>	
e) Test to be carried on the presence of NPC's representative	<u>Yes</u>	

Name of Firm

Name & Signature of Representative

Designation



	NPC's Data	Contractor's Data
f) Required No. of NPC Personnel to witness tests	Three (3)	_____

Note: Contractor shall place in the filled-in data "submitted" or "will submit", "will perform" or "had been performed" as appropriate.

B.5.2 Additional Tests

B.5.2.1 If additional tests are required, these shall be as follows:

Power arc test shall be performed to check the thermal durability and holding strength of the suspension insulator. Nine (9) insulator units of each type assembled in 3-unit strings, mounted vertically without conductors, shall be subjected to arcing of 12,000 amperes (r.m.s.) for 0.1 seconds. The residual strength of the insulator units shall not be reduced below 65% of their rated strength after testing with the power arc. The insulator strings shall withstand the power arc test without shell breakage. Failure of any one string in the test shall be cause for testing of another two (2) strings of the same type. Failure of more than one string from the total so tested shall constitute failure of this insulator design. Test report shall be submitted together with the bid.

B.5.3 Materials and Manufacturer's Experience

	NPC's Data	Contractor's Data
a) The manufacturer should have been in the business of manufacturing insulators for transmission line for not less than: years	10	_____
b) The materials offered should have been in the actual service for not less than: years	5	_____

Note: Experience less than what is required will be ground for rejection of materials being offered.

Name of Firm

Name & Signature of Representative

Designation



B.6 Submittals

B.6.1 To be submitted during the Post-qualification.

- a) Assembly drawing showing view of complete string assembly
- b) Overall dimension and bill of materials identifying parts by work number
- c) Design computation on the mechanical design of parallel string suspension assembly
- d) Material Specification
- e) Supply Record (including the volume of sales, name and country of the Purchaser)
- f) Design Test Report
- g) Proposed Time Bar Schedule to meet submittal of drawings, delivery schedule, installation & commissioning of the Line Insulators

B.7 Shipping and Packing

B.7.1 Shipping Limitations

** Note: No shipping limitations will be imposed by NPC on the Contractor.*

The responsibility will lie on the Contractor whether the dimensions of his supplied equipment and materials in crate or in box will be appropriate for loading, unloading and transported to the Project Site.

The Contractor must at his own expense, conduct an ocular route survey of all roads, bridges, overpasses, etc., from the Port of Entry to the Project Site and examine for himself the conditions of all roads and bridges.

The Contractor shall check the capacity and availability of loading and unloading facilities which will be utilized in connection with his transport operation, as well as its characteristics, taking appropriate measures to avoid damaging the same. All costs related to the reinforcements of roads, bridges and the like, if any, shall be borne by the Contractor. The Contractor shall coordinate his own transport program and shall advise the proper authorities of the transit of the heaviest items to be transported and shall comply with the instructions given by said authorities.

Name of Firm

Name & Signature of Representative

Designation



All damages caused to public roads, streets or public structures shall be compensated by the Contractor at his own expense.

B.8 Spares

B.7.1 Spares are already included in the total quantity indicated in the Bill of Quantities.

B.9 Other Technical Requirements

- a) The Contractor shall coordinate with the supplier of insulators and the supplier of concrete poles to come up with the most technically and economically advantageous design for NPC based on the criteria given in this Specification. The clearance diagram shall be drawn supported by calculations.
- b) For a complete assembly, the total leakage distance is given and the Contractor may submit a different number of units in a string provided that the total leakage distance requirement can be met.

C. Other Technical Data to be Filled-in by the Contractor

C.1 The Contractor furnished data and information are included in this Specification to indicate the guaranteed performance data, predicted performance, interface requirements and construction features of all Contractor furnished equipment. The accuracy of such information and the compatibility of such information with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

C.2 Environmental Considerations

C.2.1 In accordance with Paragraph 2.1.8 of the General Technical Requirements and the Technical Data Sheets of E.2.1, the operating environment for this installation (will, will not) affect the life expectancy of the components used in this equipment.

If there will be an effect, the following components will be affected as follows:

Component	Effect
_____	_____
_____	_____

Name of Firm

Name & Signature of Representative

Designation



C.3 Other Technical Data for the Insulators and Materials Assembly

- a) Country of Origin _____
- b) Insulator Manufacturer _____
- c) Hardware Manufacturer _____
- d) Place of testing and inspection _____

Name of Firm

Name & Signature of Representative

Designation



TO BE SUBMITTED DURING POST- QUALIFICATION

“ANNEX B”

- E.2.6 - OVERHEAD GROUND WIRE**
- E.2.8 - LINE HARDWARES**
- E.2.9 - GROUNDING MATERIALS**



PART II – TECHNICAL DATA SHEETS

Annex “B”

E.2.6: OVERHEAD GROUND WIRE

B.1 Technical Requirements

The Contractor is required to provide all the information required under the Column Contractor’s Data. Although not given by NPC, the Contractor’s Data shall be based on the International Standard.

B.2 Quantities

B.2.1 The quantities of overhead ground wire required under this contract are indicated in the Bill of Quantities, Section VII of this Specification.

B.3 Data Required for Overhead Ground Wire (OHGW)/Ground Lead Wire/Guy Wire

- a. Country of Origin _____
- b. Name of Manufacturer _____
- c. Weight of OHGW/ Ground Lead Wire/
Guy Wire _____
- d. Weight of OHGW/Ground Lead Wire/
Guy Wire per reel on wooden reels
(including reel), kg _____

B.4 Technical Characteristics and Requirements

The NPC’s Data are indicated below. The Contractor shall indicate their data corresponding to the said NPC’s Data to facilitate evaluation and to compare Contractor’s compliance to the specification.

Name of Firm

Name & Signature of Representative

Designation



B.4.1 Technical Features and Characteristics

	NPC's Data	Contractor's Data
a. Type Designation	Galvanized Steel Class "C" Grade (High Strength)	_____
b. Size	3/8 (9.525 mm)	_____
c. No. of wires	7	_____
d. Diameter of Individual wires (mm)	3.05	_____
e. Calculated total cross-sectional area (mm ²)	51.14	_____
f. Overall diameter (mm)	9.20	_____
g. Ultimate breaking strength (kgf)	4,900	_____
h. Minimum weight of zinc coating (g/m ²)	By Contractor	_____
i. Total weight (kg/km)	407	_____
j. Maximum resistivity at 20 °C (ohm- mm ² /km)	By Contractor	_____
k. DC resistance at 20 °C (ohm/km)	By Contractor	_____
l. AC resistance - 60 Hz at 20 ° C (ohm/km)	By Contractor	_____
m. Initial modulus of elasticity of complete wire (N/mm ²)	By Contractor	_____
n. Final modulus of elasticity of complete wire (N/mm ²)	By Contractor	_____

Name of Firm

Name & Signature of Representative

Designation



o. Permanent elongation due to 10 year creep at 20% RTS (at temperature range)

By Contractor

p. Temperature Coefficient of linear expansion (1/°C)

By Contractor

q. Maximum short circuit current (kA) at time duration (seconds)

25 Ka/3 sec.

r. Recommended minimum sheave diameter (mm)

By Contractor

B.4.2 Other Technical Requirements

a. Lay (Right or Left)

NPC's Data

Contractor's Data

Left

b. Length of Lay (outer layer), mm

By Contractor

c. Corrosion inhibitor (grease) requirements:
Required

To be provided

d. Weight of Conductor (dry), kg/m

By Contractor

e. Weight of Conductor (with grease), kg/m

By Contractor

f. Nominal wire length per reel (m)

1,200 minimum

g. Length tolerance (%)

± 5

B.4.5 Cable Reel

a. Material

Wood

Name of Firm

Name & Signature of Representative

Designation



B.4.6 GUY WIRE

B.4.6.1 Technical Feature and Characteristics

	NPC's Data	Contractor's Data
a. Type Designation	High Strength Class "C"	_____
b. Size	7/16"	_____
c. No. of wires	7	_____
d. Diameter of Individual wires (mm)	3.68	_____
e. Calculated total cross-sectional area (mm ²)	74.50	_____
f. Overall diameter (mm)	11.10	_____
g. Ultimate breaking strength (kgf)	6,590	_____
h. Minimum weight of zinc coating (g/m ²)	By Contractor	_____
i. Total weight (kg/m)	0.595	_____
j. Lay (Right or Left)	By Contractor	_____
k. Length of Lay, outer layer (mm)	By Contractor	_____
l. Elongation in 609.6 mm (%)	By Contractor	_____
m. Nominal wire length per reel (m)	2,000	_____
n. Length tolerance (%)	+ 5	_____

B.4.6.2 Cable Reel

a. Material	Wood	_____
-------------	------	-------

Name of Firm

Name & Signature of Representative

Designation



B.4.7 STRUCTURE GROUND LEAD WIRE

B.4.7.1 Technical Features and Characteristics

	NPC's Data	Contractor's Data
a. Type Designation	Ordinary Grade Class C	_____
b. Size	9.525	_____
c. No. of wires	7	_____
d. Diameter of Individual wires (mm)	3.05	_____
e. Calculated total cross-sectional area (mm ²)	51.20	_____
f. Overall diameter (mm)	9.52	_____
g. Ultimate breaking strength (kgf)	1,929	_____
h. Minimum weight of zinc coating (g/m ²)	By Contractor	_____
i. Total weight (kg/km)	406	_____
j. Lay (Right or Left)	By Contractor	_____
k. Length of Lay, outer layer (mm)	By Contractor	_____
l. Elongation, min. (%)	By Contractor	_____
m. Nominal wire length per reel (m)	2,000	_____
n. Length tolerance (%)	± 5	_____

B.4.7.2 Cable Reel

a. Material	Wood	_____
-------------	------	-------

Name of Firm

Name & Signature of Representative

Designation



B.5 Manufacturer's Experience

	NPC's Data	Contractor's Data
a. The manufacturer should have been in the business of manufacturing overhead ground wire for not less than: Years	Five (5)	_____
b. The type of materials to be supplied should have been in the actual service for not less than: Years	Three (3)	_____

Note: Experience less than what is required will be ground for rejection of materials being offered.

B.6 Spares

B.6.1 Spares are already included in the total quantity indicated in the Bill of Quantities.

C. Other Technical Data to be Filled-in by Contractor

C.1 The Contractor furnished data and information are included in this specification to indicate the guaranteed performance data, predicted performance, interface requirements and construction features of all Supplier furnished materials. The accuracy of such information and the compatibility of such information with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

C.2 Environmental Considerations

C.2.1 In accordance with Paragraph 2.1.8 of the General Technical Requirements and the Technical Data Sheets of Section E.2.1, the operating environment for this installation (will, will not) affect the life expectancy of the components used in this equipment. If there will be an effect, the following components will be affected:

Component	Effect
_____	_____
_____	_____
_____	_____
_____	_____

Name of Firm

Name & Signature of Representative

Designation



PART II – TECHNICAL DATA SHEETS

Annex “B”

E.2.8: LINE HARDWARES

B.1 Technical Requirements

The Contractor is required to provide all the information required under the Column “Contractor’s Data”. Although not given by NPC, the Contractor’s Data shall be based on the International Standard.

B.2 Quantities

B.2.1 The quantities of line hardware required under this contract are indicated in the Bill of Quantities, Section VII of this Specification.

B.3 Technical Characteristics and Requirements

The NPC’s data are indicated below. The Contractor shall indicate their data corresponding to the said NPC’s data to facilitate evaluation and to compare Contractor’s compliance to the specification.

B.3.1 Technical Characteristics of Suspension Clamp for Power Conductor

	NPC’s Data	Contractor’s Data
a) Type	Bolted-Free Center	_____
b) Material of Body	Aluminum Alloy	_____
c) Applied Conductor	336.4 MCM ACSR/AW “LINNET”	_____
d) Ultimate Breaking Strength, kg.	6,000 (min.)	_____
e) Slip Strength, kg.	1,600 (min.)	_____
f) Armor Rods (Used, Not Used)	Used	_____
g) Galvanizing coating weight, if applicable	As per ASTM A 153	_____

Name of Firm

Name & Signature of Representative

Designation



B.3.2 Technical Features and Characteristics of Tension Clamp for Power Conductor

	NPC's Data	Contractor's Data
a) Type	Bolted Type (4 –U Bolt)	_____
b) Material of Body	Aluminum Alloy	_____
c) Applied Conductor Material	336.4 MCM ACSR/AW "LINNET"	_____
d) Ultimate Breaking Strength, kg.	6,800 (min.)	_____
e) Slip Strength, kg	5,400 (min.)	_____
f) Galvanizing coating weight, if applicable	As per ASTM A 153	_____

B.3.3 Technical Features and Characteristics of Armor Rod for Power Conductor

	NPC's Data	Contractor's Data
a) Type	Preformed	_____
b) Applied Conductor	336.4 MCM ACSR/AW "LINNET"	_____
c) Material	Aluminum	_____
d) Color Code	Green	_____
e) Rod diameter, mm.	5.18	_____
f) Direction of Lay	Right Hand	_____

Name of Firm

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Designation



	NPC's Data	Contractor's Data
g) Length, mm.	1829	
h) Number of Rods	12	

B.3.4 Technical Features and Characteristics of Vibration Damper for Power Conductor

a) Type	Stockbridge	
b) Material	Aluminum Alloy	
c) Break-away torque, kgf-cm	Manufacturer's Std.	
d) Applied conductor	336.4MCM ACSR/AW "Linnet"	
f) Performance test data	To be submitted	

B.3.6 Technical Features and Characteristics of Vibration Damper for Overhead Ground Wire

a) Type	Stockbridge	
b) Material	Galvanized Steel	
c) Break-away torque, kgf-cm	Manufacturer's Standard	
d) Applied Wire	3/8" Galvanized Steel Wire	
e) Performance test data	To be submitted	

Name of Firm

Name & Signature of Representative

Designation



B.4 Tests and Experience Requirements

B.4.1 Test Requirements

- a) Design test and reports required To be submitted _____
- b) Certified Test design reports of prototype or duplicate production types are acceptable To be submitted _____
- c) Galvanizing Tests To be submitted _____
- d) Other Tests as follows:
 - 1. Slip Strength, where applicable To be submitted _____
 - 2. Breaking Strength, where applicable To be submitted _____
 - 3. Zinc coating; coating weight and uniformity To be submitted _____
 - 4. Wear resistance, To be submitted _____
 - 5. Twist Withstand, where applicable To be submitted _____

Note: Contractor shall place in the filled-in data "Submitted" or "will submit", "will perform" or "had been performed" as appropriate.

Name of Firm

Name & Signature of Representative

Designation



B.4.2 Materials and Manufacturer’s Experience

	NPC’s Data	Contractor’s Data
a) The Manufacturer should have been in the business of manufacturing line hardware for not less than: years	Ten (10)	_____
b) The materials offered should have been in the actual service for not less than: years	Five (5)	_____

Note: *Experience less than what is required will be ground for rejection of materials being offered.*

B.5 Submittals

B.5.1 The following should be submitted during the Post-qualification.

1. Proposed time bar schedule to meet submission of drawings & delivery schedule.
2. Certified type test report.
3. Assembly drawing showing view of complete assembly.
4. Overall dimension and bill of materials identifying parts mark by number.
5. Reference list, brochures and catalogues.

B.6 Shipping and Packing

B.6.1 Shipping Limitations

* *Note: No shipping limitation will be imposed by NPC on the Supplier.*

The responsibility will lie on the Contractor whether the dimensions of his supplied equipment and materials in crate or in box will be appropriate for loading, unloading and transported to the Project Site.

The Contractor must at his own expense, conduct an ocular route survey of all roads, bridges, overpasses, etc., from the Port of Entry to the Project Site and examine for himself the conditions of all roads and bridges.

Name of Firm

Name & Signature of Representative

Designation



The Contractor shall check the capacity and availability of loading and unloading facilities which will be utilized in connection with his transport operation, as well as its characteristics, taking appropriate measures to avoid damaging the same. All costs related to the reinforcements of roads, bridges and the like, if any, shall be borne by the Contractor. The Contractor shall coordinate his own transport program and shall advise the proper authorities of the transit of the heaviest items to be transported and shall comply with the instructions given by said authorities.

All damages caused to public roads, streets or public structures shall be compensated by the Contractor at his own expense.

B.7 Spares

B.7.1 Spares are already included in the total quantity indicated in the Bill of Materials.

B.8 Other Technical Requirements

B.8.1 Other hardware not defined in these Technical Data Sheets are indicated in the Insulator String Assembly Drawings of this Specification. The Contractor is required to strictly observe the physical properties as well as the Mechanical and Electrical Strength of these hardware.

