REPUBLIC OF THE PHILIPPINES

NATIONAL POWER CORPORATION

(Pambansang Korporasyon sa Elektrisidad)

BID DOCUMENTS

Name of Project : **SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP**

Location : **Agus 4, Ditucalan, Lanao Del Norte**

PR No. : **MG-A5M22-042**

Contents:

Design and Development Department

SECTION I

INVITATION TO BID

National Power Corporation
INVITATION TO BID
PUBLIC BIDDING – BCS 2023-0120

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
MG-A5M22-042 / PB230405-HG Supply, Delivery, Installation, Test and Commissioning of 25-Ton Gantry Crane at Tailrace Outlet Structure of Agus 4 HEP • PCAB License: License Category of at least **"Category D – General Building"** and registration classification of at least **"Small B – Building & Industrial Plant" or "Small B – Structural Steel Work"**	Supply, Delivery, Installation, Test and Commissioning of Gantry / Hoisting Equipment of at least 25 Tons Capacity for Hydroelectric Plant (HEP)	24 March 2023 9:30 A.M	11 April 2023 9:30 A.M	₱ 25,000,000.00 / ₱ 25,000.00
S1-TDP23-002 / PB230405-JD00060 Supply and Delivery of Spare Parts for 600kW Perkins Diesel Engine, Model No. TP825 for Ticao DPP	Supply and Delivery of Diesel Generating Sets or Mechanical and/or Electrical Parts / Components / Equipment for Diesel Generating Sets	24 March 2023 9:30 A.M	05 April 2023 9:30 A.M	₱ 1,760,160.00 / ₱ 5,000.00
Venue: Kañao Function Room, NPC Bldg. Diliman, Quezon City				

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
MG-A5M22-042	Three Hundred (300) Calendar Days	-
S1-TDP23-002	Ninety (90) Calendar Days	Ten (10) Years

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 5564/5211
    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. BARRUELA
Vice President, Corporate Affairs Group and
Chairman, Bids and Awards Committee

SECTION II

INSTRUCTION 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, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP** , with Project Identification Number **PR NO.: MG-A5M22-042.**

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 2023 in the amount of specified in the Invitation to Bid. 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 criterial 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 SHEET

SECTION III - BID DATA SHEET

ITB Clause	
5.2	For this purpose, contracts similar to the Project shall be supply, delivery, installation, test and commissioning of gantry/hoisting equipment of at least 25 Tons Capacity for Hydrolectric Plant (HEP). 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 for reasons attributable to the Bidder.
7.1	Only a maximum of fifty percent (50%) of the Works may be subcontracted. All Subcontractors must be approved by NPC.
10.1	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: 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. 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.
	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: 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	The required License issued by the Philippine Contractors Accreditation Board (PCAB): License Category of at least **"CATEGORY D – GENERAL BUILDING"** and registration classification of at least **"SMALL B – BUILDING & INDUSTRIAL PLANT"** ***or*** **"SMALL B - STRUCTURAL STEEL WORK"**

10.4	The list of key personnel shall include the following minimum requirements: **a. One (1) Project Engineer** Registered Civil Engineer who had supervised at least a project similar in nature as to the type and cost of the proposed project including dams and waterways within the last 10 years. Must have at least three (3) years professional experience as Dam and Waterways Expert **b. One (1) Mechanical Engineer** Professional Mechanical Engineer (PME) with at least five (5) years experience, with certificate from any hoisting equipment manufacturer **c. One (1) Materials Engineer** Registered Civil Engineer with valid accreditation from the Department of Public Works and Highways (DPWH) as Materials Engineer I **d. One (1) Crane Technician** Automation Engineer with at least three (3) years experience as technician from the manufacturer **e. Two (2) Welders** NC II with at least three (3) years experience in welding/cutting work **f. One (1) Safety Officer 2** 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). Must be present during the whole duration of the project. 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, certificate of accreditation including ID card issued by DPWH for Materials Engineer, 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. 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.
10.5	The list of construction equipment (owned or leased) shall include the following minimum requirements: a. Cargo Truck (at least 6 – 8 Tons capacity) - 1 unit b. Welding Machine (at least 300A) - 2 units c. Oxy-Acytylene Cutting outfit - 1 unit d. Portable Generator (at least 300kVA) - 1 unit e. Bar Cutter (at least 25mm Φ capable) - 1 unit f. Portable Jackhammer - 1 unit g. Concrete Vibrator (at least 3.5HP) - 1 unit

	h. Concrete Cutter (at least 3.5HP) - 1 unit i. Concrete Mixer (at least 2 - bagger) - 1 unit j. Service Vehicle (4 x 4 pickup) - 1 unit k. Mini Dump Truck (3 cu.m.) - 1 unit l. Core Boring Machine (at least 25mm) - 1 unit
10.6	Bidders shall also submit the following requirements in their first envelope, Eligibility and Technical Component of their bid: 1. Documents to be submitted with the bid/proposal for evaluation as specified in Clause CW-12.0 of Section VI – Technical Specifications Manufacturer's brochures, manuals and other supporting documents (if required), 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 determined not complying with the specifications during technical evaluation and post-qualification process. 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. 2. Complete eligibility documents of the proposed sub-contractor, if any
10.7	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.
12	No further instructions
15.1	The bid security shall be in the form of a Bid Securing Declaration or any of the following forms and amounts: 1. The amount of not less than *2% of ABC,* 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 *5% of ABC* if bid security is in Surety Bond.
19.2	Partial Bid is not allowed
20	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. The licenses and permits relevant to the Project and the corresponding law requiring it as specified in the Technical Specifications, if any.

21	The following documents shall form part of the contract: 1. Notice to Proceed 2. Construction schedule and S-curve 3. Manpower Schedule 4. Construction Methods 5. Equipment Utilization Schedule 6. 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 BWC 7. PERT/CPM.

SECTION IV – GENERAL CONDITIONS OF CONTRACT

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SECTION IV

GENERAL CONDITIONS OF CONTRACT

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	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: 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. 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: 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. 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. 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. 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.

	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 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. 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. 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.
4.1	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.
5	1. The following must be indicated in the performance bond to be posted by the Contractor: 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 *(Contract/Purchase Order Description)* in accordance with the terms and conditions of *(Contract No. & Schedule/Purchase Order No.)* entered into by the parties." 2. The bond shall remain valid and effective until the duration of the contract *(should be specific date reckoned from the contract effectivity)* 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 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. 4. Other required conditions in addition to the standard policy terms issued by the Bonding Company: 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.
6	No site investigation report.
7.2	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. 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. In case of other structures, such as Bailey and wooden bridges, shallow wells, spring developments, and other similar structures: Two (2) years.
10	No dayworks are applicable to the contract.
11.1	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.
11.2	The period between Program of Work updates is Thirty (30) calendar days. The amount to be withheld for late submission of an updated Program of Work is One percent (1%) of contract amount.