C. Other Technical Data to be Filled-in and Submitted by the Supplier

C.1 The Contractor furnished data and information as mentioned in B.3 are included in this specification to indicate the guaranteed performance data, predicted performance, interface requirements and construction features of all Contractor furnished equipment. The accuracy of such information and the compatibility of such information with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

C.2 Environmental Considerations

C.2.1 In accordance with Paragraph 2.1.8 of the General Technical Requirements and the Technical Data Sheets of section E.2.1, the operating environment for this installation (will, will not) affect the life expectancy of the components used in this equipment.

If there will be an effect, the following components will be affected as follows:

Component	Effect
_____	_____
_____	_____
_____	_____
_____	_____

Name of Firm

Name & Signature of Representative

Designation



C.3 Other Technical Data Required for Line Hardware

**Contractor's
Data**

a) Suspension Clamp for Power Conductor

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

b) Tension Clamp for Power Conductor

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

c) Armor Rod for Power Conductor

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

d) Armor Rod for Overhead Ground Wire

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

e) Vibration Damper for Power Conductor

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

f) Vibration Damper for Overhead Ground Wire

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

Name of Firm

Name & Signature of Representative

Designation



g) Suspension Clamp for Overhead Ground Wire

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

h) Tension Clamp for Overhead Ground Wire

- 1. Name of Manufacturer _____
- 2. Place of Manufacture _____
- 3. Weight _____
- 4. Place of Testing & Inspection _____

Name of Firm

Name & Signature of Representative

Designation



PART II – TECHNICAL DATA SHEETS

E.2.9: GROUNDING MATERIALS

B.1 Technical Requirements

The Bidder is required to provide all the information required under the Column "Contractor's Data". Although not given by NPC, the Contractor's Data shall be based on the International Standard.

NPC's requirements are indicated below. The Contractor shall indicate their data corresponding to the said NPC requirements to facilitate evaluation and to compare Contractor compliance to the specifications.

Non-compliance with the requirements shall be ground for disqualification.

B.2 Quantities

B. 2.1 The quantities of overhead ground wire required under this contract are indicated in the Bill of Quantities, SECTION VII of this Specification.

B. 3 Technical Characteristics and Requirements

The NPC's Data are indicated below. The Contractor shall indicate their data corresponding to the said NPC's Data to facilitate evaluation and to compare Contractor's compliance to the specification.

Name of Firm

Name & Signature of Representative

Designation



B.3.1 Earth Rods

	NPC's Data	Contactors Data
a. Manufacturer	By Contractor	
b. Place of manufacture	By Contractor	
c. Length of rods, m	3	
d. Diameter of rods, mm	16	
e. Weight of rods, kg	Manufacturers' Std.	
f. Minimum weight of zinc coating, g/m ²	600 (approx.)	

B.3.2 Structure Ground Wire

a. Manufacturer	By Contractor	
b. Place of manufacture	By Contractor	
c. Type designation	Ordinary Grade Steel Galvanized	
d. Size, mm	9.525 (3/8")	
e. Number of stranding	7	
f. Diameter of individual wires, mm	3.05	
g. Calculated total cross-sectional area, mm ²	51.20	
h. Overall diameter, mm	9.52	
i. Ultimate breaking strength, kg	1,929	
j. Minimum weight of zinc coating, g/m ²	778	

Name of Firm

Name & Signature of Representative

Designation

	NPC's Data	Contractors Data
k. Total weight, kg/km	406	
l. Lay (right, left)	Right	
m. Length of lay (outer layer), mm	Manufacturers' Std.	
n. Nominal wire length per reel, m	Manufacturers' Std.	
o. Length tolerance, %	± 5	
B.3.3 Cable Reel		
a. Material (wood, metal)	Wood	
b. Returnable (yes, no)	No	
B.3.4 Miscellaneous Materials		
a. Supplier shall provide the following accessory materials for the complete installation of grounding:		
a.1. Terminal connector/ground clamp to connect grounding wire to pole/tower	Yes	

Name of Firm

Name & Signature of Representative

Designation



B.4 Test and Experience Requirements

B.4.1 Test and Requirements

	NPC's Data	Contractors Data
a. Mechanical test on the material used (yes, no)	Yes, if other than ASTM	_____
b. Stress-strain test reports: Required (yes, No)	Yes	_____
c. Breaking Strength Test and Reports Require (Yes, No)	Yes	_____
d. Embrittlement Tests required (Yes, No)	No	_____
e. Factory routine test to be performed on the grounding material	Yes	_____
f. Factory Acceptance Test to be witnessed by NPC's representative (yes, no)	No	_____
g. Required no. of NPC's personnel to witness testing.	None	_____

B.4.2 Additional Test

B.4.2.1 If additional tests are required, these shall be as follows:

All manufacturer standard tests not within the specified test requirements in the specifications

Name of Firm

Name & Signature of Representative

Designation



B.4.3 Material and Manufacturer’s Experience

	NPC’s Data	Contractors Data
a. The manufacturer should have been in the business of manufacturing overhead ground wire for not less than : Years	5	
b. The type of materials to be supplied should have been in the actual service for not less than : Years	3	

Note: Experience less than what is required will be ground for rejection of materials being offered.

B.5 Shipping and Packing

B.5.1 Shipping Limitations

The responsibility will lie on the Contractor whether the dimensions of his supplied equipment and materials in crate or in box will be appropriate for loading, unloading and transported to the Project Site.

The Contractor must at his own expense, conduct an ocular route survey of all roads, bridges, overpasses, etc., from the Port of Entry to the Project Site and examine for himself the conditions of all roads and bridges.

The Contractor shall check the capacity and availability of loading and unloading facilities which will be utilized in connection with his transport operation, as well as its characteristics, taking appropriate measures to avoid damaging the same. All costs related to the reinforcements of roads, bridges and the like, if any, shall be borne by the Contractor. The Contractor shall coordinate his own transport program and shall advise the proper authorities of the transit of the heaviest items to be transported and shall comply with the instructions given by said authorities.

All damages caused to public roads, streets or public structures shall be compensated by the Contractor at his own expense.

Name of Firm

Name & Signature of Representative

Designation



B.6 Spares

B.6.1 Spares are already included in the total quantity indicated in the Bill of Quantities.

B.7 Tools and Appliances

B. 7.1 No particular tools intended for NPC would be required for the installation of grounding materials.

C. Other Technical Data to be Filled-in by Contractor

C.1 The Contractor furnished data and information are included in this specification to indicate the guaranteed performance data, predicted performance, interface requirements and construction features of all Supplier furnished materials. The accuracy of such information and the compatibility of such information with overall performance requirements specified by NPC are the sole responsibility of the Contractor.

C.2 Environmental Considerations

C.2.1 In accordance with Clause 2.1.8.1.2 of the General Technical Requirements and the Technical Data Sheets of Clause E.2.1, the operating environment for this installation (will/will not) _____ affect the life expectancy of the components used in this equipment.

If there will be an effect, the following components will be affected:

Component	Effect
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Name of Firm

Name & Signature of Representative

Designation



SECTION VII

BILL OF QUANTITIES



**PART VII - BILL OF QUANTITIES
TAP-USON**

Item No.	Description of Work or Materials	Work to Be Done	Reference	Unit	Estimated Quantity	Unit Price in Pesos (Words and Figures)	Total Amount (In Figures)
1.0	Right of Way	Clearing	Refer to NPC TS & Drawing	km	1.2	_____ (P _____)	(P _____)
1.1	50 Footer Steel Poles						
1.1.1	Type "Ece"	Supply	Refer to NPC TS & Drawing	pole	1	_____ (P _____)	(P _____)
		Erection	Refer to NPC TS & Drawing	pole	1	_____ (P _____)	(P _____)
1.1.1	Type "3Dce"	Supply	Refer to NPC TS & Drawing	pole	1	_____ (P _____)	(P _____)
		Erection	Refer to NPC TS & Drawing	pole	1	_____ (P _____)	(P _____)
1.2	55 Footer Steel Poles						
1.2.1	Type "Ece"	Supply	Refer to NPC TS & Drawing	pole	5	_____ (P _____)	(P _____)
		Erection	Refer to NPC TS & Drawing	pole	5	_____ (P _____)	(P _____)
1.3	60 Footer Steel Poles						
1.3.1	Type "Cce"	Supply	Refer to NPC TS & Drawing	pole	2	_____ (P _____)	(P _____)
		Erection	Refer to NPC TS & Drawing	pole	2	_____ (P _____)	(P _____)

Name of Firm

Name and Signature of Authorized Representative

Designation

**PART VII - BILL OF QUANTITIES
TAP-USON**

Item No.	Description of Work or Materials	Work to Be Done	Reference	Unit	Estimated Quantity	Unit Price In Pesos (Words and Figures)	Total Amount (In Figures)
1.3.2	Type "Dce"	Supply	Refer to NPC TS & Drawing	poles	3	_____ (P _____)	(P _____)
		Erection	Refer to NPC TS & Drawing	poles	3	_____ (P _____)	(P _____)
1.3.3	Type "Ece"	Supply	Refer to NPC TS & Drawing	poles	2	_____ (P _____)	(P _____)
		Erection	Refer to NPC TS & Drawing	poles	2	_____ (P _____)	(P _____)
1.4	Structure Dressing(s)						
1.4.1	Type "C"	Supply	Refer to NPC TS & Drawing	structure	2	_____ (P _____)	(P _____)
		Installation	Refer to NPC TS & Drawing	structure	2	_____ (P _____)	(P _____)
1.4.2	Type "D"	Supply	Refer to NPC TS & Drawing	structure	3	_____ (P _____)	(P _____)
		Installation	Refer to NPC TS & Drawing	structure	3	_____ (P _____)	(P _____)
1.4.3	Type "E"	Supply	Refer to NPC TS & Drawing	structures	8	_____ (P _____)	(P _____)
		Installation	Refer to NPC TS & Drawing	structures	8	_____ (P _____)	(P _____)

Name of Firm

Name and Signature of Authorized Representative

Designation

**PART VII - BILL OF QUANTITIES
TAP-USON**

Item No.	Description of Work or Materials	Work to Be Done	Reference	Unit	Estimated Quantity	Unit Price In Pesos (Words and Figures)	Total Amount (In Figures)
1.4.4	Type "3D"	Supply	Refer to NPC TS & Drawing	structures	1	_____ (P_____)	(P_____)
		Installation	Refer to NPC TS & Drawing	structures	1	_____ (P_____)	(P_____)
1.5	Insulator String Assemblies						
1.5.1	Type "D"	Supply	Refer to NPC TS & Drawing	assy	84	_____ (P_____)	(P_____)
		Installation	Refer to NPC TS & Drawing	assy	84	_____ (P_____)	(P_____)
1.5.2	Type "S" Additional for the Tapping Point (See Dwg. No. TU-BDE-04.006 for modified Type "D" pole structure)	Supply	Refer to NPC TS & Drawing	structure	3	_____ (P_____)	(P_____)
		Installation	Refer to NPC TS & Drawing	structure	3	_____ (P_____)	(P_____)
1.6	Ground String Assemblies						
1.6.1	Type "SWT"	Supply	Refer to NPC TS & Drawing	assy	29	_____ (P_____)	(P_____)
		Installation	Refer to NPC TS & Drawing	assy	29	_____ (P_____)	(P_____)
1.7	Preformed Armor Rod (336.4 MCM ACSR "LINNET")	Supply	Refer to NPC TS & Drawing	sets	6	_____ (P_____)	(P_____)
		Installation	Refer to NPC TS & Drawing	sets	6	_____ (P_____)	(P_____)

Name of Firm

Name and Signature of Authorized Representative

Designation

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**PART VII - BILL OF QUANTITIES
TAP-USON**

Item No.	Description of Work or Materials	Work to Be Done	Reference	Unit	Estimated Quantity	Unit Price in Pesos (Words and Figures)	Total Amount (In Figures)
1.8	Power Conductor, 336.4 MCM ACSR/AW, Bare Conductor 26/7-Strands Al/Stl. Code Name "LINNET"	Supply	Refer to NPC TS & Drawing	km	5	_____ (P _____)	(P _____)
		String	Refer to NPC TS & Drawing	km	5	_____ (P _____)	(P _____)
1.9	Overhead Ground Wire, High Strength Grade Class "C", Galvanized, 9.525 (3/8")mm Diameter	Supply	Refer to NPC TS & Drawing	km	1.5	_____ (P _____)	(P _____)
		String	Refer to NPC TS & Drawing	km	1.5	_____ (P _____)	(P _____)
1.10	Ground Lead Wire, Stranded, 3/8" dia., Ordinary Grade Class "C"	Supply	Refer to NPC TS & Drawing	meters	50	_____ (P _____)	(P _____)
		Installation	Refer to NPC TS & Drawing	meters	50	_____ (P _____)	(P _____)
1.11	Ground Rod with Ground Clamp	Supply	Refer to NPC TS & Drawing	pcs.	14	_____ (P _____)	(P _____)
		Installation	Refer to NPC TS & Drawing	pcs.	14	_____ (P _____)	(P _____)
1.12	Stockbridge Vibration Dampers						
1.12.1	Conductor (ACSR)	Supply	Refer to NPC TS & Drawing	pcs	84	_____ (P _____)	(P _____)
		Installation	Refer to NPC TS & Drawing	pcs	84	_____ (P _____)	(P _____)

Name of Firm

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Designation

**PART VII - BILL OF QUANTITIES
TAP-USON**

Item No.	Description of Work or Materials	Work to Be Done	Reference	Unit	Estimated Quantity	Unit Price in Pesos (Words and Figures)	Total Amount (In Figures)
1.12.2	Shield Wire (OHGW)	Supply	Refer to NPC TS & Drawing	pcs	8	_____ (P_____)	(P_____)
		Installation	Refer to NPC TS & Drawing	pcs	8	_____ (P_____)	(P_____)
1.13	Dismantling/Extraction & haul of existing Concrete Pole Structure No. MC-193 (3D-50) complete with associated line materials/hardware to Uson stockyard.	Dismantling/Extraction and Haul	Refer to NPC TS & Drawing	poles	3	_____ (P_____)	(P_____)
CIVIL WORKS							
1.14	Steel Pole Concrete Encasement						
1.14.1	Excavation	Excavate, stockpile & dispose	Refer to NPC TS & Drawing	cu. m.	82.32	_____ (P_____)	(P_____)
1.14.2	Backfilling	Backfill, spread & compact	Refer to NPC TS & Drawing	cu. m.	9.05	_____ (P_____)	(P_____)
1.14.3	Sand and Gravel Bedding	Furnish, place & spread	Refer to NPC TS & Drawing	cu. m.	2.01	_____ (P_____)	(P_____)
1.14.4	Concrete 3000psi (20.7 Mpa)	Furnish, place & vibrate	Refer to NPC TS & Drawing	cu. m.	86.34	_____ (P_____)	(P_____)
1.14.5	Reinforcing Bars (Grade 275)	Furnish, cut, bend schedule & install	Refer to NPC TS & Drawing	kg.	7143.28	_____ (P_____)	(P_____)
TOTAL BID PRICE						_____ (P_____)	(P_____)

Name of Firm

Name and Signature of Authorized Representative

Designation

SECTION VIII

BIDDING FORMS

SECTION VIII – BIDDING FORMS

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NPCSF-INFR-15	- Summary Sheets of Materials Prices, Labor Rates and Equipment Rental Rates

Standard Form No: NPCSF-INFR-01

Checklist of Technical & Financial Envelope Requirements for Bidders

A. THE 1ST ENVELOPE (TECHNICAL COMPONENT) SHALL CONTAIN THE FOLLOWING:

1. ELIGIBILITY DOCUMENTS

a. (CLASS A)

➤ Any of the following:

- PhilGEPS Certificate of Registration and Membership under Platinum Category in accordance with Section 8.5.2 of the IRR;

OR:

- The following updated and valid Class "A" eligibility documents enumerated under "Annex A" of the Platinum Membership:

- Registration Certificate from the Securities and Exchange Commission (SEC) for corporations, Department of Trade and Industry (DTI) for sole proprietorship, or Cooperative Development Authority (CDA) for cooperatives;
- Mayor's/Business permit issued by the city or municipality where the principal place of business of the prospective bidder is located, or the equivalent document for Exclusive Economic Zones or Areas.