12	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. 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. Qualified Constructors Performance Evaluators (CPE) shall conduct project evaluation as follows: (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. (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.
13	The maximum amount of advance payment is fifteen percent (15%) of the Contract Price and paid in lump sum.
14	No further instructions.
15.1	The date by which "as built" drawings and operating and maintenance manuals are required is within thirty (30) calendar days after completion of contract.
15.2	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.

SECTION VI

TECHNICAL SPECIFICATIONS

SECTION VI

TECHNICAL SPECIFICATIONS

PROJECT HIGHLIGHTS

SECTION VI - TECHNICAL SPECIFICATIONS

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GW-1.0 PROJECT HIGHLIGHTS

GW-1.1 General

This section covers the general technical requirements for furnishing all supervision, labor, materials, supplies, tools and equipment in accordance with specifications contained herein and as shown on the accompanying drawings to complete the **SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP.**

The proposed installation of gantry crane in the tailrace outlet structure is intended for the fast installation and removal for the two (2) existing stop logs and three (3) dewatering pump, especially during emergencies and routinary dry repair activities every 5 years.

The Contractor shall accept full responsibility for its work in the performance qualifications, specifications, documentation, reports, fabrication, corrosion protection, cleaning, shop testing, preparation for shipment, field testing, warranty provisions and compliance with the applicable codes and standards and the requirements of this specification.

The Contractor shall strictly observe the general requirements of this specification in conjunction with the specific requirements specified in the relevant specifications.

GW-1.2 Project Location

The project is located at tailrace outlet structure of Agus 4 HEP, Ditucalan, Lanao Del Norte.

GW-1.3 Scope of Work

The works and services to be performed under this Contract shall essentially consist of, but not limited to the following:

1. Moving-in including furnishing, superintendence, construction, operation and maintenance of general construction facilities and moving-out thereof after completion and acceptance;
2. Site grading, structural excavation and backfilling works for all concrete footings and column;
3. Complete design and construction of all foundation, structural steel components and connection details (i.e. runway girder, girder, columns, braces, brackets, gusset plates, stiffener, baseplate, non-shrink cementitious grout, concrete jacketing for baseplate, hoist shelter, bolts, nuts and washers, etc.);
4. Core boring works on existing concrete dam abutment and installation of structural columns including application of epoxy on anchor bolts and grouting.
5. Corrosion protection and painting for all structural steel structure including existing lifting beam and stoplogs.

6. Supply, delivery and installation of the lacking accessories for the existing lifting beam such as roller guide assembly, lifting hook, interlinking mechanism, interlinking counterweight and lifting pin hoist.
7. Complete construction of seclusion fence with gate including gravel surfacing;
8. Supply, delivery, installation and test of water level monitoring and data logger including other accessories;
9. Supply, laying and test of power supply cables for gantry crane including ground conductors and other appurtenances required for the interfacing of supplied equipment;
10. Supply, installation, test and commissioning of 1 x 150 kVA, 4160V/480V, 3-Phase, 60Hz distribution transformer;
11. Supply, installation and test of 15kV fuse disconnect switches with lightning arrester combination;
12. Supply, installation of conduit system;
13. Clearing of right of way (6 meters) wide from the entire route;
14. Final survey and staking of steel poles;
15. Supply, delivery and erection/installation of steel poles, line hardware, insulators, primary and neutral conductors, dressing of steel poles, guying and ground wires, etc.;
16. Stringing of overhead and neutral conductor including ratcheting, installation, of armor rods, armor tapes, tie wires, etc.;
17. Tapping connection to the existing three-phase distribution line;
18. Test and commissioning of distribution line system;
19. Supply of lineman's basic equipment and tools to be supplied as a accessories and cost thereof shall be included in the bid.
20. Submission of electrical drawings, brochures/catalogues and manuals for evaluation.
21. Conduct actual site inspection/verification to have clear view and understanding of the Agus 4 HEP Management requirements;
22. Provide the services of a competent technical personnel who shall be responsible for the supervision of installation/erection, test and commissioning;
23. Design/prepare detailed drawings. The drawing shall be approved by NPC designated representative before start of fabrication and/or installation;
24. Provide tools, equipment and materials/consumables during the conduct of test and commissioning;
25. Restore all affected structures to the satisfaction of the Agus 4 HEP/NPC;
26. Conduct training of Agus 4 HEP personnel in the operation and maintenance of the Gantry Crane;
27. Supply of spare parts for One (1) year including quarterly check-up and repair/maintenance;
28. Submission of drawings, brochures/catalogues, operations and maintenance manual and spare parts;
29. Render maintenance services upon request of NPC in the event of any abnormality occur within the warranty period; and
30. All other works and services required to complete the project.

GW-1.4 Contract Period

The Contractor shall complete the works as herein specified within Three hundred (300) calendar days. The contract period is inclusive of ten (10) unworkable days considered unfavorable for the execution of the works. The total contract duration shall be reckoned from the date of contract effectivity as specified in the **Notice to Proceed**.

GW-1.5 Contractor's Classification

The Contractor must have a valid Philippine Contractors Accreditation Board (PCAB) license Category of at least "**Category D – General Building**" and registration classification of at least "**Small B – Building & Industrial Plant**" or "**Small B – Structural Steel Work**"

The Contractor must have undertaken similar contracts and/or projects involving supply, delivery, installation, test, and commissioning of gantry/hoisting equipment of at least 25 tons capacity for HEP.

GW-1.6 Minimum Required Personnel

For the duration of the contract, the Contractor shall have the following minimum required personnel assigned to the project:

a) One (1) Project Engineer/Site Engineer

Registered Civil Engineer who had supervised at least a project similar in nature as to the type and cost of the proposed project within the last 10 years. Must have at least 3 years professional experience as Dam and Waterways Expert.

b) One (1) Materials Engineer

Registered Civil Engineer with valid accreditation from the Department of Public Works and Highways (DPWH) as Materials Engineer I.

c) One (1) Mechanical Engineer
Professional Mechanical Engineer with at least five (5) years experience with certificate from any hoisting equipment manufacturer

d) One (1) Crane Technician
Automation Engineer with a least three (3) years experience as technician from the manufacturer.

e) Two (2) Welders
NC-II with at least three (3) years experience in welding/cutting work.

f) One (1) Safety Officer 2
Construction Safety Officer 2 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). Must be present during the whole duration of the project.

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.

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.

GW-1.7 Minimum Required Construction Equipment

The list of construction equipment (owned or leased) shall include the following:

a.	Cargo Truck (6-8 tons capacity)	- 1 unit
b.	Welding Machine (300 Amp)	- 2 units
c.	Oxyacetylene cutting outfit	- 1 unit
d.	Portable Generator (300 kVA)	- 1 unit
e.	Bar cutter (25mmΦ capable)	- 1 unit
f.	Portable Jackhammer	- 1 unit
g.	Concrete Vibrator (3.5HP)	- 1 unit
h.	Concrete Cutter (3.5 HP)	- 1 unit
i.	Concrete Mixer (2-bagger)	- 1 unit
j.	Service Vehicle (4x4 pick up)	- 1 unit
k.	Mini Dump Truck (3 cu.m)	- 1 unit
l.	Core Boring Machine (At least 25 mm)	- 1 unit

SECTION VI

TECHNICAL SPECIFICATIONS

CIVIL WORKS

SECTION VI – TECHNICAL SPECIFICATIONS

CW – CIVIL WORKS

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CW – CIVIL WORKS

CW-1.0 GENERAL CONSTRUCTION FACILITIES

CW-1.1 Scope

This section covers the construction and/or maintenance of access roads, drainage system and other appurtenant structures, moving-in of the Contractor's construction equipment, setting up of the Contractor's camp and the disposition of the Contractor's various facilities at the end of the Contract.