In cases of recently expired Mayor's/Business permits, it shall be accepted together with the official receipt as proof that the bidder has applied for renewal within the period prescribed by the concerned local government unit, provided that the renewed permit shall be submitted as a post qualification requirement in accordance with Section 34.2 of the Revised IRR of RA 9184.

- The prospective bidder's audited financial statements, showing, among others, the prospective bidder's total and current assets and liabilities, stamped "received" by the BIR or its duly accredited and authorized institutions, for the preceding calendar year which should not be earlier than two (2) years from the date of bid submission.
- Tax clearance per Executive Order 398, Series of 2005, as finally reviewed and approved by the BIR;
- Valid Philippine Contractors Accreditation Board (PCAB) license and registration for the type and cost of the contract for this Project or Special PCAB License in case of Joint Ventures.

OR:

- A combination thereof.

➤ Statement of all its ongoing government and private contracts if any, whether similar or not similar in nature and complexity to the contract to be bid (*NPCSF-INFR-02*)

➤ The Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid, and whose value, adjusted to current prices using the Philippine Statistics Authority (PSA) consumer price index, must be at least 50% of the ABC (*NPCSF-INFR-03*) complete with the following supporting documents:

- Contract
- Owner's Certificate of Final Acceptance issued by the project owner other than the contractor or a final rating of at least Satisfactory in the Constructors Performance Evaluation System (CPES). In case of contracts with the private sector, an equivalent document (Ex. Official Receipt or Sales Invoice) shall be submitted

Standard Form No: NPCSF-INFR-01
Page 2 of 3

(The Single Largest Completed Contract (SLCC) as declared by the bidder shall be verified and validated to ascertain such completed contract. Hence, bidders must ensure access to sites of such projects/equipment to NPC representatives for verification and validation purposes during post-qualification process.

It shall be a ground for disqualification, if verification and validation cannot be conducted due to inaccessibility of the site for whatever reason or fault of the bidder.)

- Special PCAB License in case of Joint Ventures
- Duly signed computation of its Net Financial Contracting Capacity (NFCC) at least equal to the ABC (NPCSF-INFR-04);

b. (CLASS B)

- Valid Joint Venture Agreement, if applicable (NPCSF-INFR-05)

2. Technical Documents

- Bid Security, any one of the following:
 - Bid Securing Declaration (NPCSF-INFR-06c)
OR
 - Cash or Cashier's/Manager's check issued by a Universal or Commercial Bank – 2% of ABC;
OR
 - Bank draft/guarantee or irrevocable letter of credit issued by a Universal or Commercial Bank: (NPCSF-INFR-06a) - 2% of ABC;
OR
 - Surety Bond callable upon demand issued by a reputable surety or insurance company (NPCSF-INFR-06b) - 5% of ABC, with
 - Certification from the Insurance Commission as authorized company to issue surety
- Duly signed, completely filled-out and notarized Omnibus Sworn statement (Revised) (NPCSF-INFR-07), complete with the following attachments:
 - For Sole Proprietorship:
 - Special Power of Attorney
 - For Partnership/Corporation/Cooperative/Joint Venture:
 - Document showing proof of authorization (e.g., duly notarized Secretary's Certificate, Board/Partnership Resolution, or Special Power of Attorney, whichever is applicable)
- Organization Chart for the project (NPCSF-INFR-08)
- Duly Signed List of Contractor's Key Personnel (based on the minimum key personnel) with complete supporting documents (NPCSF-INFR-09, 10a, 10b & 11)
- Duly Signed List of Contractor's Equipment (owned, leased or under purchase agreement (NPCSF-INFR-12), with
 - Proof of ownership and/or certificate of availability issued by Equipment Lessors

Standard Form No: NPCSF-INFR-01

Page 3 of 3

- Documents to be submitted with the Bid/Proposal as specified in Annex A of Section VI – Part II, Technical Data Sheets
- Complete eligibility documents of proposed sub-contractor, if applicable

B. THE 2ND ENVELOPE (FINANCIAL COMPONENT) SHALL CONTAIN THE FOLLOWING:

- Duly signed Bid Letter indicating the total bid amount in accordance with the prescribed form (NPCSF-INFR-13)
- Duly signed and completely filled-out Bill of Quantities (Section VII) indicating the unit and total prices per item and the total amount in the prescribed Bill of Quantities form.
- Duly Signed Detailed Estimates for each items of work showing the computations in arriving at each item's unit prices used in coming up with the bid (NPCSF-INFR-14)
- Summary sheets indicating the direct unit prices of construction materials, labor rates and equipment rental rates used in coming up with the bid (NPCSF-INFR-15)

CONDITIONS:

1. *Each Bidder shall submit one copy of the first and second components of its Bid. NPC may request additional hard copies and/or electronic copies of the Bid. However, failure of the Bidders to comply with the said request shall not be a ground for disqualification.*
2. *A Bidder not submitting bid for reason that his cost estimate is higher than the ABC, is required to submit his letter of non-participation/regret supported by corresponding detailed estimates. Failure to submit the two (2) documents shall be understood as acts that tend to defeat the purpose of public bidding without valid reason as stated under Section 69.1.(i) of the revised IRR of R.A. 9184.*

Standard Form Number: NPCSF-INFR-02

List of All Ongoing Government and Private Contracts Including Contract Awarded But Not Yet Started

Business Name : _____
Business Address : _____

Name of Contract/Location/ Project Cost	a. Owner's Name b. Address c. Telephone Nos.	Nature of Work	Contractor's Role		a. Date Awarded b. Date Started c. Date of Completion or Estimated Completion Time	Value of Outstanding Works
			Description	%		
<u>Government</u>						
<u>Private</u>						
					Total Cost	

The bidder shall declare in this form all his on-going government and private contracts including contracts where the bidder (either as individual or as a Joint Venture) is a partner in a Joint Venture agreement other than his current joint venture where he is a partner. Non declaration will be a ground for disqualification of bid.

Note : This statement shall be supported with the following documents for all the contract(s) stated above which shall be submitted during Post-qualification:

1. Contract/Purchase Order and/or Notice of Award
2. Certification coming from the project owner/client that the performance is satisfactory as of the bidding date.

Submitted by : _____
(Printed Name & Signature)
Designation : _____
Date : _____

Standard Form Number: NPCSF-INFR-03

The Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid

Business Name : _____
Business Address : _____

Name of Contract	a. Owner's Name b. Address c. Telephone Nos.	Nature of Work	Contractor's Role		a. Amount at Award b. Amount at Completion c. Duration	a. Date Awarded b. Contract Effectivity c. Date Completed
			Description	%		

- Notes: 1. The bidder must state only one (1) Single Largest Completed Contract (SLCC) similar to the contract to be bid.
2. Supporting documents such as Contract/Purchase Order and any of the following: Owner's Certificate of Final Acceptance issued by the project owner other than the contractor; or A final rating of at least Satisfactory in the Constructors Performance Evaluation System (CPES); or Official Receipt (O.R); or Sales Invoice for the contract stated above shall be submitted during Bid Opening.

Submitted by _____
(Printed Name & Signature)

Designation : _____
Date : _____

Standard Form Number: NPCSF-INFR-04

NET FINANCIAL CONTRACTING CAPACITY (NFCC)

A. Summary of the Bidder's/Contractor's assets and liabilities on the basis of the income tax return and audited financial statement for the immediately preceding calendar year are:

		Year 20__
1.	Total Assets	
2.	Current Assets	
3.	Total Liabilities	
4.	Current Liabilities	
5.	Net Worth (1-3)	
6.	Net Working Capital (2-4)	

B. The Net Financial Contracting Capacity (NFCC) based on the above data is computed as follows:

NFCC = [(Current assets minus current liabilities) x 15] minus the value of all outstanding or uncompleted portions of the projects under ongoing contracts, including awarded contracts yet to be started coinciding with the contract for this Project.

NFCC = P _____

Herewith attached is certified true copy of the audited financial statement, stamped "RECEIVED" by the BIR or BIR authorized collecting agent for the immediately preceding calendar year.

Submitted by:

Name of Bidder/Contractor

Signature of Authorized Representative

Date : _____

Standard Form Number: NPCSF-INFR-05

JOINT VENTURE AGREEMENT

KNOW ALL MEN BY THESE PRESENTS:

That this JOINT VENTURE AGREEMENT is entered into by and between:
_____, of legal age, (*civil status*) _____, authorized representative of
_____ and a resident of _____.

- and -

_____, of legal age, (*civil status*) _____, authorized representative of
_____ a resident of _____.

That both parties agree to join together their capital, manpower, equipment, and other resources and efforts to enable the Joint Venture to participate in the Bidding and Undertaking of the hereunder stated Contract of the **National Power Corporation**.

NAME OF PROJECT

CONTRACT AMOUNT

That the capital contribution of each member firm:

NAME OF FIRM	CAPITAL CONTRIBUTION
1. _____	P _____
2. _____	P _____

That both parties agree to be jointly and severally liable for their participation in the Bidding and Undertaking of the said contract.

That both parties agree that _____ and/or _____ shall be the Official Representative/s of the Joint Venture, and are granted full power and authority to do, execute and perform any and all acts necessary and/or to represent the Joint Venture in the Bidding and Undertaking of the said contract, as fully and effectively and the Joint Venture may do and if personally present with full power of substitution and revocation.

That this Joint Venture Agreement shall remain in effect only for the above stated Contract until terminated by both parties.

Name & Signature of Authorized Representative

Official Designation

Name of Firm

Name & Signature of Authorized Representative

Official Designation

Name of Firm

Witnesses

1. _____

2. _____

[Jurat]

[Format shall be based on the latest Rules on Notarial Practice]

Standard Form Number: NPCSF-INFR-06a

FORM OF BID SECURITY (BANK GUARANTEE)

WHEREAS, (Name of Bidder) (hereinafter called "the Bidder") has submitted his bid dated (Date) for the [name of project] (hereinafter called "the Bid").

KNOW ALL MEN by these presents that We (Name of Bank) of (Name of Country) having our registered office at _____ (hereinafter called "the Bank" are bound unto National Power Corporation (hereinafter called "the Entity") in the sum of [amount in words & figures as prescribed in the bidding documents] for which payment well and truly to be made to the said Entity the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____ 20____.

THE CONDITIONS of this obligation are that:

- 1) if the Bidder withdraws his Bid during the period of bid validity specified in the Bidding Documents; or
- 2) if the Bidder does not accept the correction of arithmetical errors of his bid price in accordance with the Instructions to Bidder; or
- 3) if the Bidder, having determined as the LCB, fails or refuses to submit the required tax clearance, latest income and business tax returns and PhilGEPs registration certificate within the prescribed period; or
- 4) if the Bidder having been notified of the acceptance of his bid and award of contract to him by the Entity during the period of bid validity:
 - a) fails or refuses to execute the Contract; or
 - b) fails or refuses to submit the required valid JVA, if applicable; or
 - c) fails or refuses to furnish the Performance Security in accordance with the Instructions to Bidders;

we undertake to pay to the Entity up to the above amount upon receipt of his first written demand, without the Entity having to substantiate its demand, provided that in his demand the Entity will note that the amount claimed by it is due to the occurrence of any one or combination of the four (4) conditions stated above.

The Guarantee will remain in force up to 120 days after the opening of bids or as it may be extended by the Entity, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE _____ SIGNATURE OF THE BANK _____

WITNESS _____ SEAL _____

(Signature, Name and Address)

Standard Form Number: NPCSF-INFR-06b

FORM OF BID SECURITY (SURETY BOND)

BOND NO.: _____ DATE BOND EXECUTED: _____

By this bond, We (Name of Bidder) _____ (hereinafter called "the Principal") and (Name of Surety) _____ of (Name of Country of Surety) _____, authorized to transact business in the Philippines (hereinafter called "the Surety") are held and firmly bound unto National Power Corporation (hereinafter called "the Employer") as Obligee, in the sum of (amount in words & figures as prescribed in the bidding documents), callable on demand, for the payment of which sum, well and truly to be made, we, the said Principal and Surety bind ourselves, our successors and assigns, jointly and severally, firmly by these presents.

SEALED with our seals and dated this _____ day of _____, 20 _____

WHEREAS, the Principal has submitted a written Bid to the Employer dated the _____ day of _____, 20 _____, for the _____ (hereinafter called "the Bid").

NOW, THEREFORE, the conditions of this obligation are:

- 1) if the Bidder withdraws his Bid during the period of bid validity specified in the Bidding Documents; or
- 2) if the Bidder does not accept the correction of arithmetical errors of his bid price in accordance with the Instructions to Bidder; or
- 3) if the Bidder, having determined as the LCB, fails or refuses to submit the required tax clearance, latest income and business tax returns and PhilGEPs registration certificate within the prescribed period; or
- 4) if the Bidder having been notified of the acceptance of his bid and award of contract to him by the Entity during the period of bid validity:
 - d) fails or refuses to execute the Contract; or
 - e) fails or refuses to submit the required valid JVA, if applicable; or
 - f) fails or refuses to furnish the Performance Security in accordance with the Instructions to Bidders;

then this obligation shall remain in full force and effect, otherwise it shall be null and void.

PROVIDED HOWEVER, that the Surety shall not be:

- a) liable for a greater sum than the specified penalty of this bond, nor
- b) liable for a greater sum than the difference between the amount of the said Principal's Bid and the amount of the Bid that is accepted by the Employer.

Standard Form Number: NPCSF-INFR-06b
Page 2 of 2

This Surety executing this instrument hereby agrees that its obligation shall be valid for 120 calendar days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Surety is hereby waived.

PRINCIPAL _____ SURETY _____

SIGNATURE(S) _____ SIGNATURES(S) _____

NAME(S) AND TITLE(S) _____ NAME(S) _____

SEAL _____ SEAL _____

Standard Form No: NPCSF-INFR-06c

REPUBLIC OF THE PHILIPPINES)
CITY OF _____) S.S.

BID-SECURING DECLARATION
SUPPLY AND ERECTION/INSTALLATION OF TAP-USON 69KV TRANSMISSION LINE
PROJECT
LuzP22Z1468Sdg

To: **National Power Corporation**
BIR Road cor. Quezon Ave.
Diliman, Quezon City

I/We¹, the undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Bid Security, which may be in the form of a Bid-Securing Declaration.
2. I/We accept that: (a) I/we will be automatically disqualified from bidding for any contract with any procuring entity for a period of two (2) years upon receipt of your Blacklisting Order; and, (b) I/we will pay the applicable fine provided under Section 6 of the Guidelines on the Use of Bid Securing Declaration, within fifteen (15) days from receipt of the written demand by the Procuring Entity for the commission of acts resulting to the enforcement of the Bid Securing Declaration under Sections 23.1 (b), 34.2, 40.1 and 69.1, except 69.1 (f) of the IRR of R.A. 9184; without prejudice to other legal action the government may undertake.
3. I/We understand that this Bid-Securing Declaration shall cease to be valid on the following circumstances:
 - (a) Upon expiration of the bid validity period, or any extension thereof pursuant to your request;
 - (b) I am/we are declared ineligible or post-disqualified upon receipt of your notice to such effect, and (i) I/we failed to timely file a request for reconsideration or (ii) I/we filed a waiver to avail of said right;
 - (c) I am/we are declared as the bidder with the Lowest Calculated and Responsive Bid, and I/we have furnished the performance security and signed the Contract.

IN WITNESS WHEREOF, I/we have hereunto set my hand this ____ day of ____
20____ at _____, Philippines.

*[Name and Signature of Bidder's Representative/
Authorized Signatory]/ [Signatory's legal capacity]*
Affiant

[Jurat]

[Format shall be based on the latest Rules on Notarial Practice]

¹ Select one and delete the other. Adopt same instruction for similar terms throughout the document.