CW-1.2 Moving-in

The Contractor shall bring to the site all his necessary construction equipment and plant and install all stationary construction equipment and plant at location and in the manner approved by the NPC. The Contractor shall submit sufficient detailed plans showing the proposed location of such stationary equipment and plant and other pertinent data. No installation of such stationary equipment shall be undertaken unless the corresponding plans have been approved by the NPC.

CW-1.3 Contractor's Camp Facilities

The Contractor shall provide and grade his camp site, construct his camp, employee housing, warehouse, machine and repair shops, fuel storage tanks and provide such related facilities and sanitary conveniences that the Contractor deems necessary for maintaining health, peace and order in the camp and work areas. The areas that may be used by the Contractor within the plant site shall be designated by the NPC.

The Contractor shall provide, maintain and operate, under competent direction, such camps and facilities as are necessary for the housing, feeding and accommodation of his employees.

CW-1.4 Water Supply

The Contractor shall, at his own expense, 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 purposes, chlorination or some other approved methods of sterilization shall be carried out. The installation and maintenance of these services shall be subject to the approval of the NPC.

CW-1.5 Sewerage Disposal and Sanitation

The Contractor shall, at his own expense, be responsible for the installation operation and maintenance of an adequate sewerage disposal and sanitation system and shall provide adequate toilet and wash-up facilities for his employees at his camp and in the areas where work is being carried out.

The Contractor shall execute the work with due regard to adequate sanitary provisions and applicable codes and shall take all necessary steps to prevent the pollution of water in any spring, river, or other sources of water supply. All toilets or wash-up facilities shall be subject to the prior and continuing approval of the NPC.

CW-1.6 Fire Protection

The Contractor shall observe all necessary precautions against fire, shall provide and maintain at his own expense, portable fire-fighting equipment he may deem necessary, and shall comply with all applicable laws of the Philippines relating thereto.

In the event of an uncontrollable fire occurring in the area of the Contractor's operation, the Contractor shall have to extinguish the fire immediately at his own expense, to the full extent of the manpower and equipment employed under the contract at the time of the fire.

The Contractor shall indemnify NPC against all liabilities, claims, damages and/or lawsuits arising thereto.

CW-1.7 Construction Power

The Contractor shall be responsible for providing his own electric power supply required for construction and erection/installation. If power is available from NPC and should the Contractor elect to utilize the NPC's power supply, he shall make an arrangement with NPC concerned group as to the billing rates and other requirements needed for direct connection to NPC.

CW-1.8 Camp Security

The Contractor shall provide his own security force to the extent that he deems necessary for maintaining peace and order in the camp and work areas and to safeguard materials and equipment. Nothing under the provisions of this paragraph shall relieve the Contractor from full responsibility for the maintenance of peace and order and protection of life and property in all areas where he operates.

CW-1.9 Construction Material Storage

The Contractor is required to put up warehouse(s) with capacities sufficient to store the construction materials required in the work. The warehouse(s) shall be specifically for this contract, notwithstanding his other facilities in the site that may serve the purpose.

CW-1.10 Removal of Camp and Construction Facilities

After the completion of the work covered by the contract and prior to acceptance of the completed work, the entire camp facilities of the Contractor, including its water supply system, electric distribution system, quarters, warehouses, shops, dining halls, commissaries, temporary shed and other facilities therein shall be removed by the Contractor. The site shall be cleared and cleaned as directed by the NPC.

CW-1.11 Measurement and Payment

No separate measurement and payment will be made for the Contractor's Construction Facilities. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-2.0 CARE OF WATER DURING CONSTRUCTION

CW-2.1 Scope

In accordance with the specifications contained in this section or otherwise directed, the Contractor shall construct and maintain all necessary temporary drainage ditches and other temporary protective works and he shall also furnish, install, maintain and operate necessary pumping equipment and other devices to protect construction operations free from water coming from any source, including rain.

CW-2.2 Drainage and Dewatering

The Contractor shall be responsible for dewatering foundation areas so that work can be carried out on a suitably dry condition. The Contractor shall construct drainage ditches, holes, culverts, furnish, maintain and operate at his own expense all necessary pumps and other dewatering devices to keep all work areas free from water.

After the work is completed and before it is accepted by the NPC, the Contractor shall remove all pumping equipment and shall remove, fill or plug all temporary drainage structures as directed, all at his expense.

CW-2.3 Measurement and Payment

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 of temporary drainage structures, pumping system and other dewatering devices necessary to keep construction operations free from water, shall be included in the various pay items in the Bill of Quantities for structures where such care of water is required.

CW-3.0 ENVIRONMENTAL REQUIREMENTS FOR CIVIL WORKS

CW-3.1 Scope

This section pertains to the environmental and safety provisions, requirements and conditions that shall govern during the execution of all civil works under this project.

CW-3.2 General Conditions

The Contractor shall ensure compliance with the applicable environmental and safety regulations, as well as ECC conditions, during

installation/construction of this project through the implementation of measures that include, but not limited to, the following:

a) Designate a Safety Officer and a Pollution Control Officer who shall respectively handle all safety and environmental concerns of the project.

b) Prepare and submit Construction Safety and Health Plan.

c) Properly manage debris and various waste generated during installation/construction, such as the following:

- Dispose of demolition and construction debris in a designated or NPC approved disposal area(s);
- Stockpile (and cover if possible) or haul to the designated and/or pre-developed dump sites (spoil disposal areas) that shall be provided with suitable drainage – equipped with sediment traps, stripped top soil, spoils from quarry/borrow sites and excavated materials;
- Segregate solid wastes, such as empty cement sacks, scraps of tin or wood, used wires and other domestic garbage, for recycling or storage in NPC-approved temporary storage areas and further disposal to LGU-designated disposal sites.
- Properly handle, store and dispose-off, through DENR-accredited transporter/treater, hazardous wastes i.e. used oils, paints, thinner, etc.

d) Limit construction activities that generate excessive noise to daytime works only to prevent nuisance to nearby residents during rest hours.

e) As far as practicable, undertake site stripping, grading and excavations during dry weather.

f) Construction/Installation shall be carried-out in a manner where landslides and erosions are minimized.

g) Avoid unnecessary opening/clearing of areas outside construction sites or destruction of vegetative cover, especially cutting of existing trees; and to re-vegetate disturbed areas.

h) Implement biological control measures such as maintenance of vegetation buffers (i.e. sodding of grass, planting of creeping vines, herbs, shrubs and trees) to shield streams/rivers from sedimentation; planting of vegetative cover over erodible surfaces; and planting of exposed sloping areas with shallow-rooted species like grasses, herbs or creepers.

i) Locate fill slopes and spoil heaps away from drainage routes and properly remove/dispose the same as soon as practicable.

j) Preserve or replace, if practicable, natural drainage patterns (when disturbed by civil works) with appropriate drainage channels.

k) Convey oil-contaminated wastewater from workshops, garages, or gas filling stations through an oil trap (i.e. improvised oil-water separator) prior to discharge.

l) Spray water, wherever and whenever necessary, to minimize dust generation.

m) Provide PPEs and other safety provisions required by DOLE, for its project/site works.

n) Take all necessary steps to prevent the pollution of groundwater and/or water bodies in the vicinity of the project site.

CW-3.3 Measurement and Payment

No separate measurement and payment will be made for the Contractor's compliance to the foregoing. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-4.0 STRUCTURAL EXCAVATION, FILL AND BACKFILL

CW-4.1 Scope

In accordance with the specifications contained herein and as shown on the drawings and otherwise directed, the Contractor shall perform all the required structural excavation, fill and backfill for the entire project, including the proper disposal of excess excavated materials.

CW-4.2 Materials

CW-4.2.1 Structural Excavation

No classification will be made on the materials excavated. The Contractor shall determine his/her unit bid price for structural excavation based on unclassified material regardless of the nature of the materials actually encountered and excavated.

CW-4.2.2 Structural Fill

a. Sand and Gravel Fill

The material shall be of the same classification as the sand and gravel base consisting of river sand and gravel as approved by the NPC. The composite material shall be free from vegetable matter and lumps or balls of clay, and shall be uniformly graded from coarse to fine in accordance with the grading requirements shown below:

Sieve Designation (Square Mesh Sieves)	Percentage by Weight Passing
50.0 mm (2")	100
25.4 mm (1")	55-85
9.5 mm (3/8")	35-60
4.76 mm (No. 4)	25-50
2.08 mm (No. 10)	20-40
0.42 mm (No. 40)	8-20
0.074 mm (No. 200)	2-8

b. Structural Earth Fill

Structural earth fill shall consist of filling with suitable materials obtained from grading excavation or from borrow areas approved by the NPC.

CW-4.2.3 Special Foundation, if any

The NPC shall have the option to use one or both of the following materials for special foundations, whether or not shown on the drawings:

a. Lean Concrete

The strength of lean concrete shall be 13.79MPa or as designated by the NPC.

b. Selected Materials

Selected materials shall consist of compactable material which, when compacted, shall attain the required bearing capacity. The material could be a combination of earth and rock particles not greater than 8 cm including sandy clay, gravelly clay, or shale, all approved by the NPC.

Bed materials for water pipes and/or drainage culverts shall use sand fills.

CW-4.2.4 Structural Backfill

Backfill for Structures Other Than Pipes – Material for backfill shall consist of compactable and approved material taken from grading and structural excavations. Any additional material needed shall be obtained from borrow areas proposed by the Contractor and approved by the NPC.

Backfill for Sewerage and Drainage Pipes – The layer of backfill materials immediately above, up to 60 cm. from the top of pipe, and on the sides of the pipe shall consist of selected material consisting of clay soil and/or other fine materials that are free from stone particles, roots, debris. The upper layer shall consist of compactable materials taken from pipe trench and other structural excavation.

Backfill for Water Supply Pipes – Backfill for water supply pipes shall consist of compactable materials taken from trench excavation and approved by the NPC.

CW-4.3 Construction

CW-4.3.1 Excavation

a. General

The Contractor shall notify the NPC sufficiently in advance before the beginning of any excavation so that a joint survey for baseline data and cross-sectional measurements can be undertaken on the undisturbed/natural ground surface. All excavation shall be carried out according to the lines, slopes and grades shown on the drawings. In case an increase or decrease in quantities occur as a result of changes made by the NPC to such lines, slopes, and grades, the provisions on Variation Orders under the General Conditions of Contract (GCC) shall apply.

After each excavation is completed or where replacement of unsuitable material below required foundation grade has been undertaken, the Contractor shall notify the NPC so that proper inspection and confirmatory test on the bearing capacity of the foundation material can be made. In no case that concrete, sewer, drainage or water supply pipe can be placed unless a written approval has been issued by the NPC.
Over-excavation performed by the Contractor due to his carelessness shall be filled and properly compacted with the suitable material approved by NPC, at no additional cost to NPC.

b. Structural Excavation, Structure Other Than Pipes

The Contractor shall excavate the foundations to the specified side slopes and depths shown on the drawings, after which the NPC will conduct tests on the underlying material below foundation grade to determine the actual bearing capacity at such depth. If the required bearing capacity is not attained, the NPC shall instruct the Contractor to excavate further down until, in the opinion of the NPC, the bearing capacity is adequate to sustain the applied load on the foundation.

Compliance to such instruction shall not entitle the Contractor for additional compensation over and above the unit prices for excavation regardless of the nature of material excavated. For purposes of measurement, the applicable paylines for the excavation under this condition or situation shall be as shown on the drawings that show the paylines for excavation and special foundation materials.

c. Drainage and Sewerage Pipes and Cable Trench

The width of trench excavation for drainage and sewerage pipes and cable trench shall be as indicated on the drawings. All trench bottoms shall be excavated to the foundation grade indicated, regardless of the foundation material classification.

d. Water Supply Pipes

Trenches for main or feeder lines shall be excavated to the depth of no less than 0.25 meter on open ground and 0.60 meter under roadways and parking areas, both depths measured from the finished grade surface.

Service pipes shall be buried to a depth of at least 0.15 meter below grade line.

CW-4.3.2 Structural Foundation Fill

No fill materials shall be placed in any part of the fill foundation unless the foundations have been inspected and approved by the NPC. Fill materials shall be placed and spread in layer covering the entire length and breadth of the section under construction, each layer not to exceed 15 cm. in loose volume thickness and compacted thoroughly to the desired compaction as determined by the NPC. No succeeding layer shall be placed until the previous layer has been tested and approved, as to compaction, by the NPC.

CW-4.3.3 Special Foundations

If unsuitable material is encountered or if the foundation material is unsuitable such that the required bearing capacity of the foundation cannot be attained at the required elevation, further excavation shall be performed by the Contractor as stated in CW-5.3.1b.

Excavated materials below foundation grade shall be replaced at the direction of the NPC, either by lean concrete or by selected materials as mentioned in CW-5.2.3.
Selected materials shall be placed in 15-cm layers and compacted until the required bearing capacity is attained.

CW-4.3.4 Backfill

1. Structures, Other Than Pipes

Excavated areas around structures for backfilling shall be backfilled with approved materials in horizontal layers, each not exceeding 15cm. (6") in loose volume thickness. Each layer shall either be moistened or dried as directed and thoroughly tamped with tampers having no less than 160 $cm^2$of tamping area and weighing not less than 20 kg. The last layer shall be neatly brought up to the level of the adjoining finished grade surface.