Standard Form No: NPCSF-INFR-07b

Omnibus Sworn Statement (Revised)

**REPUBLIC OF THE PHILIPPINES)
CITY/MUNICIPALITY OF _____) S.S.**

AFFIDAVIT

I, [Name of Affiant], of legal age, [Civil Status], [Nationality], and residing at [Address of Affiant], after having been duly sworn in accordance with law, do hereby depose and state that:

1. *[Select one, delete the other:]*

[If a sole proprietorship:] I am the sole proprietor or authorized representative of [Name of Bidder] with office address at [address of Bidder];

[If a partnership, corporation, cooperative, or joint venture:] I am the duly authorized and designated representative of [Name of Bidder] with office address at [address of Bidder];

2. *[Select one, delete the other:]*

[If a sole proprietorship:] As the owner and sole proprietor, or authorized representative of [Name of Bidder], I have full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for [Name of the Project] of the [Name of the Procuring Entity], as shown in the attached duly notarized Special Power of Attorney;

[If a partnership, corporation, cooperative, or joint venture:] I am granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for [Name of the Project] of the [Name of the Procuring Entity], as shown in the attached [state title of attached document showing proof of authorization (e.g., duly notarized Secretary's Certificate, Board/Partnership Resolution, or Special Power of Attorney, whichever is applicable);];

3. [Name of Bidder] is not "blacklisted" or barred from bidding by the Government of the Philippines or any of its agencies, offices, corporations, or Local Government Units, foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the Government Procurement Policy Board, by itself or by relation, membership, association, affiliation, or controlling interest with another blacklisted person or entity as defined and provided for in the Uniform Guidelines on Blacklisting;

4. Each of the documents submitted in satisfaction of the bidding requirements is an authentic copy of the original, complete, and all statements and information provided therein are true and correct;

5. [Name of Bidder] is authorizing the Head of the Procuring Entity or its duly authorized representative(s) to verify all the documents submitted;

6. *[Select one, delete the rest:]*

[If a sole proprietorship:] The owner or sole proprietor is not related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

[If a partnership or cooperative:] None of the officers and members of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

[If a corporation or joint venture:] None of the officers, directors, and controlling stockholders of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

7. *[Name of Bidder]* complies with existing labor laws and standards; and
8. *[Name of Bidder]* is aware of and has undertaken the responsibilities as a Bidder in compliance with the Philippine Bidding Documents, which includes:
 - a. Carefully examining all of the Bidding Documents;
 - b. Acknowledging all conditions, local or otherwise, affecting the implementation of the Contract;
 - c. Making an estimate of the facilities available and needed for the contract to be bid, if any; and
 - d. Inquiring or securing Supplemental/Bid Bulletin(s) issued for the *[Name of the Project]*.
9. *[Name of Bidder]* did not give or pay directly or indirectly, any commission, amount, fee, or any form of consideration, pecuniary or otherwise, to any person or official, personnel or representative of the government in relation to any procurement project or activity.
10. In case advance payment was made or given, failure to perform or deliver any of the obligations and undertakings in the contract shall be sufficient grounds to constitute criminal liability for Swindling (Estafa) or the commission of fraud with unfaithfulness or abuse of confidence through misappropriating or converting any payment received by a person or entity under an obligation involving the duty to deliver certain goods or services, to the prejudice of the public and the government of the Philippines pursuant to Article 315 of Act No. 3815 s. 1930, as amended, or the Revised Penal Code.

IN WITNESS WHEREOF, I have hereunto set my hand this __ day of __, 20__ at _____, Philippines.

[Insert NAME OF BIDDER OR ITS AUTHORIZED REPRESENTATIVE]
[Insert signatory's legal capacity]
Affiant

[Jurat]
[Format shall be based on the latest Rules on Notarial Practice]

Standard Form Number: NPCSF-INFR-08

CONTRACTOR'S ORGANIZATIONAL CHART FOR THE CONTRACT

Submit Copy of the Organizational Chart that the Contractor intends to use to execute the Contract if awarded to him. Indicate in the chart the names of the Project Manager, Project Engineer, Foreman and other Key Engineering Personnel.

Attach the required Proposed Organizational Chart for the Contract as stated above

NOTES:

1. *This organization chart should represent the "Contractor's Organization" required for the Project, and not the organizational chart of the entire firm.*
2. *Each such nominated engineer/key personnel shall comply with and submit duly accomplished forms NPCSF-INFR-10a, NPCSF-INFR-10b and NPCSF-INFR-11.*
3. *All these are required to be in the Technical Envelope of the Bidder.*

Standard Form Number: NPCSF-INFR-09

LIST OF KEY PERSONNEL PROPOSED TO BE ASSIGNED TO THE CONTRACT
(Based on the Minimum Key Personnel Required in the Bidding Documents)

Business Name: _____
 Business: _____

	DESIGNATION				
1 Name					
2 Address					
3 Date of Birth					
4 Employed Since					
5 Experience					
6 Previous Employment					
7 Education					
8 PRC License					

Required Attachments:

1. Certificate of Employment, Bio Data and Construction Safety and Health Training Certificate of the Safety Officer
2. Certificate of Employment, Bio Data and valid PRC License of the (professional) personnel

Submitted by: _____
 (Printed Name & Signature)

Designation: _____

Date: _____

One of the requirements from the bidder to be included in its Technical Envelope is a list of contractor's key personnel (based on the minimum key personnel required in the bidding documents) to be assigned to the contract to be bid, with their complete qualification and experience data (including the key personnel's signed written commitment to work for the project once awarded the contract).

Standard Form Number: NPCSF-INFR-10a

**KEY PERSONNEL'S CERTIFICATE OF EMPLOYMENT
(PROFESSIONAL PERSONNEL)**

Issuance Date

THE PRESIDENT

National Power Corporation
BIR Road cor. Quezon Ave.
Diliman, Quezon City

Dear Sir:

I am (Name of Nominee) a Licensed _____ Engineer with Professional License No. _____ issued on (date of issuance) at (place of issuance).

I hereby certify that (Name of Bidder) has engaged my services as (Designation) for the (Name of Project), if awarded to it.

As (Designation), I supervised the following completed projects similar to the contract under bidding:

NAME OF PROJECT	OWNER	COST	DATE COMPLETED
_____	_____	_____	_____

At present, I am supervising the following projects:

NAME OF PROJECT	OWNER	COST	DATE COMPLETED
_____	_____	_____	_____

In case of my separation for any reason whatsoever from the above-mentioned Contractor, I shall notify the National Power Corporation at least twenty one (21) days before the effective date of my separation.

As (Designation), I know I will have to stay in the job site all the time to supervise and manage the Contract works to the best of my ability, and aware that I am authorized to handle only one (1) contract at a time.

I do not allow the use of my name for the purpose of enabling the above-mentioned Contractor to qualify for the Contract without any firm commitment on my part to assume the post of (Designation) therefor, if the contract is awarded to him since I understand that to do so will be a sufficient ground for my disqualification as (Designation) in any future National Power Corporation bidding or employment with any Contractor doing business with the National Power Corporation.

(Name and Signature)
AFFIANT

[Jurat]

[Format shall be based on the latest Rules on Notarial Practice]

One of the requirements from the bidder to be included in its Technical Envelope is a list of contractor's key personnel (viz. Project Manager, Project Engineer, Construction Safety Officer, Foremen, etc), to be assigned to the contract to be bid, with their complete qualification and experience data (including the key personnel's signed written commitment to work for the project once awarded the contract).

Standard Form Number: NPCSF-INFR-10b

**KEY PERSONNEL'S CERTIFICATE OF EMPLOYMENT
(CONSTRUCTION SAFETY AND HEALTH OFFICER)**

Issuance Date

THE PRESIDENT

National Power Corporation
BIR Road cor. Quezon Ave.
Diliman, Quezon City

Dear Sir:

I am (Name of Nominee) an Construction Safety & Health Officer with Certificate No. _____ issued on (date of issuance) at (place of issuance).

I hereby certify that (Name of Bidder) has engaged my services as Construction Safety & Health Officer for the (Name of Project), if awarded to it.

I am the Construction Safety & Health Officer of the following completed projects similar to the contract under bidding:

NAME OF PROJECT	OWNER	COST	DATE COMPLETED
_____	_____	_____	_____

At present, I am the Construction Safety & Health Officer of the following projects:

NAME OF PROJECT	OWNER	COST	DATE COMPLETED
_____	_____	_____	_____

In case of my separation for any reason whatsoever from the above-mentioned Contractor, I shall notify the National Power Corporation at least twenty one (21) days before the effective date of my separation.

As Construction Safety & Health Officer, I know I will have to stay in the job site all the time and aware that I am authorized to handle only one (1) contract at a time.

I do not allow the use of my name for the purpose of enabling the above-mentioned Contractor to qualify for the Contract without any firm commitment on my part to assume the post of Construction Safety & Health Officer, if the contract is awarded to him since I understand that to do so will be a sufficient ground for my disqualification as Construction Safety & Health Officer in any future National Power Corporation bidding or employment with any Contractor doing business with the National Power Corporation.

(Name and Signature)
AFFIANT

[Jurat]

[Format shall be based on the latest Rules on Notarial Practice]

One of the requirements from the bidder to be included in its Technical Envelope is a list of contractor's key personnel (viz. Project Manager, Project Engineer, Construction Safety Officer, Foremen, etc), to be assigned to the contract to be bid, with their complete qualification and experience data (including the key personnel's signed written commitment to work for the project once awarded the contract).

Standard Form Number: NPCSF-INFR-11

**KEY PERSONNEL
(FORMAT OF BIO-DATA)**

Give the detailed information of the following personnel who are scheduled to be assigned as full-time field staff for the project. Fill up a form for each person.

1. Name : _____
2. Date of Birth : _____
3. Nationality : _____
4. Education and Degrees : _____
5. Specialty : _____
6. Registration : _____
7. Length of Service with the Firm : _____ Year from _____ (months) _____ (year)
To _____ (months) _____ (year)
8. Years of Experience : _____
9. If Item 7 is less than ten (10) years, give name and length of service with previous employers for a ten (10)-year period (attached additional sheet/s), if necessary:

Name and Address of Employer

Length of Service

_____	_____ year(s) from _____ to _____
_____	_____ year(s) from _____ to _____
_____	_____ year(s) from _____ to _____

10. Experience:

This should cover the past ten (10) years of experience. (Attached as many pages as necessary to show involvement of personnel in projects using the format below).

1. Name : _____
2. Name and Address of Owner : _____
3. Name and Address of the
Owner's Engineer
(Consultant) : _____
4. Indicate the Features of Project
(particulars of the project
components and any other particular
interest connected with the project): _____
5. Contract Amount Expressed in
Philippine Currency : _____
6. Position : _____
7. Structures for which the employee
was responsible : _____
8. Assignment Period : from _____ (months) _____ (years)
: to _____ (months) _____ (years)

Name and Signature of Employee

It is hereby certified that the above personnel can be assigned to this project, if the contract is awarded to our company.

(Place and Date)

(The Authorized Representative)

One of the requirements from the bidder to be included in its Technical Envelope is a list of contractor's key personnel (viz. Project Manager, Project Engineer, Construction Safety Officer, Foremen, etc), to be assigned to the contract to be bid, with their complete qualification and experience data (including the key personnel's signed written commitment to work for the project once awarded the contract).

Standard Form Number: NPCSF-INFR-12

LIST OF EQUIPMENT, OWNED OR LEASED AND/OR UNDER PURCHASE AGREEMENTS
(Based on the Minimum Equipment Required in the Bidding Documents)

Business Name: _____
 Business: _____

Description	Model/Year	Capacity / Performance / Size	Plate No.	Motor No. / Body No.	Location	Condition	Proof of Ownership / Lessor or Vendor
A. Owned							
i.							
ii.							
iii.							
iv.							
v.							
B. Leased							
i.							
ii.							
iii.							
iv.							
v.							
C. Under Purchase Agreements							
i.							
ii.							
iii.							
iv.							
v.							

Submitted by: _____
 (Printed Name & Signature)
 Designation: _____
 Date: _____

One of the requirements from the bidder to be included in its Technical Envelope is the list of its equipment units pledged for the contract to be bid, based on minimum equipment required in the bidding docs. which are owned (supported by proof/s of ownership), leased, and/or under purchase agreements (with corresponding engine numbers, chassis numbers and/or serial numbers), supported by certification of availability of equipment from the equipment lessor/vendor for the duration of the project

Standard Form No. : NPCSF-INFR-13

BID LETTER

Date: _____

To: **THE PRESIDENT**
National Power Corporation
BIR Road cor. Quezon Ave.
Diliman, Quezon City

We, the undersigned, declare that:

(a) We have examined and have no reservation to the Bidding Documents, including Addenda, for the Contract **SUPPLY AND ERECTION/INSTALLATION OF TAP-USON 69KV TRANSMISSION LINE PROJECT (LuzP22Z1468Sdg)**.

(b) We offer to execute the Works for this Contract in accordance with the Bid Documents, Technical Specifications, General and Special Conditions of Contract accompanying this Bid;

The total price of our Bid, excluding any discounts offered below is: [insert information]

The discounts offered and the methodology for their application are: [insert information]

(c) Our Bid shall be valid for a period of [insert number] days from the date fixed for the Bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(d) If our Bid is accepted, we commit to obtain a Performance Security in the amount of [insert percentage amount] percent of the Contract Price for the due performance of the Contract;

(e) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from the following eligible countries: [insert information];

(f) We are not participating, as Bidders, in more than one Bid in this bidding process, other than alternative offers in accordance with the Bidding Documents;

(g) Our firm, its affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, has not been declared ineligible by the Funding Source;

(h) We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal Contract is prepared and executed; and

(i) We understand that you are not bound to accept the Lowest Calculated Bid or any other Bid that you may receive.

(j) We likewise certify/confirm that the undersigned, is the duly authorized representative of the bidder, and granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for the **SUPPLY AND ERECTION/INSTALLATION OF**

TAP-USON 69KV TRANSMISSION LINE PROJECT (LuzP22Z1468Sdg) of the
National Power Corporation.

- (k) We acknowledge that failure to sign each and every page of this Bid Letter, including the Bill of Quantities, shall be a ground for the rejection of our bid.

Name: _____

In the capacity of: _____

Signed: _____

Duly authorized to sign the Bid for and on behalf of: _____

Date: _____

Standard Form No. : NPCSF-INFR-15

**SUMMARY SHEETS OF MATERIALS PRICES, LABOR RATES
AND EQUIPMENT RENTAL RATES**

Name of Bidder : _____

I. Unit Prices of Materials

Materials Description	Unit	Unit Price
1.		
2.		
3.		
4.		
5.		
6.		
7.		

II. Manpower Hourly Rates

Designation	Rate/Hr.
1.	
2.	
3.	
4.	
5.	
6.	
7.	

III. Equipment Hourly Rental Rates

Equipment Description	Rental Rate/Hr.
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Name, Signature of Authorized Representative

Designation

SECTION IX

BID DRAWINGS



SECTION X

ANNEXES



POLE No.	STATION		SPAN (metres)		DEVIATION ANGLE	POLE		ELEV. LEVEL (m.)	GUYING ARRANGEMENT	CONDUCTOR			OHGW			Plan & Profile Sheet No.	REMARKS
	(km.)	No. (meter)	Actual (Forward)	Wind		Vertical	Type			Height	Sus. String	Ten. String	Jumper String	Vibration Damper	Sus. Assembly		
MC 192																	
MC 192A			71.40				Ecc	55									
MC 193	0+		65.00				Dcc	60									Existing Pole Structure (Mobo-Cataingan T/L)
TU 1		129.15	129.15				Dcc	60									Additional (Intermediate Pole along MC Line)
TU 2		235.70	106.55				Ecc	60									Replacement for extracted 3D-50 used as Tapping Point (see Dwg.)
TU 3		294.46	58.76				Ecc	50									Crossing Creek
TU 4		359.10	64.64				Ccc	60									Crossing Road & Sag of Wire
TU 5		501.42	142.32				3Dec	50									Crossing Creek
TU 6		590.30	88.88				Ecc	55									Crossing Creek
TU 7		686.16	95.87				Ecc	55									Crossing Creek
TU 8		764.66	78.49				Ecc	60									Crossing Creek
TU 9		890.11	125.46				Ecc	55									Crossing Creek
TU 10		989.33	99.22				Ccc	60									Crossing Creek
TU 11	1+	63.13	73.80				Dcc	60									Crossing Creek
TU 12		159.16	96.03				Ecc	55									Crossing Creek
GANTRY		181.19	22.03														

NATIONAL POWER CORPORATION
Diliman, Quezon City

STRUCTURE LIST
SUPPLY AND ERECTION/INSTALLATION OF
TAP-USON 69KV TRANSMISSION LINE

PROJECT
(LuzP22Z14685dg)

Prepared by: *B. MAGUILA* Principal Engineer, A

Recommended by: *C. LUGOD, JR.* Division Manager, EEICD

Date: _____

Prepared by: *A.C. ESPERITU* Division Manager, CEAD

Recommended by: _____

Date: _____

Notes:

- For Type "C" Structure, Suspension Clamp with Socket Connector is to be used for Conductor String Assembly & Suspension Clamp with Anchor Shackle is to be used for Ground String Assembly.
- All Pole Structures are direct burial steel poles with Concrete Encasement.
- Use modified steel pole structure type "D" for Structure No. MC-193, (see Bid Drawing No. TU-BDE-04-006)

BID DRAWINGS**TABLE OF CONTENTS**

ITEM NO.	DRAWING TITLE	DRAWING NO.
1	69KV TRANSMISSION LINE GENERAL DESIGN DATA	TU-BDE-04-001
2	69KV STEEL POLE CONSTRUCTION TYPE "C" SINGLE POLE/SINGLE CIRCUIT	TU-BDE-04-002
3	69KV STEEL POLE CONSTRUCTION TYPE "D" SINGLE POLE/SINGLE CIRCUIT	TU-BDE-04-003
4	69KV STEEL POLE CONSTRUCTION TYPE "E" SINGLE POLE/SINGLE CIRCUIT	TU-BDE-04-004
5	69KV STEEL POLE CONSTRUCTION TYPE "3D" THREE POLE/SINGLE CIRCUIT	TU-BDE-04-005
6	MODIFIED 69KV STEEL POLE CONSTRUCTION TYPE "D" (FOR REPLACEMENT OF MC-194)	TU-BDE-04-006
7	69KV TRANSMISSION LINE CONSTRUCTION DETAILS	TU-BDE-04-007
8	69KV TRANSMISSION LINE STEEL POLE CROSS ARM DRILLING GUIDE	TU-BDE-04-008
9	69KV STEEL POLE WITH CONCRETE ENCASEMENT GROUNDING DETAILS	TU-BDE-04-009
10	69KV STEEL POLE (ELEVATION, SECTION & DETAILS)	TU-BDC-04-001
11	STEEL POLE CONCRETE ENCASEMENT (PLAN,ELEVATION & DETAILS)	TU-BDC-04-002
12	69KV STEEL POLE & CONCRETE ENCASEMENT (DESCRIPTION & CHART/DETAILS)	TU-BDC-04-003

GENERAL DESIGN DATA

1. VOLTAGE 69 KV

2. CONDUCTORS AND WIRES

CONDUCTORS AND WIRES	CONDUCTORS		OVERHEAD GROUND WIRE (OHGW)		GUY WIRE		STRUCTURE GROUND WIRE	
TYPE & SIZE	ACSR/AW, 336.4 MCM (LINNET)		3/8" HIGH GRADE STEEL GALVANIZED		7/16" HIGH STRENGTH GRADE STEEL GALVANIZED		3/8" ORDINARY GRADE STEEL GALVANIZED	
STRANDING	26/7		7-strand		7-strand		7-strand	
OUTSIDE DIAMETER	18.3 mm.	0.721 inch	9.525 mm.	0.375 inch	11 mm.	0.435 inch	9.525 mm.	0.375 inch
AREA	198.3 mm ²	0.3072 in. ²	51.1mm. ²	0.0792 in. ²	74.6 mm. ²	0.1155 in. ²	51.1 mm. ²	0.0792 in. ²
WEIGHT	0.889 $\frac{kg}{m}$	0.463 $\frac{lb.}{ft.}$	0.406 $\frac{kg}{m}$	0.273 $\frac{lb.}{ft.}$	0.594 $\frac{kg}{m}$	0.399 $\frac{lb.}{ft.}$	0.406 $\frac{kg}{m}$	0.273 $\frac{lb.}{ft.}$
ULTIMATE STRENGTH	8,366 kg.	14,050 lbs.	4,900 kg.	10,800 lbs.	6,375 kg.	14,500 lbs.	1,929 kg.	4,250 lbs.

3. MAXIMUM LOADING:

TEMPERATURE _____ 20 °C (68 °F)
WIND VELOCITY _____ 240 KPH

4. TENSION LIMITS (% OF ULTIMATE TENSILE STRENGTH):

	UNLOADED FINAL AT 20 °C (68 °F)	LOADED FINAL AT 20 °C (68 °F)
CONDUCTOR	20	40
OVERHEAD GROUND WIRE	20	40
INSULATOR ASSEMBLY		50 M & E

5. SPAN LIMITATIONS (METERS):

STRUCTURE TYPE	SINGLE POLE SINGLE CIRCUIT				H - FRAME SINGLE CIRCUIT		3-POLE SINGLE CIRCUIT	
	B	C	D	E	HS	HT	3T	3D
WIND SPAN	120	120	120	120	220	220	320	320
WEIGHT SPAN	160	180	170	180				
MAX. SPAN	130	130	130	130	320	320	375	375
ANGLE	0-2° 15-30°		30-90° 0-15°		0-2°	2-15°	15-30°	30-90°

NOTE: TO BE USED ONLY DURING ERECTION AND NOT FOR THE DESIGN OF CONCRETE POLE

6. CLEARANCES, VALUES STRICTLY MINIMUM:

CROSSING OVER AT 50.0 °C (122 °F) NO WIND, FINAL SAG	CLEARANCE
TRACK RAILS OF RAILROADS	11.5 m.
PUBLIC STREETS AND HIGHWAYS	10.0 m.
RURAL ROAD	8.50 m.
CULTIVATED FIELDS, AREA ACCESSIBLE ONLY TO PEDESTRIANS	7.50 m.
ALONG ROADS IN RURAL DISTRICTS	In accordance with PEC
ALL OTHER TYPES OF OBSTRUCTION	Part II latest edition.

7. FOR STEEL POLE WITH CONCRETE ENCASEMENT _____ Refer to Dwg. No. _____

8. CROSSARMS AND BRACES:

MATERIAL _____ GALVANIZED STEEL
GALVANIZING ACCORDING TO _____ ASTM A123

9. STEEL POLE DATA _____ Refer to NPC Std. Specifications

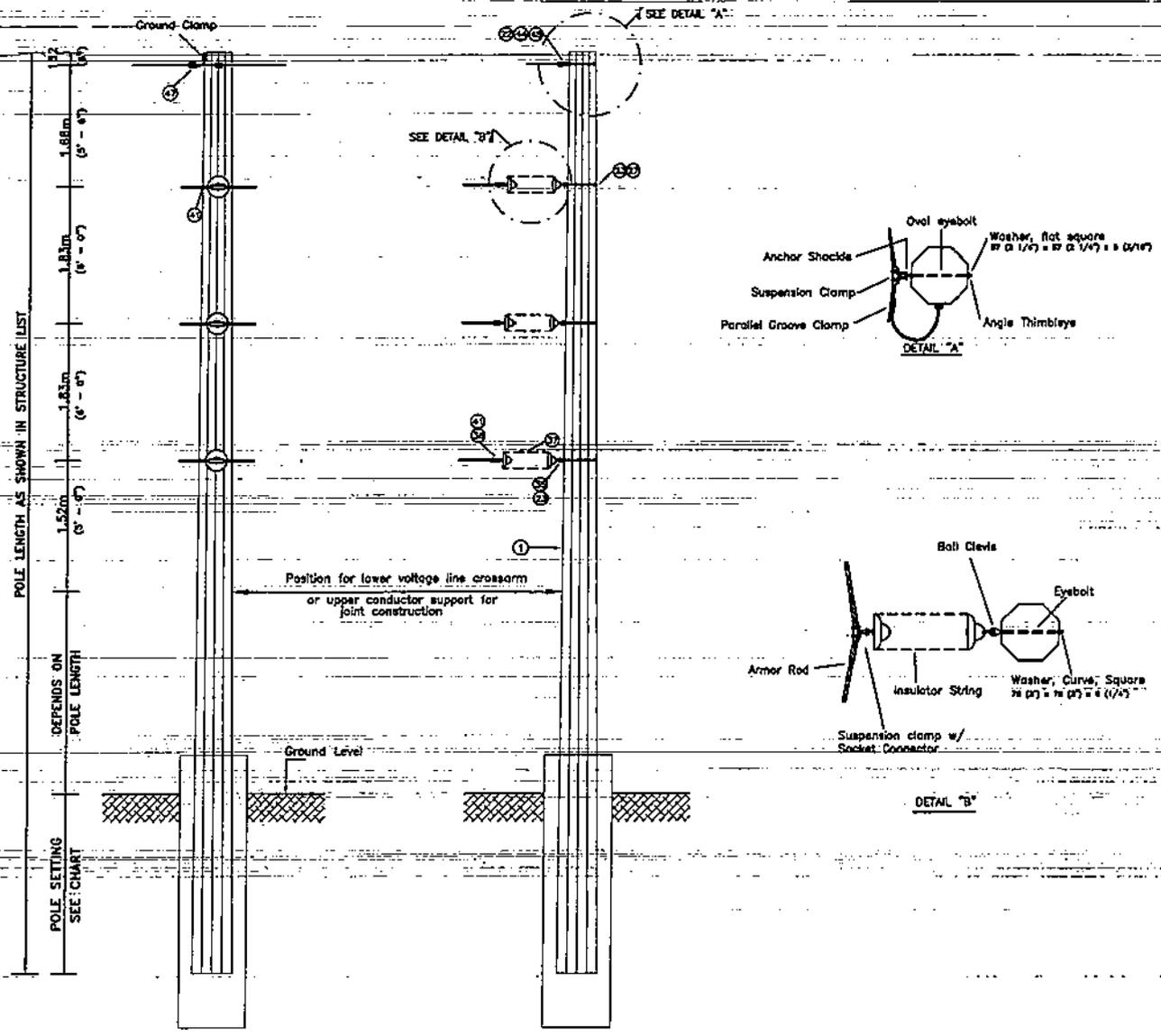
10. POLE SETTING:

LENGTH OF POLE	DEPTH OF POLE SETTING				
	IN EARTH		IN ROCK		
METER	FEET	METER	FEET	METER	FEET
13.72	45	1.98	6.50	1.37	4.50
15.24	50	2.13	7.00	1.52	5.00
16.76	55	2.29	7.50	1.68	5.50
18.29	60	2.44	8.00	1.83	6.00
19.81	65	2.59	8.50	1.98	6.50
21.34	70	2.74	9.00	2.13	7.00
22.86	75	2.90	9.50	2.29	7.50
24.38	80	3.05	10.00	2.44	8.00
25.91	85	3.20	10.50	2.59	8.50
27.43	90	3.35	11.00	2.74	9.00

OWNER				NATIONAL POWER CORPORATION	
				AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP-USON 69KV TRANSMISSION LINE PROJECT					
LOCATION: USON, MARBATE					
TITLE: 69KV, STEEL TRANSMISSION LINE GENERAL DESIGN DATA					
DESIGNED	BY	CHKD	DATE	SUBMITTED	
DRAWN	BY				B. M. AGUILA Principal Engineer, ESDO
REVIEWED	PRINCIPAL ENGR. / ARCHT.			RECOMMENDED	C. C. LUCOD, JR. Manager, ESDO
CIVIL/ARCHT				APPROVED	R. G. SOMEREBERRA Manager, DDO
ELEC.					
MECH.					
DWG. NO. TU-BDE-04-001			SPECS NO. LUZP22Z1468Sdg		
REV.	DATE	NATURE OF REVISION	BY	CHKD	RECD. APPD.
SCALE: N.T.S.				BID DRAWING	
				REV. 0	

BILL OF MATERIALS		
ITEM NO.	DESCRIPTION	QTY.
1	Steel Pole	1
22	Eyebolt, Oval, 16 (5/8) x 306 (12)	1
23	Eyebolt, Oval, 16 (5/8) x 406 (16)	3
27	Washer, Curve, Square 76 (3) x 76 (3) x 6 (1/4) for 16 (5/8) Dia. Bolt	3
29	Washer, Flat, Square, 57 (2 1/4) x 57 (2 1/4) x 5 (3/16) w/ .12 (11/16) Dia. Hole	1
35	Ball Clevis	3
37	Insulator, Suspension, Ball & Socket Type, 146 (5 3/4) x 254 (10)	1
38	Clamp, Suspension, with Socket Connector (over A. R.)	3
41	Armor Rod, Pre-Formed or tapered for ACSR "UNNET" (per set)	3
44	Anchor Shackle, 14 (9/16) with 16 (5/8) Pin	1
45	Clamp, suspension for OHW	1 ^M
47	Clamp, Parallel Groove, 2-bolt for OHW	1 ^M

- NOTES:
1. * - Number of insulator shall be as per Technical Data Sheets.
 2. M - Refer to Structure List for the required quantities for the particular structure. The quantities shown are on per single pole structure basis.
 3. Details for Reinforced Concrete Encasement shall be referred to Civil Drawings.



OWNER: NATIONAL POWER CORPORATION
 AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP USON
 69KV TRANSMISSION LINE PROJECT

LOCATION: USON, MASBATE

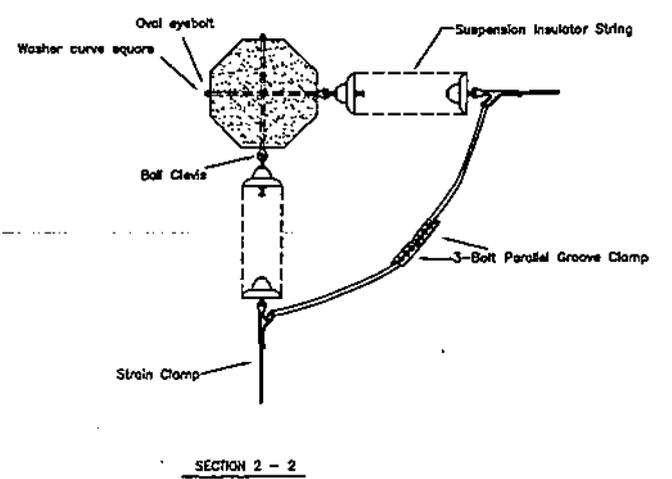
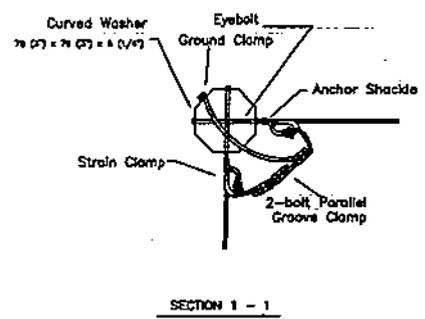
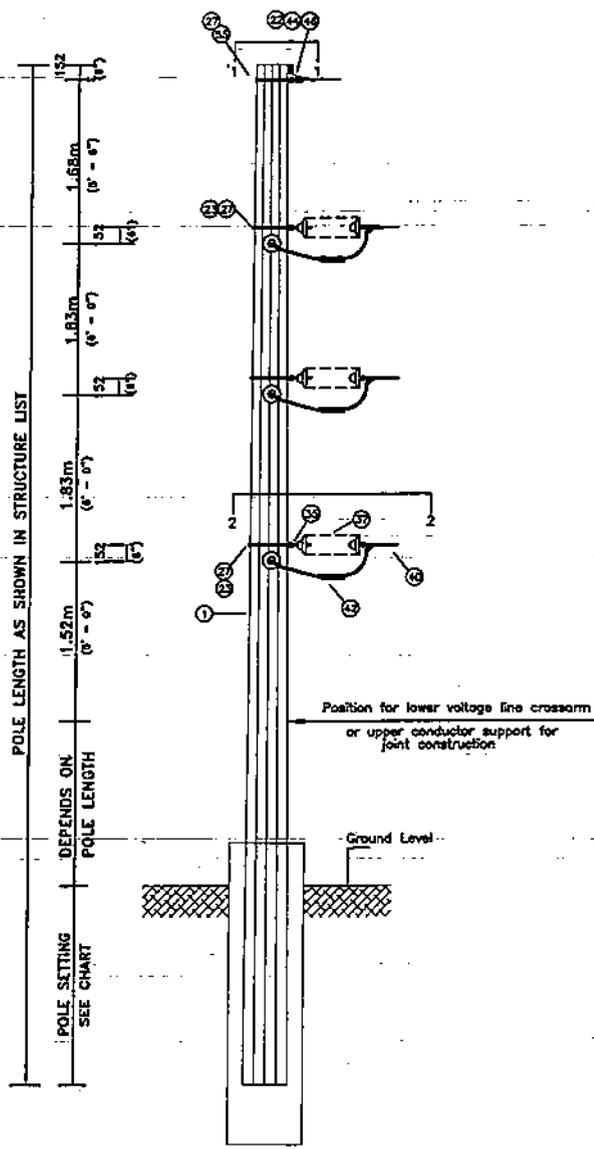
TITLE: 69KV STEEL POLE WITH CONCRETE
 ENCASEMENT CONSTRUCTION TYPE "C"
 SINGLE POLE/SINGLE CIRCUIT