In no case shall backfill be placed around concrete structures until after fourteen (14) days from placement of the concrete.

2. Drainage and Sewerage Pipes

After the pipes have been installed and grouted joints sufficiently cured, but in no case less than seven (7) days allowed for curing as specified in NSCP and the whole pipeline inspected, backfill materials specified herein shall be placed in layers as directed, each layer either dried or moistened as directed and thoroughly tamped. The backfill shall be brought up evenly on both sides of the pipe up to the top of the pipe and finally up to the finished grade surface.

3. Water Supply Pipes

After the pipeline has been installed and tested it shall be backfilled in layers as directed and compacted to the satisfaction of the NPC.

CW-4.4 Measurement and Payment

No separate measurement and payment will be made for the Structural Excavation, Fill and Backfill. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-5.0 CONCRETE

CW-5.1 Scope

In accordance with the specifications contained in this section, the Contractor shall furnish all materials, labor, equipment and tools and perform all concreting works in accordance with the drawings, or as otherwise directed.

CW-5.2 Class of Concrete

Class of concrete or strength shall be as indicated on the drawings, which shall conform to the minimum requirement for compressive strength indicated on the provision of NSCP for Concrete and, in no case, shall not be less than 20.7 MPa.

CW-5.3 Materials

CW-5.3.1 Cement

Cement for concrete works shall be furnished by the Contractor and shall conform to the requirements of the latest edition of the Standard Specifications for Portland Cement (ASTMC150).

Unless otherwise specified, cement shall be ordinary Portland Cement. Type I for general construction which concrete is not in contact with soils or ground water and Type II for concrete in contact with soil or ground water.

Changing of brand or type of cement within the same structure will not be permitted unless with prior permission and approval obtained from the NPC.

CW-5.3.2 Reinforcing Steel

The Contractor shall furnish all reinforcing steel of the sizes shown on the drawings and in accordance with the herein specifications for reinforcing steel.

CW-5.3.3 Water

Water for use in concrete shall be subject to the approval of the NPC. It shall not be salty and shall be reasonably clear and free from oil, acid, injurious alkali or vegetable matter.

CW-5.3.4 Aggregates

All coarse and fine aggregates shall consist of hard, tough, durable and clean, uncoated particles. All foreign materials and dust shall be removed by processing. Aggregates shall generally be rounded and reasonably free from

thin, flat and elongated particles in all sizes and well graded from coarse to fine.

CW-5.3.5 Formwork

Timber, lumber and plywood to be used for falsework and formwork shall be sound and shall comply with the requirements of this specifications. Use forms where a smooth form finish is required. Lumber shall be square-edged or tongue-and-groove boards, free or raised grain, knotholes and the other surfaces defects. Steel when used shall conform to the requirements of the ASTM A36. Steel form surfaces shall not contain irregularities, dents, or sags.

Forms shall be wood, plywood, or steel. Wood forms for surfaces exposed to view in the finished structure and requiring a smooth form finish, shall be plywood. For unexposed surfaces, undressed square-edge lumber may be used. Forms for surfaces requiring special finishes shall be plywood, or shall be lined with plywood, a non-absorptive, hard-pressed fiberboard, absorptive-type lining or other suitable material. Plywood, other than for lining, shall be concrete-form plywood free of raised grain, torn surfaces, worn edges, patches, or other surface defects, which would impair the texture of the concrete surface. Surfaces of steel forms shall be free from irregularities, dents, and sags.

CW-5.4 Storage of Materials

CW-5.4.1 Cement and Aggregates

All cement shall be stored, immediately upon delivery at the Site, in weatherproof building that will protect the cement from dampness. The floor shall be adequately raised from the ground and in buildings placed in the locations approved by NPC. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such a manner that allows the earliest deliveries to be used first and to provide easy access for identification and inspection of each shipment. Storage buildings shall have capacity for storage of sufficient quantity of cement to allow sampling at least twelve (12) days before the cement is to be used. Bulk cement, if used, shall be transferred to elevated air tight and weatherproof bins. Stored cement shall meet the test requirements at any time after storage when NPC orders retest. At the time of use, all cement shall be free flowing and free of lumps.

Handling and storing of concrete aggregates shall be such that segregation or inclusion of foreign materials is sufficiently prevented. NPC may require that aggregates be stored on separate platforms at satisfactory locations.

In order to secure greater uniformity of concrete mix, NPC may require that the coarse aggregate be separated into two or more sizes. Different sizes of aggregates shall be stored in separate bins or in separate stockpiles and relatively away from each other to prevent the material at the edges of the piles from intermixing.

CW-5.4.2 Reinforcing Steel

Reinforcing steel shall be stored in accordance with the specifications for reinforcing steel.

CW-5.5 Concreting

CW-5.5.1 General

The written approval of the NPC shall be secured prior to any concreting work. All concrete shall be poured on dry and cleaned surfaces.

CW-5.5.2 Formwork Construction

Forms shall be installed mortar and watertight, true to the dimensions, lines and grades of the structure and with the sufficient strength, rigidity, shape and surface smoothness as to leave the finished works true to the dimensions shown on the drawings or required by NPC and with the surface finish as specified.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms, which will subsequently be removed, shall be thoroughly coated with a release agent or coating prior to its use. The release agent shall be commercial quality form oil or other approved coating which will permit the ready release of the forms and will not discolor the concrete.

Formwork for concrete placed underwater shall be watertight.

Forms shall be constructed so that the form surface of the concrete does not undulate excessively in any direction. Undulations exceeding either 2 mm or 1/270 of the center distance between studs, joints, form stiffeners, form fasteners, or wales will be considered to be excessive. Should any form of the forming system, even though previously approved for the use, produce a concrete surface with excessive undulations, its use shall be discontinued until modifications, satisfactory to NPC's Representative, have been made.

Portions of concrete structures with surface undulations in excess of the limits herein stated may be rejected by the NPC.

Form fasteners consisting of bolts, clamps or other devices shall be used as necessary to prevent spreading of the forms during concrete placement. The use of ties consisting of twisted wire loops to hold the forms in position will not be permitted.

All formworks shall be provided with adequate clean-out openings to permit inspection and easy cleaning after all reinforcement has been placed. Where forms for continuous surfaces are placed in successive units, the forms shall be fitted over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Panel forms shall be constructed so that they can be removed without damaging the concrete. All exposed joints, edges, and external corners shall be chamfered a minimum of 20 mm unless specified otherwise herein. Forms for heavy girders and similar members shall be constructed with a proper camber.

Coating: Before placing the concrete, the contact surface of forms shall be coated with a non-staining mineral oil or suitable non-staining form coating compound or shall be given two coats of nitrocellulose lacquer, except as specified otherwise. Mineral oil shall not be used on forms for surfaces, which are to be painted. For surfaces not exposed to view in the finished structure, sheathing may be wetted thoroughly with clean water. All excess coating shall be removed by wiping with cloths. Reused forms shall have the contact surfaces cleaned thoroughly. Those that have been coated shall be given an additional application of the coating. Plaster waste molds shall be layered with two coats of the thin shellac or lacquer and coated with soft or thinned non-staining grease.

Tolerance and Variations: The Contractor shall set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed any of the tolerances specified. Variations in floor levels shall be measured before removal of supporting shores. The Contractor shall make the necessary corrective measures for the variations resulting from deflection, or when the latter affects concrete quality or curing. The tolerances specified shall not exceed by any portion of the concrete surfaces; the specified variation for one element of the structure shall be considered unacceptable when it permits another element of the structure to exceed its allowable variations. Except as otherwise specified herein, tolerances shall conform to ACI 347.

CW-5.5.3 Placing Reinforcement

Reinforcing steel and embedded items shall be properly and securely installed prior to the placing of concrete.

In no case shall concreting start without prior inspection and approval by the NPC of the placed reinforcement and other embedded items.

CW-5.5.4 Mixing Concrete

Mixing of concrete shall conform to the requirements of ACI Code for Concrete Construction.

CW-5.5.5 Placing Concrete

Concrete shall be conveyed from mixers to the forms or to the place of deposit as rapidly as possible and by methods that will prevent segregation or loss of ingredients. There shall be no vertical drop greater than 1.5 meters except where suitable equipment like metal pipe or tremie is used. The pipe or tremie shall be kept full of concrete and its end shall be kept buried in the newly placed concrete. Chutes through which concrete is delivered to the structure in a thin, continuously exposed flow will not be permitted except for very limited or isolated sections of the work.

Earth surfaces, upon which concrete shall be placed, shall be cleaned, dry and thoroughly compacted before placing the concrete.

Rock surface, upon which concrete shall be placed, shall be thoroughly cleaned of loose or semi-detached or unsound rock particles. Before placing concrete, all surfaces shall be wetted thoroughly to keep them in a completely

moist condition, after which leveling mortar of the same cement ratio as the concrete mix complete contact between concrete and the leveled surface.

CW-5.5.6 Finishing Concrete

After the concrete has been deposited, distributed and vibrated, the concrete shall be struck off and screened by mechanical means approved by the NPC. The finishing machine shall be of the screening and troweling type designed and operated both to strike off and to consolidate. Hand finishing may be employed when suitable finishing machines are not available. Finishing of concrete shall be done, as directed, to the satisfaction of the NPC.

All finished surfaces shall be tested with 3 meters straight edge and any variation of the surface from the desired crown or cross section shall be properly corrected.

CW-5.5.7 Removal of Forms

Formwork shall not be removed without the permission of NPC; where such permission, however, shall not relieve the Contractor of its responsibility for the safety of the work. Blocks and bracing shall be removed at the time the forms are removed and in no case shall any portion of the wood forms be left in the concrete.

Falsework removal for continuous structures shall be as directed by NPC but in which case shall be temporarily supported such that the structure is gradually subjected to its working stresses. False work shall not be released in any span until the strength specified hereunder is attained.

When concrete strength tests are to be used as basis for the removal of forms and supports, the compressive strength of concrete must meet the following minimum requirements:

	Min. Time	Min.% Strength
Centering under girders and beams	14 days	80%
Sides of beams and all vertical surfaces	1 day	70%
Floor Slabs	14 days	80%

The site shall be cleared of all debris and refuse resulting from work.

CW-5.5.8 Curing and Protection

Concrete shall be cured for a period of not less than fourteen (14) consecutive days by keeping the surfaces of concrete continuously (not periodically) wet. Where tongue and groove forms were used and left in place of curing, they shall be kept wet at all times prevent opening at the joints and drying out of the concrete.

CW-5.5.9 Sampling and Testing of Concrete

The Contractor shall furnish all materials, either separately or mixed, as required by NPC. Selection of materials and the making of test specimens shall be made under the supervision of NPC and delivered to NPC laboratory or any NPC-accredited testing agency at the Contractor's expense.

The expense of making and curing all concrete specimens including the materials comprising the concrete specimens shall be borne by the Contractor. The cost of shipping and testing the concrete shall likewise be at the expense of the Contractor.

No concreting work on the project will be permitted to be done until NPC signifies in writing that, following the performance of the necessary tests, he gives his approval to the use of all materials involve in making the concrete.

As work progresses, test cylinders shall be fabricated from the concrete samples and tested in accordance with ASTM C31 and ASTM C39. At least one set of four (4) cylinders shall be made from each 10 cu.m of the concrete placed of each class. Also at least one set shall be made per day for each class of concrete placed each day.

Two (2) cylinders shall be tested at 28 days for specification compliance and one shall be tested at 7 and 14 days respectively for information. The acceptance test result shall be the average of the strength of the two cylinders tested at 28 days.

The compressive strength of the concrete shall be deemed acceptable if the averages of the three consecutive strength test results is equal to or exceeds the specified strength and no individual test falls below the specified strength by more than 3.50 MPa.

Concrete deemed to be not acceptable using the above criteria maybe rejected unless the Contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be taken in accordance with ASTM C42 and soaked for 24 hours prior to testing. Concrete in the area represented by the cores will be deemed acceptable if the average strength of the cores is equal to at least 85% of and no single core is less than 75% of the specified strength.

CW-5.5.10 Tolerances and Repair for Concrete Construction

Concrete structures shall be constructed to the lines shown on the drawings or where so required to suit actual field requirements. Any structure that does not conform to such lines shall be repaired or removed and made anew by the Contractor at no additional cost to the Corporation.

Repairs shall be made at surface imperfections due to faulty placing of concrete and cuts on the structures due to the removal of excess concrete on the lines shown on the drawings. Such repairs shall be made immediately after early stripping of the forms, after the imperfections have been identified and the methods of repair appropriately established.

CW-5.5.11 Second Stage Concrete

The second stage of concrete finishing shall be done only after the final installation of all pertinent equipment, anchorages, pipings, conduits and other embedded items as may be required for all electromechanical works.

CW-5.6 Measurement and Payment

No separate measurement and payment will be made for the Concrete and Formworks. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-6.0 REINFORCING STEEL

CW-6.1 Description

This work shall consist of furnishing, fabricating, and placing of steel reinforcement of the type, size, shape and grade required in accordance with these specifications and in conformity with the requirements shown on the Drawings or as directed by the NPC.

CW-6.2 Material Requirement

All material shall conform to the requirements hereinafter given. Certified test reports (mill test or other) shall be submitted to the NPC for all reinforcement steel used. These tests shall show the results of all chemical and physical tests made.

CW-6.2.1 Bar Reinforcement

Reinforcement bars for concrete shall be hot-rolled, weld able, deformed billet-steel bars conforming to the requirements specified in ASTM A615 and PNS 49 unless shown on the Drawings or as required by the NPC. The use of the cold twisted bars is not permitted. Bar reinforcement shall be shipped in standard bundles, tagged and marked in accordance with the Code of Standard Practice of the Concrete Reinforcement Steel Institute.