DESIGNED	BY	CHKD	DATE	SUBMITTED	<i>B. M. AGUILA</i>
DRAWN	SLP			RECOMMENDED	<i>C. C. LUGOD, JR.</i>
REVIEWED	PRINCIPAL ENGR. / ARCHT.			APPROVED	<i>N. C. SERRA</i>
CIVIL/ARCHT					
ELEC					
MECH					

DWG. NO. TU-BDE-04-002 SPECS. NO. LuzP22Z1468Sdg

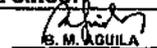
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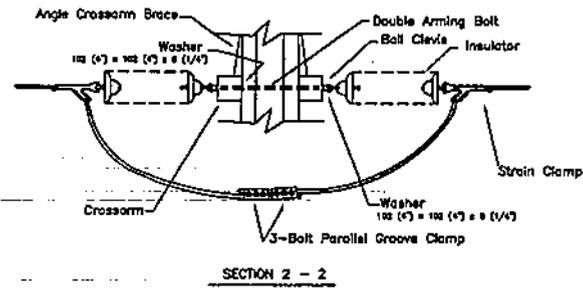
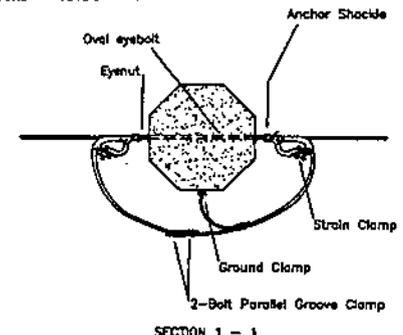
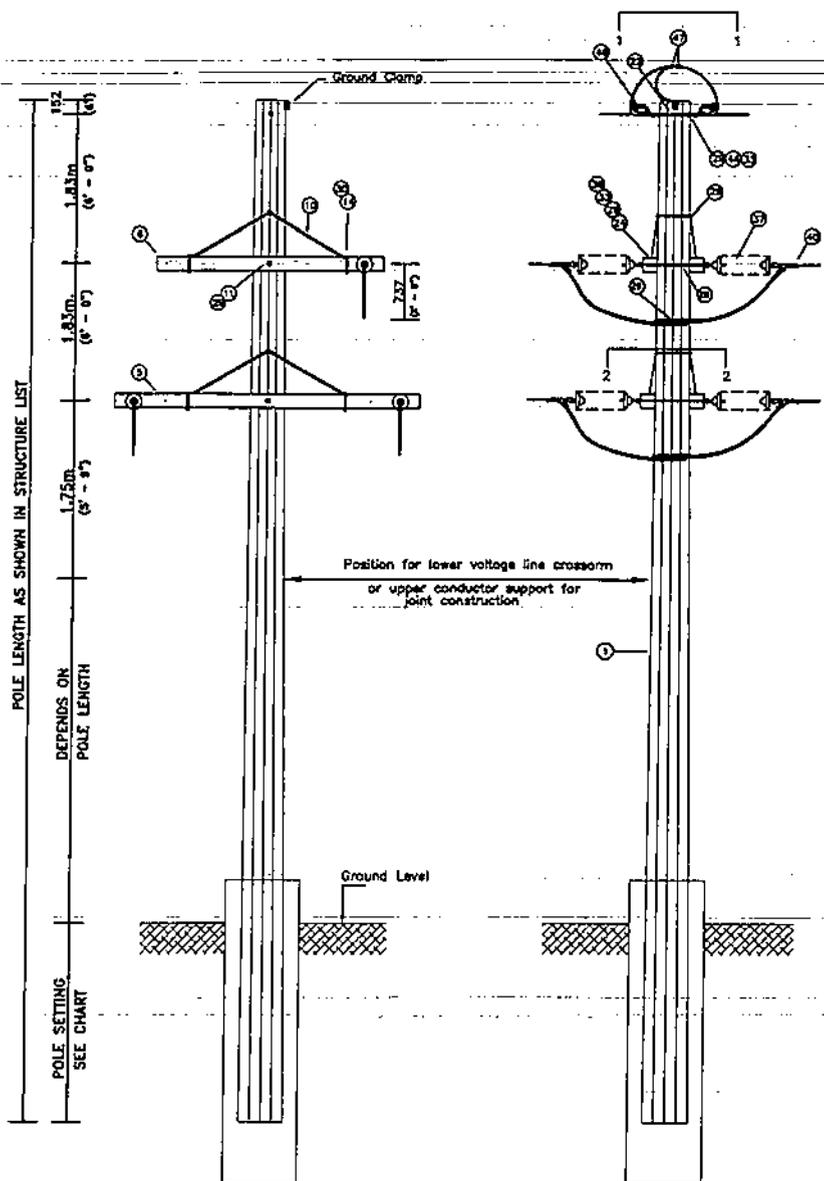
REV.	DATE	NATURE OF REVISION	BY	CHKD	REQD.	APPD.



BILL OF MATERIALS		
ITEM NO.	DESCRIPTION	QTY.
1	Steel Pole	1
22	Eyebolt, Oval, 18 (5/8") x 305 (12')	2
23	Eyebolt, Oval, 18 (5/8") x 406 (16')	6
27	Washer, Curve, Square 76 (3") x 76 (3") x 6 (1/4") for 16 (5/8") Dia. Bol.	8
35	Ball Clevis	6
37	Insulator, Suspension, Ball & Socket Type, 145 (5 3/4") x 254 (10')	1
40	Strain Clamp with Socket fitting for ACSR	6
42	Parallel Groove Clamp for ACSR	6
44	Anchor Shackle, 14 (9/16") with 15 (5/8") Pin	2
45	Strain Clamp, for OHGW	2**
47	Clamp, Parallel Groove, 2-bolt for OHGW	3**

- NOTES:
- * - Number of insulators shall be as per Technical Data Sheets.
 - ** - Refer to Structure List for the required quantities for the particular structure. The quantities shown are on per single pole structure basis.
 - Details for Reinforced Concrete Encasement shall be referred to Civil Drawings.

OWNER		 NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP-LINION 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MASBATE			
TITLE: 69KV STEEL POLE WITH CONCRETE ENCASEMENT CONSTRUCTION TYPE "D" SINGLE POLE/SINGLE CIRCUIT			
DESIGNED	BY	CHKD	DATE
DRAWN	ALF		
REVIEWED	PRINCIPAL ENGR. / ARCHT.	RECOMMENDED	
CIVIL/ARCHT			
ELEC.			
MECH.			
SUBMITTED:		 B. M. AQUILA Electrical Engineer, EDCO	
APPROVED:		 N. G. SOROSIETRA Manager, EDCO	
DWG NO. TU-BDE-04-003		SPEC. NO. LuzP22Z1468Sdg	
REV.	DATE	NATURE OF REVISION	BY
SCALE: N. T. S.	BID DRAWING		REV. 0

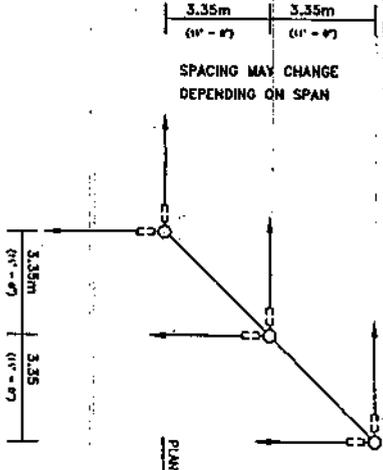
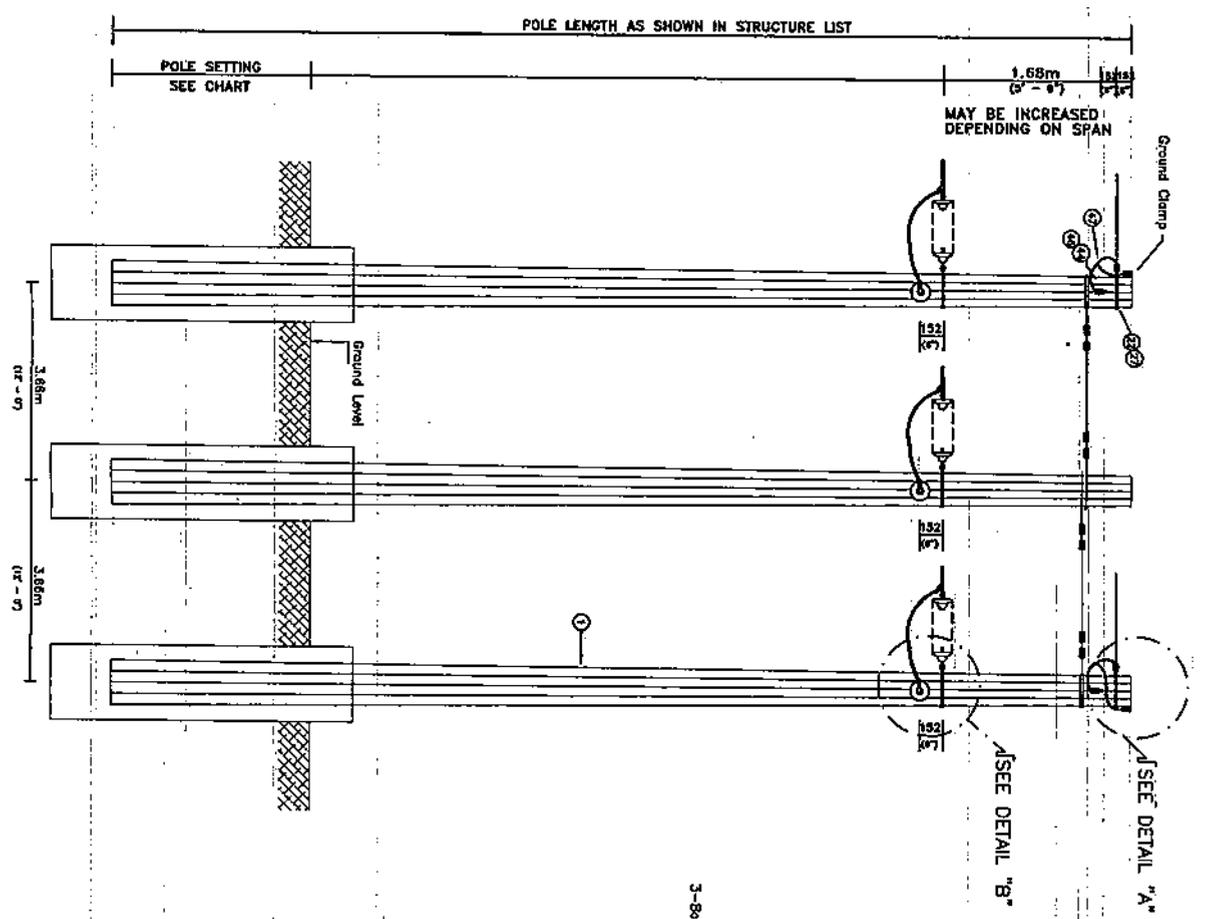


BILL OF MATERIALS		
ITEM NO.	DESCRIPTION	QTY.
1	Steel Pole	1
5	Steel Crossarm, BC 100 x 70 x 4 x 3.05m (10'-0")	2
6	Steel Crossarm, BC 100 x 70 x 4 x 2.44m (8'-0")	2
10	Angle Crossarm Brace, 44 (1 3/4) x 44 (1 3/4) x 5 (3/16)	4
11	Machine Bolt, 18 (5/8") x 558 (22)	2
13	Machine Bolt, 16 (5/8") x 305 (12)	2
14	Machine Bolt, 13 (1/2") x 203 (8)	8
22	Eyebolt, Oval, 16 (5/8") x 305 (12)	1
24	Double Arming Bolt, 16 (5/8") x 558 (22)	4
28	Washer, Flat, Square, 102 (4) x 102 (4) x 6 (1/4) for 16 (5/8) B Bolt	8
29	Washer, Flat, Square, 57 (2 1/4) x 57 (2 1/4) x 5 (3/16) w/ 17 (11/16) ID Hole	1
30	Washer, Round, for 13 (1/2) Dia. Bolt w/ 14 (9/16) Dia. Hole	8
33	Eyebolt for 16 (5/8) Dia. Bolt	4
35	Ball Clevis	6
37	Insulator, Suspension, Ball & Socket Type, 146 (5 3/4) x 254 (10")	4
40	Strain Clamp with Socket Filling for ACSR	6
44	Anchor Shackle, 14 (9/16") with 16 (5/8") Pin	2
46	Strain Clamp, for OHGW	2**
47	Clamp, Parallel Groove, 2-bolt for OHGW	3**
42	Parallel Groove Clamp for ACSR	6

- NOTES:
- * - Number of insulators shall be as per Technical Data Sheets.
 - ** - Refer to Structure List for the required quantities for the particular structure. The quantities shown are on per single pole structure basis.
 - Details for Reinforced Concrete Encasement shall be referred to Civil Drawings.

OWNER:		NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP-USON 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MASBATE			
TITLE: 69KV STEEL POLE WITH CONCRETE ENCASEMENT CONSTRUCTION TYPE "E" SINGLE POLE/SINGLE CIRCUIT			
DESIGNED	BY	CHKD	DATE
DRAWN	MLP		
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			
SUBMITTED:		 B. M. AGUILERA Chief Engineer - ELEC	
RECOMMENDED:		 P. C. LUGOD, JR. Chief Engineer - CIVIL	
APPROVED:		 R. G. SERRERA Chief Engineer - MECH.	
DWG. NO. TU-BDE-04-004		SPECS. NO. LuzP2221468Sdg	
SCALE: N. T. S.		BID DRAWING	
REV.	DATE	NATURE OF REVISION	BY

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



BILL OF MATERIALS
DESCRIPTION

ITEM NO.	DESCRIPTION	QTY.
1	Steel Pole	3
19	Eyebolt, Oval, 1 3/4" Dia. x 356 (14)	6
22	Eyebolt, Oval, 1 1/2" Dia. x 305 (12)	4
28	Anchor, Direct Square, 1/2" x 1/4" for 3/4" Dia. Bolt	6
27	Washer, Oval Square 7/8" x 7/8" (1) x 1/4" for 1/2" Dia. Bolt	4
35	Bolt, Oval	6
37	Insulator, Suspension, Ball & Socket Type, 145 (3) x 1/2" x 254 (10)	3
40	Strain clamp w/ oval fiber for ASB	6
42	Parallel Groove clamp for ASB	6
44	Anchor Shackle, 1 1/2" (3/16) with 1/2" (3/8) Pin	4
46	Strain Clamp for 8/16W	4
47	Clamp, Parallel Groove, 2-bolt for 8/16W	6

- NOTES:**
- Number of insulators shall be as per Technical Data Sheets.
 - Details for reinforced Concrete Foundation shall be referred to Civil Drawings.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPR.

SCALE: N.T.S. **BID DRAWING** REV. 0

OWNER:

NATIONAL POWER CORPORATION
 ASHMAN ROAD, DILIMAN, QUEZON CITY

PROJECT:
 SUPPLY & ERECTION/INSTALLATION OF TAP-USBN
 69KV TRANSMISSION LINE PROJECT

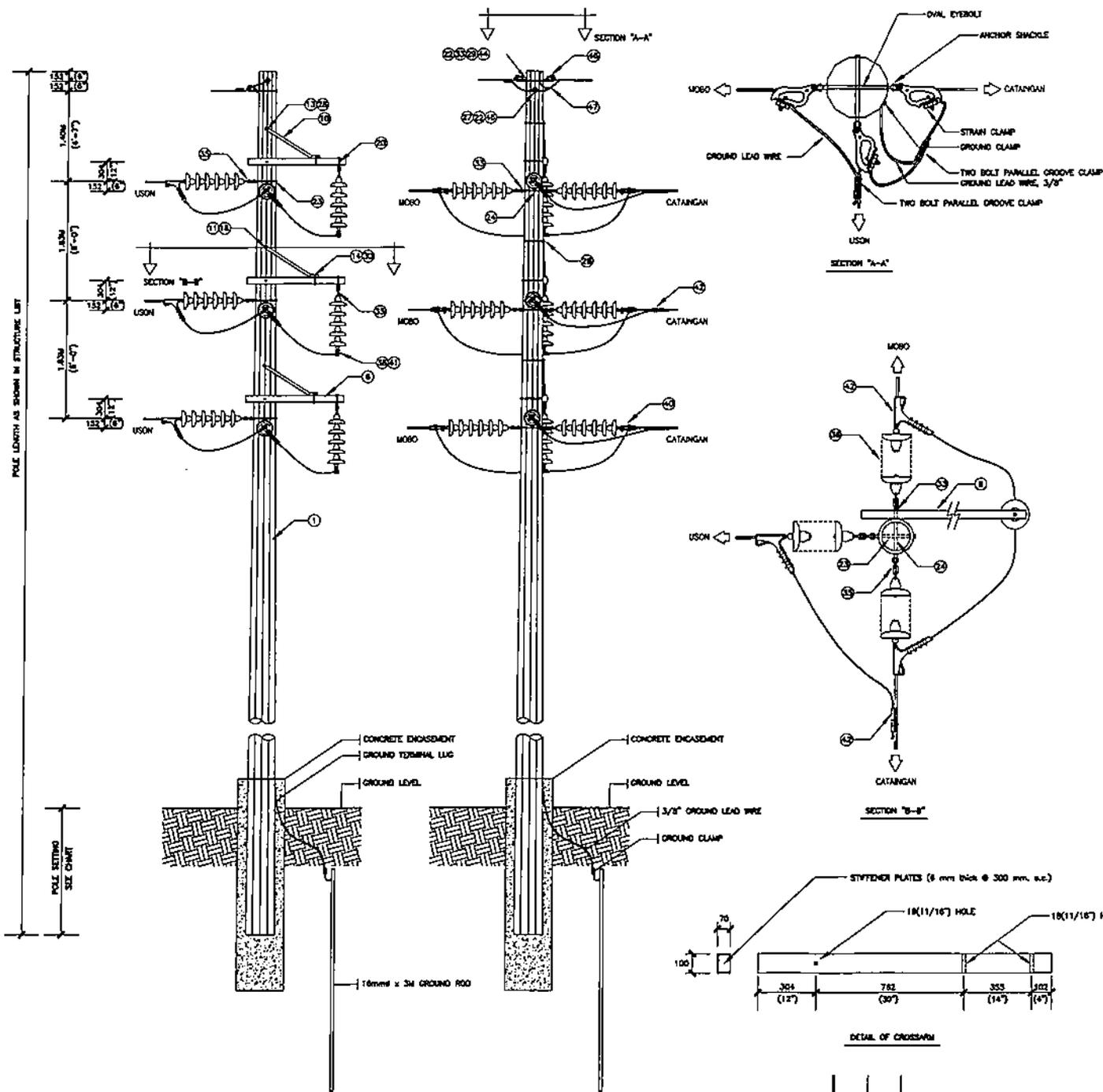
LOCATION:
 USBN, MALABATE

TITLE:
**69KV STEEL POLE WITH CONCRETE
 ENCASMENT CONSTRUCTION TYPE "3D"
 TRIPLE POLE SINGLE CIRCUIT**

DESIGNED BY	CHKD. DATE	STARTED
DRAWN BY		
REVIEWED BY		
ENCLASMENT		
ETC.		
MECH.		

APPROVED:  M. M. CASTILLO, Jr.
 Chief Engineer, L-2550
 RECOMMENDED:  M. L. LISON, Jr.
 Chief Engineer, L-2550
 APPROVED:  M. S. ...
 Chief Engineer, L-2550

DWG. NO. TU-BDE-04-05
 SPEC. NO. LUPP22714688-09

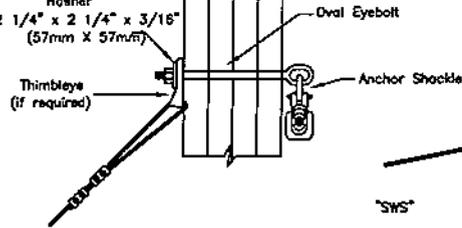


BILL OF MATERIALS		
ITEM NO.	DESCRIPTION	QTY.
1	Steel Pole	1
6	Steel Crossarm, 6C 100 x 70 x 6 x 1.52M (4'-12")	3
10	Angle Crossarm Brce, 44 (1-3/4") x 44 (1-3/4") x 5 (3/16")	3
11	Machine Bolt, 16 (5/8") x 559 (22")	3
13	Machine Bolt, 16 (5/8") x 305 (12")	3
14	Machine Bolt, 12 (1/2") x 203 (8")	3
20	Eyebolt, Oval, 16 (5/8") x 203 (8")	3
22	Eyebolt, Oval, 16 (5/8") x 305 (12")	2
23	Eyebolt, Oval, 16 (5/8") x 406 (16")	3
24	Double Arming Bolt, 16 (5/8") x 457 (18")	3
27	Washer, Curved, Square 76 (3") x 76 (3") x 6 (1/4") for 16 (5/8") Dia. Bolt	4
28	Washer, Flat, Square 102 (4") x 102 (4") x 6 (1/4") for 16 (5/8") Dia. Bolt	15
29	Washer, Flat, Square 57 (2-1/4") x 57 (2-1/4") x 5 (3/16") w/ 18 (11/16") Dia. Bolt	2
30	Washer, Round, for 12 (1/2") Dia. Bolt w/ 15 (9/16") Dia. Hole	3
33	Eyebolt for 16 (5/8") Dia. Bolt	7
35	Ball Chain	12
37	Insulator, Suspension, Ball & Socket Type, 146 (5 3/4") x 254 (10")	51
38	Clamp, Suspension, with Socket Connector (Over A.R.)	3
40	Strain Clamp with Socket Fitting for 336.4 MCM ACSR	9
41	Armor Rod, Pre-Formed or Tapered for 336.4 MCM ACSR "Lined" (per set)	3
42	Parallel Groove Clamp for 336.4 MCM ACSR	6
44	Anchor Shackle, 14 (9/16") with 16 (5/8") Pn for OHGW	3
46	Strain Clamp, for OHGW	3
47	Clamp, Parallel Groove, 2-bolt for OHGW	4
49	Ground Lead Wire, 10 (3/8") Dia., Ordinary Grade Class "C"	9'
	Ground Rod, Steel, Hot Dip Galvanized, 16 (5/8") x 3000 (10')	1
	Compression Clamp for 5/8" & 3/8" dia.	1
	Lugs complete with bolts, nuts and washer, Hot Dip Galvanized	1

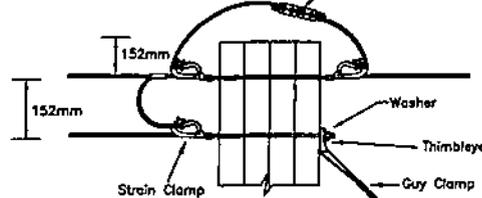
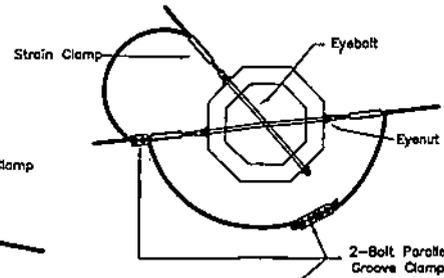
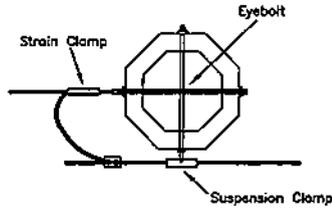
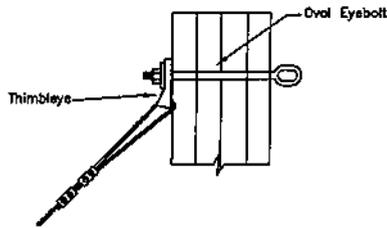
- All dimensions are in millimeters unless otherwise indicated.
- Work this drawing with Civil Eng'g. Drawings.

OWNER:		 NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP - USON 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MASBATE			
TITLE: MODIFIED 69KV STEEL POLE STRUCTURE TYPE "B/D" (FOR REPLACEMENT OF MC 194)			
DESIGNED	BY	CHKD	DATE
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			
DWG. NO. TU-BDE-04.006		SPEC. NO. LutzP22Z1468Sdg	
REV.	DATE	NATURE OF REVISION	BY
SCALE: HTS		BID DRAWING	
		REV. 0	

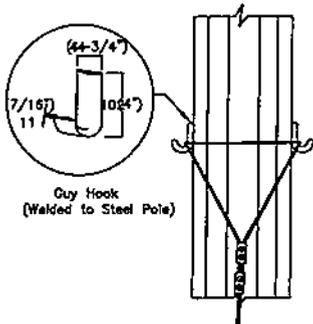
Washer
2 1/4" x 2 1/4" x 3/16"
(57mm X 57mm)



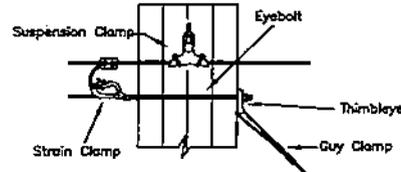
"SWS"
DETAIL OF ATTACHMENT
GROUND WIRE TO SUSPENSION STRUCTURE



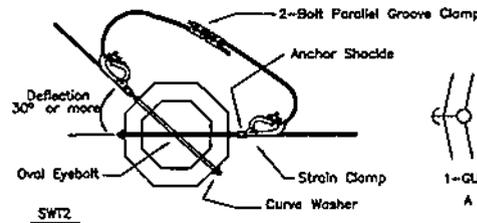
DETAIL OF ATTACHMENT OF OHGW
FROM H-FRAME TO TYPE "E"
STRUCTURE AND VICE VERSA



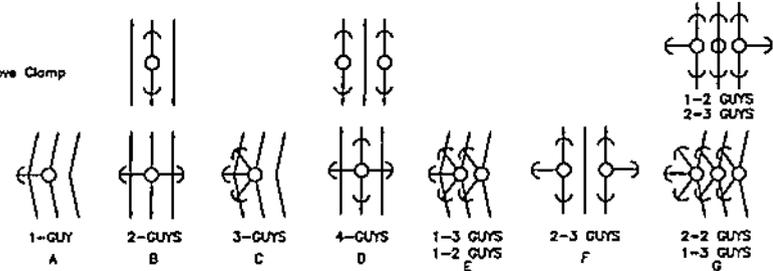
DETAIL OF GUYING ATTACHMENT TO POLE



DETAIL OF ATTACHMENT OF OHGW
FROM H-FRAME TO TYPE "B" or "C" TO H-FRAME



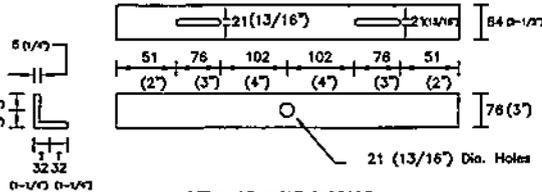
SWT2



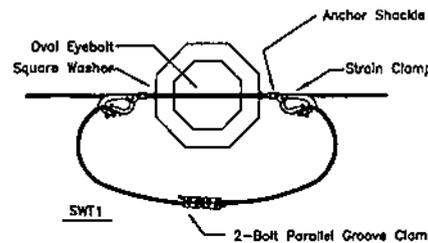
NOTES:

1. USE TYPE SWT2 FOR DEFLECTION 30° OR MORE EXCEPT IN TYPE "C" STRUCTURE.
2. VIBRATION DAMPERS ARE TO BE USED ONLY ON SPAN BETWEEN:
 - A. DEAD-END TO DEAD-END
 - B. DEAD-END TO SUSPENSION.
3. ON SPANS UP TO 305m (1,000 FT.) USE ONE (1) DAMPER AT EACH END.
4. ON SPANS ABOVE 305m (1,000 FT.) USE TWO (2) DAMPERS AT EACH END

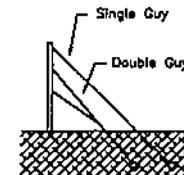
GUYING MATERIALS (PER ANCHOR ROD BASIS)		GUY ARRANGEMENT						
		SINGLE			DOUBLE			
ITEM NO.	DESCRIPTION	1	2	3	4	1	2	3
61	Guy Hook	2	2	4	4	4	8	
52	3-Bolt Guy Clamp	4	8	12	16	8	16	
53	Anchor Rod, Galv. Thimbley, 16 (5/8) x 2.44m (8')	1	2	3	4	-	-	-
54	Anchor Rod, Galv. Steel, Twin Eye, 19 (3/4) x 2.44 (8')	-	-	-	-	1	2	
55	Thimbley for 16 (5/8) Dia. Bolt, Galv. Steel	1	-	-	-	-	-	
56	Guy Wire 11 (7/16) Galv. Steel High Strength	70	140	210	280	140	280	
57	Concrete Anchor block, 250 x 250 x 1200	1	2	3	4	1	2	
26	Washer, Curved, Square, 100 (4") x 100(4") x 6 (1/4")	1	2	3	4	1	2	



DETAIL OF ANGLE SUPPORT
FOR SUSPENSION INSULATORS



DETAIL OF ATTACHMENT



OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP - USON
69KV TRANSMISSION LINE PROJECT

LOCATION: USON, MASBATE

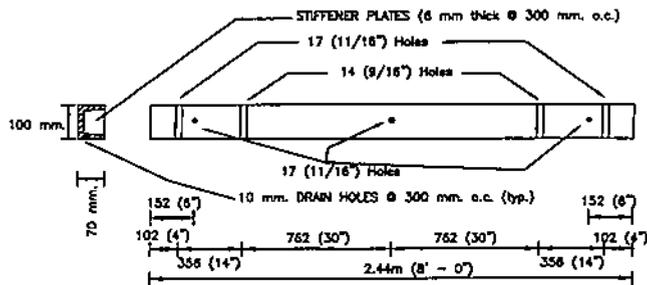
TITLE: 69KV TRANSMISSION LINE STEEL POLE
CONSTRUCTION DETAILS & GUYING ARRANGEMENTS

DESIGNED	BY	CHKD	DATE	SUBMITTED:
				A. M. AGUILA
DRWN				Principal Engineer
REVIEWED	PRINCIPAL ENGR. / ARCHT.			RECOMMENDED
CIVIL ARCHT				C. C. LUGOD, JR.
ELC				APPROVED:
MECH				M. G. LUISA

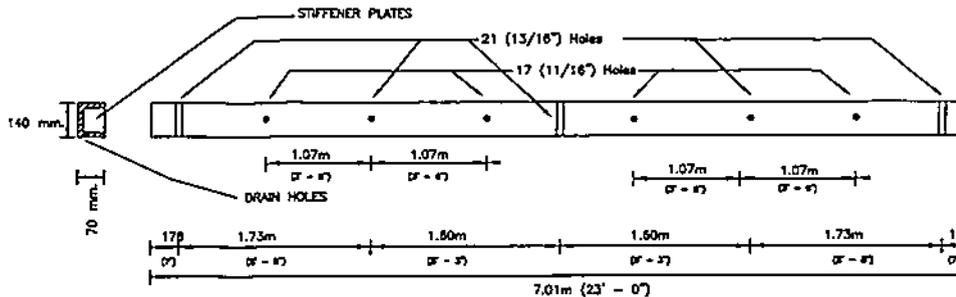
OWD. NO. TU-SDE-04.007 SPECS. NO. LuzP22Z1468Sdg

SCALE: NTS BID DRAWING REV. 0

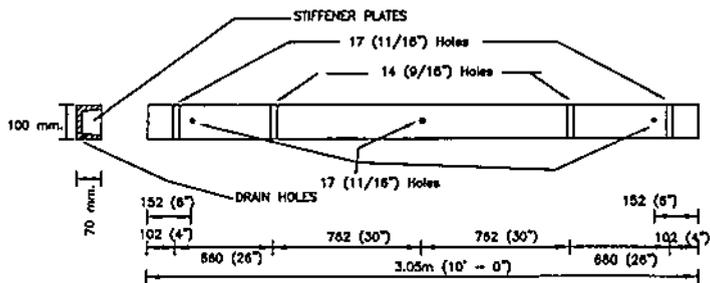
REV.	DATE	NATURE OF REVISION	BY	CHKD	RECD	APPD



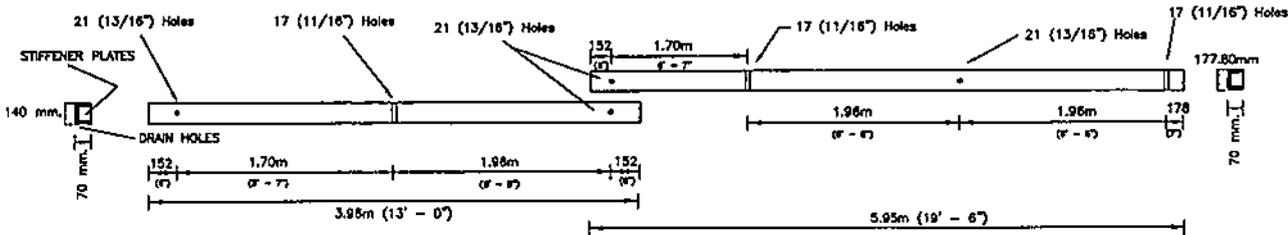
FOR TYPE B AND E



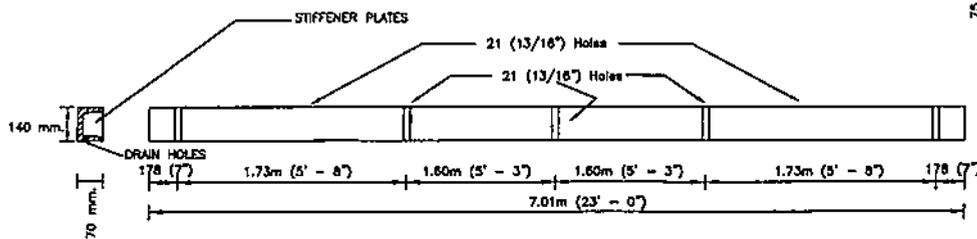
TYPE "HT" AND "HT"-HT"