CW-6.2.2 Sampling

The NPC's Representative will sample reinforcement bars at the source of supply or at the point of distribution, and the Contractor shall notify the NPC in sufficient time in advance to permit sampling and testing before shipment is made. Three (3) samples from each size shall be taken at random representing five (5) tons or fraction thereof of each size.

CW-6.3 Construction Requirement

CW-6.3.1 Order List for Bent Bars

Before materials are ordered, the Contractor shall furnish all order lists and bending diagrams for the approval of the NPC. The approval of order lists and bending diagrams by the NPC shall in no way relieve the Contractor of responsibility for the correctness of such lists and such lists and diagrams. Any expenses incident to the revisions of materials furnished in accordance

with such lists and diagrams to make them comply with the drawings shall be borne by the Contractor.

Shop Drawings for Reinforcing Steel (ACI 315): Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions and details of bar reinforcing, accessories and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing steel.

CW-6.3.2 Fabrication

Bent bar reinforcement shall be cold bent as shown on the drawings or as required by the NPC. Bars shall be bent around circular pin having the following diameters (D) in relation to the diameter of the bar (d):

Bars 6mmΦ to 20mmΦ inclusive	D=6d
Bars 25mmΦ and 28mmΦ	D=8d
Bars 32mmΦ and greater	D=10d

Bends and hooks in stirrups and lateral ties may be bent to the diameter of the principal bar enclosed therein.

CW-6.3.3 Protection of Material

Steel reinforcement shall be protected at all times from injury. When placed in the work, it shall be free from dirt, detrimental scale, paint, oil or other foreign matter. However, when steel has on its surface easily removable and detrimental rust, loose scale or dust, it shall be cleaned by a satisfactory method, approved by the NPC.

Store reinforcement of the different sizes in racks raised above the ground with accurate identification. Protect reinforcing steel from contaminants such as grease, oil and dirt.

CW-6.3.4 Placing and Fastening Reinforcement & Miscellaneous Material (ACI-301)

All reinforcement bars, stirrups, hanger bars, wire fabric, spirals and other reinforcing materials shall be provided as indicated in the drawing or required by the specification, together with all necessary wire ties, chairs, screws, supports, and other devices necessary to install and secure the reinforcement properly. All reinforcement, when placed, shall be free from rust, scale, oil, grease, clay, and other coatings, and foreign substances that would reduce or destroy the bond. Rusting of reinforcement shall not reduce the effective cross sectional area of the reinforcement to the extent that the strength is reduced beyond specified values. Heavy, thick rust or loose, flaky rust shall be removed by rubbing with burlap or other approved method, prior to placing. Reinforcement that has bends not shown on the project drawings or on approved shop drawings, or is reduced in section by rusting such that its weight is not within permissible ASTM tolerances, shall not be used. All reinforcement shall be supported and wired together to prevent displacement by construction loads or by the placing of concrete. Unless directed otherwise by the NPC, reinforcement shall not be bent after being partially embedded in hardened concrete. Detailing of reinforcing shall conform to ACI 315. Where

cover over reinforcing steel is not specified or indicated, it shall be in accordance with ACI 318.

All steel reinforcement shall be accurately placed in position shown on the drawings or as required by the NPC and firmly held there during the placing and setting of the concrete. Bars shall be tied at all intersections except where spacing is less than 30 mm in each direction, when alternate intersections shall be tied. Ties shall fasten on the inside.
Distance from the forms shall be maintained by means of stays, blocks, hangers or other approved supports. Blocks for holding reinforcement from contact with the forms shall be pre-cast mortar blocks of approved shape and dimensions or approved chairs. Layers of bars shall, be separated by pre-cast mortar blocks or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe and wooden blocks or metal chairs shall not be permitted. Unless otherwise shown on the Drawings or required by the NPC, the minimum distance between bars shall be 40mm. Reinforcement in any member shall be placed and then inspected and approved by the NPC before the placing of concrete commences. Bundled bars shall be tied together at not more than 1.80 meters intervals.

Reinforcement shall be placed accurately and secured. It shall be supported by suitable chairs and spaces or by metal hangers. On the ground, and where otherwise subject to corrosion, concrete or other suitable non-corrodible material shall be used for supporting reinforcement. Where the concrete surface will be exposed to the weather in the finished structure or where rust would impair the appearance or finish of the structure, all reinforcement supports, within specified concrete cover, shall be galvanized or made of a suitable non-corrodible material.

All placement or movement of reinforcing steel after placement, to positions other than indicated or specified, shall be subject to the approval of the NPC.

Concrete protection for reinforcement shall be as indicated, or if not indicated, in accordance with ACI 318.

The minimum concrete cover for reinforcement specified in the bid documents shall takes precedence over all permissible reinforcement placement variations; nothing in the variations listed below is to be constructed as permitting violation or compromise thereof:

a.	Height of bottom bars	±6mm above form
b.	Lengthwise positioning	±50mm of bars
c.	Spacing bars in walls and solid slabs	±25mm
d.	Spacing bars in beams and footings	±6mm
e.	Height of top bars	±6mm
f.	Stirrup spacing:	
	(1) For any one stirrup	±25mm
	(2) For over-all group	±25mm of stirrup

Anchors and bolts; including but not limited to those for the machine and equipment bases: frames or edgings, hangers and inserts, door bucks, pipe supports, pipe sleeves, pipe passing through walls, metal ties, conduits,

flashing reflects, drains and all other materials in connection with the concrete construction shall, where practicable be placed and secured in position when the concrete is placed. Anchor bolts for machines shall be set to templates, shall be plumbed carefully and checked for location and elevation with an instrument, and shall be held in position rigidly to prevent displacement while concrete is being placed.

CW-6.3.5 Splicing

Splicing of reinforcement shall be in accordance with ACI 318, except as indicated otherwise or modified herein. Where splices in addition to those indicated on the drawings are necessary, they shall be approved by the NPC prior to their use. Splices shall not be made in beams, girders, and slabs at points of maximum stress. Butt Splicing shall preferably be used over lapping for bar sizes larger than 32 mmΦ. Splices to be welded shall conform to AWS D1.4; certification of weld ability of the reinforcement by the manufacturer, shall be submitted to the NPC. If the Contractor elects to use butt splicing of reinforcing, he shall submit complete details of the process to be used by the NPC. If the butt splices are used the Contractor shall ensure that the splice meets the requirements specified herein by performing at least three splices which shall be submitted for tests to a testing laboratory that has been approved for such testing by the NPC. The cost of these shall be borne by the Contractor.

All reinforcement shall be furnished in the full lengths indicated on the Drawings. Splicing of bars, except where shown on the Drawings will not be permitted without the written approval of the NPC. When allowed, splices shall be staggered as far as possible and with a minimum separation of not less than 40 bar diameters. Not more than one-third of the bars may be spliced in the same cross section, except where shown on the Drawings.