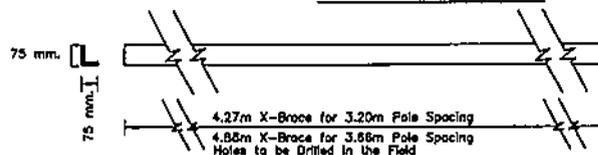
FOR TYPE B AND E



TYPE "JT" AND "JT"-JT"



TYPE "HS" AND "HS"-HS"

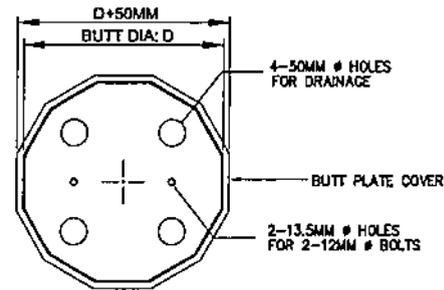
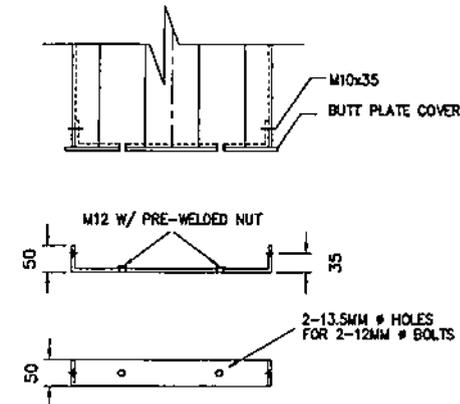
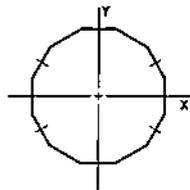
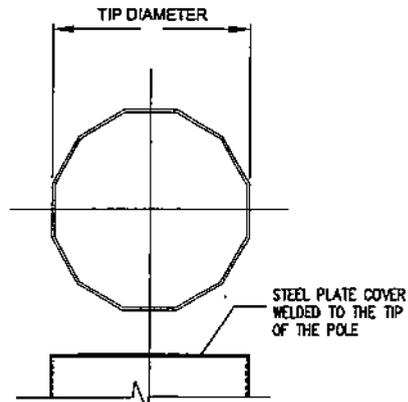
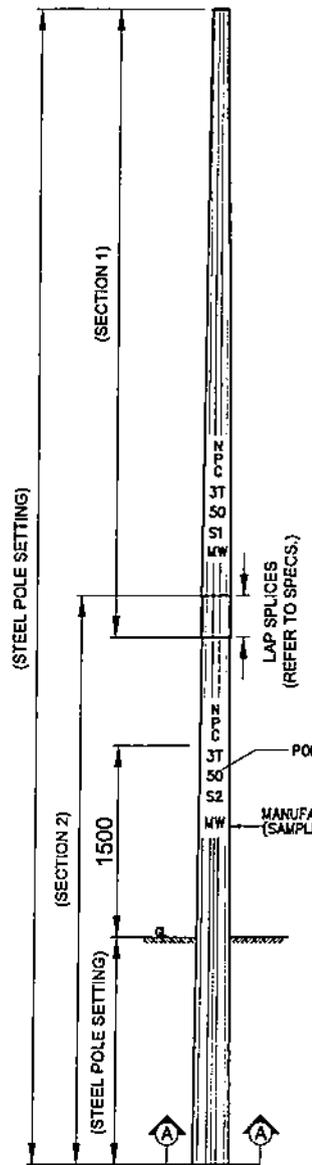


NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. SUPPLY OF CROSSARMS AND X-BRACES ARE DRILLED, CUT TO EXACT DIMENSIONS
3. PROVIDE 6 MM THK. STIFFENER PLATES FULLY WELDED TO CROSSARMS @ 300 MM. O.C.
4. PROVIDE 10 MM. DIAMETER DRAIN HOLE AT THE BOTTOM FLANGE OF CROSSARMS AT 300 MM. O.C. AS SHOWN ON THIS DRAWING.

OWNER		NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY & ERECTION/INSTALLATION OF TAP - USON 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MASBATE			
TITLE: 69KV TRANSMISSION LINE STEEL POLE CROSSARM DRILLING GUIDE			
DESIGNED	BY	CHKD	DATE
DRAWN			
REVIEWED	PRINCIPAL ENGR./ ARCHT.		RECOMMENDED
CIVIL/ARCHT			
ELEC			APPROVED
MECH			
DWG. NO. TU-BDE-04.008		SPEC. NO. LUZP2221468Sdg	
SCALE: NTS		BID DRAWING	

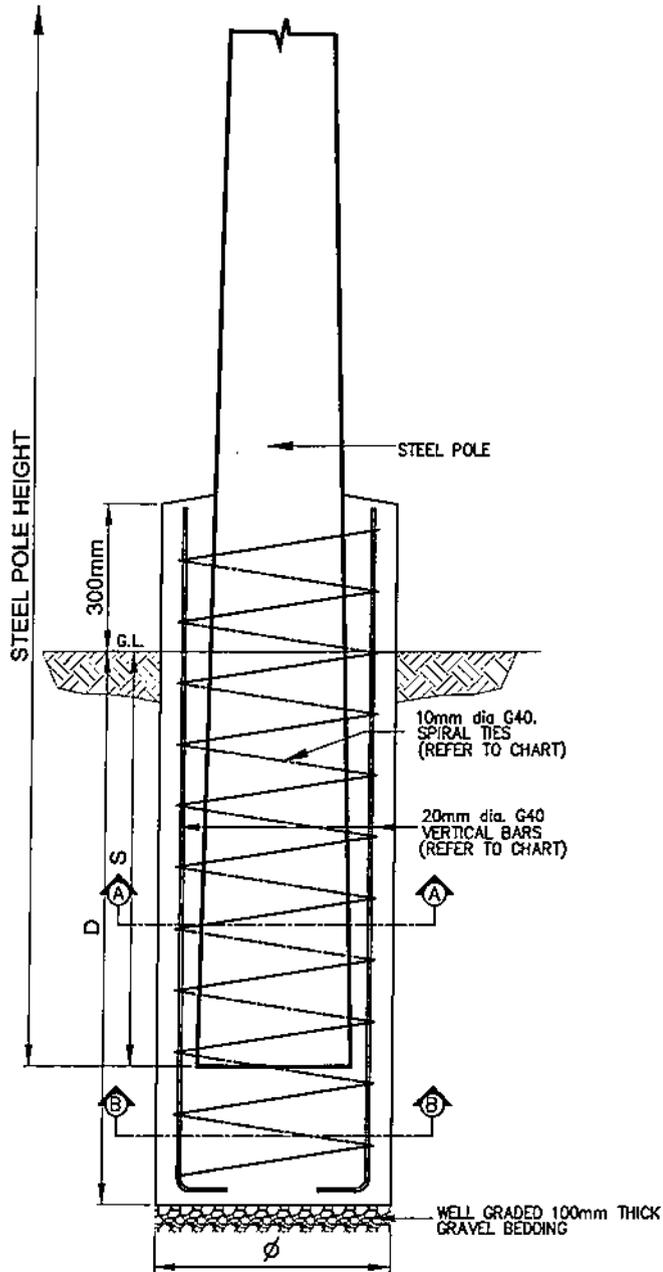
REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPR.



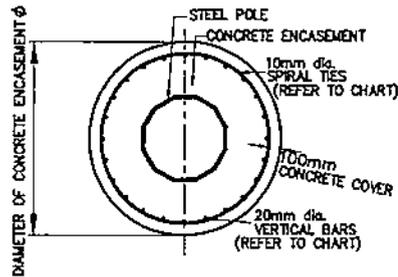
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. POLE SHAFT & COVER PLATES MATERIALS SHALL CONFORM TO ASTM A572 WITH $F_y = 65 \text{ KSI (450 MPa)}$ MIN. YIELD STRENGTH.
3. ALL WELDING WORKS SHALL BE DONE IN ACCORDANCE WITH THE LATEST PROVISION OF AWS D1.1.
4. THE STEEL POLES SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A123 WITH MINIMUM COATING THICKNESS OF 85 MICRONS.
5. GROUNDING CLAMPS, GUY ATTACHMENTS, BOLTS, NUTS AND WASHERS SHALL BE INCLUDED IN THE SUPPLY OF POLES BY THE CONTRACTOR.
6. POLES SHALL BE ODDEGONAL (12 SIDES) AND THE DIAMETER IS MEASURED ON THE OUTSIDE SURFACE AND ACROSS THE FLATS.
7. TIPS & BUTTS OF POLE SHALL BE COVERED WITH PLATE SIMILAR TO SHAFT BODY MATERIAL & THICKNESS.
8. HOLE DIAMETER & LOCATION AND OTHER POLE ATTACHMENTS SHALL BE REFERRED TO EDCO DRAWINGS FOR DIFFERENT TYPES OF STRUCTURE.
9. LAP SPICE LENGTH FOR SLIP JOINT SHALL BE AT LEAST 1.5 TIMES THE INNER BUTT DIAMETER OF THE UPPER (FEMALE) SECTION.
10. POLE MARKINGS SHALL BE EMBOSSED LEGIBLY ON THE BODY BEFORE GALVANIZING. THE SIZE/HEIGHT OF THE LETTERS SHALL BE 30 MM MINIMUM.
11. ALL THREADS MUST BE HAND-TAPPED AFTER GALVANIZING.
12. THIS DRAWING IS FOR BIDDING PURPOSES ONLY. ALL OTHER DETAILS NECESSARY FOR MANUFACTURING A DEPENDABLE AND RELIABLE STEEL POLES SHALL BE PROVIDED BY THE CONTRACTOR FOR NPC'S APPROVAL.

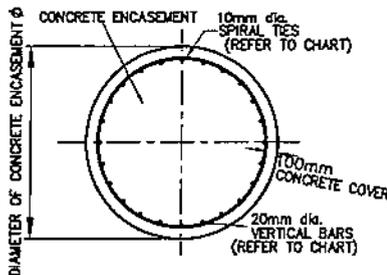
OWNER:		 NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY AND ERECTION / INSTALLATION OF TAP - USON 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MASBATE			
TITLE: 69 KV STEEL POLE (ELEVATION, SECTION & DETAILS)			
DESIGNED:	BY: <i>[Signature]</i>	CHKD: <i>[Signature]</i>	DATE: <i>[Date]</i>
DRAWN:	SUBMITTED:		<i>[Signature]</i> H. L. BENDOZA PRINCIPAL ENGINEER & CEAD
REVIEWED:	RECOMMENDED:		<i>[Signature]</i> A. G. ENRIQUETA MANAGER CEAD
CIVIL ARCHT:	APPROVED:		<i>[Signature]</i> H. G. SORIANO MANAGER, DED
ELEC:			
MECH:			
DWG. NO.	TU-BDC-04.001	SPECS. NO.	LuzP22Z1468Sdg
SCALE:	AS SHOWN	BID DRAWING	
REV.	DATE	NATURE OF REVISION	BY
			CHKD.
			RECD.
			APPD.
			REV. 0



STEEL POLE CONCRETE ENCASUREMENT
SCALE NTS



SECTION A-A
SCALE NTS



SECTION B-B
SCALE NTS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF $f_c = 20.70 \text{ MPa}$ (3000 psi) AT 28 DAYS PERIOD.
3. REINFORCING BARS SHALL CONFORM TO THE LATEST REQUIREMENTS OF PNS FOR DEFORMED STEEL BARS GRADE 40.
4. DETAILS OF REINFORCING BARS SHALL CONFORM TO THE LATEST ACI CODE.
5. ALL ASPECTS OF CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PROVISIONS OF LATEST ACI CODE.
6. SPLICING OF BARS SHALL BE STAGGERED WITH LENGTH OF SPLICING NOT LESS THAN $40 \times$ MAIN BAR DIAMETER.
7. IN THE EVENT THAT ANY OF THE FOLLOWING PARAMETERS IS NOT ATTAINED, NOTIFY DEAD FOR REVISION OF CONCRETE ENCASEMENT DESIGN.

PARAMETERS CONSIDERED:

- MINIMUM ANGLE OF INTERNAL FRICTION IS 22deg
- MINIMUM UNIT WEIGHT OF SOIL IS 18KN/CU.M
- MINIMUM COHESION OF SOIL CONSIDERED IS 25KN/SQ.M
- ALLOWABLE SOIL BEARING CAPACITY IS 20,000 KG/SQ.M

8. USE BUNDLED BARS IF CLEAR SPACING OF REINFORCING BARS IS LESS THAN 75 mm.

DRAWN:		 NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY AND ERECTION / INSTALLATION OF TAP - USON 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MASBATE			
TITLE: STEEL POLE CONCRETE ENCASUREMENT (PLAN, ELEVATION, DETAILS)			
DESIGNED	BY	CHKD	DATE
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.	RECOMMENDED	
CIVIL/ARCHT			
ELEC.		APPROVED:	
MECH.			
DWG. NO. TU-BDC-04.002		SPEC. NO. LuzP2221468Sdg	
REV.		SCALE: AS SHOWN	
DATE		MATURE OF REVISION	
BY		CHKD. RECD. APPR.	
		BID DRAWING	
		REV. 0	

STEEL POLE DESCRIPTION							
TYPE	LENGTH (ft)	POLE DIAMETER (MM)		NO. OF SECTION	BODY THICKNESS (MM)		
		TIP	BUTT		SECTION 1	SECTION 2	SECTION 3
C	60	250	730	2	6	6	NA
D	60	300	860	2	7	7	NA
E	50	200	585	2	6	6	NA
	55	200	625	2	6	6	NA
	60	200	660	2	6	6	NA
3D	50	300	710	2	7	7	NA

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.

CONCRETE ENCASEMENT CHART/DETAILS						
TYPE OF POLE	C-60	D-60	E-50	E-55	E-60	3D-50
DEPTH OF CONCRETE ENCASEMENT, D (mm)	4100	4700	3400	3600	3800	3900
OUTSIDE DIA. OF CIRCULAR TIES, OD (mm)	1100	1200	900	1000	1000	1100
DIA. OF CONCRETE ENCASEMENT, ϕ (mm)	1300	1400	1100	1200	1200	1300
STEEL POLE SETTING, S (ft)	8	8	7	7.5	8	7
NUMBER OF VERTICAL BARS 20mm G40	34	40	25	29	29	34
SPACING OF TIES 10mm G40 (mm)	100	100	100	100	100	100

OWNER:		 NATIONAL POWER CORPORATION AGHAM ROAD, DILIMAN, QUEZON CITY	
PROJECT: SUPPLY AND ERECTION / INSTALLATION OF TAP - USON 69KV TRANSMISSION LINE PROJECT			
LOCATION: USON, MABRATZ			
TITLE: 69 KV STEEL POLE & CONC. ENCASEMENT (DESCRIPTIONS & CHART/DETAILS)			
DESIGNED	BY	CHKD	DATE
DRAWN	SUBMITTED:		H. L. MENDOZA PRINCIPAL ENGINEER & CLERK
REVIEWED	RECOMMENDED:		A. C. ESPINOSA MANAGER/CLERK
CIVIL/ARCHT	APPROVED:		H. G. SORIANO MANAGER/CLERK
ELEC.			
MECH.			
DWG. NO. TU-BDC-04.003		SPECS. NO. L12P2221468Sdg	
SCALE: AS SHOWN		BID DRAWING	
REV.	DATE	NATURE OF REVISION	BY
			CHKD. RECD. APPD.
			REV. 0