Unless otherwise shown on the Drawings, bars shall be lapped a minimum distance of:

Splice Type	Grade 40 Min.Lap	But Not Less Than
Tension	24d	300mm
Compression	20d	300mm

Where d is the diameter of the bar. In lapped splices, the bars shall be placed in contact and wired together. Lapped splices will not be permitted at locations where the concrete section is insufficient to provide a minimum clear distance of one and one-third the maximum size of coarse aggregate between the splice and the nearest adjacent bar. Welding of reinforcing steel shall only be done if detailed on the Drawings or if authorized by the NPC in writing. Spiral reinforcement shall be spliced by lapping at least one and half (11/2) turns or by butt-welding unless otherwise shown on the drawings.

CW-6.4 Measurement and Payment

No separate measurement and payment will be made for the Steel Reinforcement. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-7.0 STRUCTURAL STEEL

CW-7.1 General

This section covers the fabrication, erection, and shop painting of structural steel in accordance with the AISC "Manual of Steel Construction" referred to herein. In the AISC "Manual of Steel Construction" referred to herein, the Specification for Design, Fabrication, and Erection of Structural Steel for Buildings," and "Structural Joints using A325 or A490 Bolts" shall be considered a part thereto.

CW-7.1.1 Submittals

Shop Drawings of all structural steel in five (5) copies for approval prior to fabrication of structural steel with complete information necessary for the fabrication and erection of the component parts of the structure including the location, type and size of all bolts and welds, member sizes and lengths, camber & connector details, blocks, copes, and cuts. Include all welds by standard welding symbols.

Erection Plan consists of descriptive data to illustrate the structure steel erection procedure including the sequence of erection and temporary shoring and bracing, and written description of the detailed sequence of all welding, including each welding procedure to be performed.
Certificates of Conformance for the following:

- Bolts, Nuts and Washers
- Welding Electrodes and Rods
- Paint
- Steel
- Certified Test Reports

Chemical Analysis and Tensile Strength Test of structural steel in accordance to ASTM A53.

For high strength bolts and nuts, the Contractor shall also submit chemical analysis, including tensile strength and hardness tests as required by ASTM A325.

CW-7.1.2 Delivery and Storage

All materials shall be handled, shipped and stored in a manner that will prevent distortion or other damages. Materials shall be stored in a clean and properly drained location and out of contact with the ground. Damaged materials shall be replaced or, when permitted by NPC, may be repaired in an approved manner at no additional cost to NPC.

CW-7.2 Materials

All the materials shall be of the best quality of their kind, well graded and within the allowable distortions. They shall be free from flakes, corrosion, scale of fragments that could reduce the resistance and durability or injure the external appearance.

Except as modified herein, blast clean surfaces in accordance with SSPC SP6. Wash clean surfaces that become contaminated with rust, dirt, oil, grease or other contaminants with solvents until thoroughly clean. Ensure that steel to be embedded in concrete and surfaces when assembled, are free from rust, grease, dirt and other foreign matter.

CW-7.2.1 Steel

Materials shall conform to the respective specifications specified herein. Materials not otherwise specified herein shall conform to the AISC "Manual of Steel Construction".

Structural Steel:	ASTM A36
Steel Pipe:	ASTM A53, Type E or S, Grade B, ASTM A501
Steel W-Shape Piles (Soldier Piles):	ASTM A328

CW-7.2.2 Bolts, Nuts and Washers:

All bolts, nuts and washers shall be of hot-dip galvanized steel, in accordance with the following:

Bolts:	ASTM A307, Grade C or ASTM A36 for Anchor Bolts; ASTM A325 for Fastening Bolts
Nuts:	ASTM A563, Grade A, heavy hex style, except nuts less than 38mm may be provided in hex style
Washers:	ANSI B18.22.1, Type B

CW-7.2.3 Accessories:

Welding electrodes and steel structural members shall use:

Rods	E70XX electrodes
Non-shrink Grout	ASTM C827, non-metallic

CW-7.3 Execution

CW-7.3.1 Fabrication

Structural steel fabrication shall be in accordance with the applicable provisions of the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings as set forth in the AISC "Manual of Steel Construction".

CW-7.3.2 Welding of Structural Steel Work:

All welding works shall be as indicated in the drawings and shall conform to AWS D1.1 - 77 "Structural Welding Code". Unless specified on the drawings,

fillet welds shall be a minimum of 5 mm (3/16") and welding electrodes shall be with a tensile strength of 485 MPa.

All welding works shall be executed by the AWS D1.1 qualified welders, welding operators and trackers, whose workmanship shall be subject to the approval of NPC.

CW-7.3.3 Shop Painting

Except as otherwise specified, shop prime surfaces of all structural steel, except steel to be embedded in concrete or mortar. Surfaces to be welded shall not be coated within 12 mm from the specified top of the weld prior to welding. Insure that the surfaces are thoroughly dry and clean when the paint is applied. Do not paint on wet weather except under cover. Do not apply paint to steel, which is at a temperature that will cause blistering or porosity, or will otherwise be detrimental to the life of the paint. Apply paint in a workmanlike manner, and coat all joints and crevices thoroughly. Prior to assembly, paint all surfaces that will be concealed or inaccessible after assembly.

Shop prime coat surfaces as soon as possible after cleaning. Apply one coat of inorganic zinc to a minimum dry film thickness of 100 microns.

- Field painting: When the erection work is complete, the heads of field bolts, all welds and any surface from which the shop coat of paint has become worn off or has otherwise become defective, shall be cleaned and thoroughly covered with one coat of shop coat paint. When the paint applied for touching up bolt heads and abraded surfaces has become thoroughly dry, apply two field coats of marine epoxy paint subject to the approval of NPC.

- Marking: Prior to erection, members shall be provided with a painted erection mark. In addition, connecting parts assembled in the shop for remaining holes in field connections shall be matched marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate erection markings in areas that will decrease member strength or cause stress concentrations.

CW-7.3.4 Erection

Except as modified herein, erect steel in accordance with the AISC "Manual of Steel Construction". Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, report such condition immediately to the NPC's Representative and obtain approval there from for the methods of correction for straightening, including members of steel conforming to ASTM A514.

Drain Steel work properly; fill pockets in structures exposed to the weather with an approved waterproof material.

Provide safety belts and lines for workmen aloft on high structures unless safe working platforms or safety nets are provided.

When calibrated wrenches are used for tightening bolts, calibrate them at least one each working day using not less than three typical bolts of each diameter. Do not use impact torque wrenches to tighten anchor bolts set in concrete.

Connections: Connections shall be executed as shown on drawing. In case, connections are not detailed, it shall be designed in accordance with AISC "Manual of Steel Construction". Build connections into the existing work. Punch, sub-punch and ream, or drill bolt holes.

Tolerances: Structural steel shall be furnished and installed to the lines and levels as shown on the drawings.

Any structure that does not conform shall be repaired, removed and/or erected anew by the Contractor at no additional cost to NPC.
Tolerances on structural steel shall be in accordance with the "Code of Standard Practice" of the AISC "Manual of Steel Construction".

CW-7.3.5 Tests and Inspections

Visual Inspection of Welding: After the welding is completed, hand or power wires brush welds, thoroughly clean them before the inspector makes the check inspection. Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size and insufficient throat and concavity. Inspect the preparation of groove welds for adequate throat opening and for snug positioning of backup bars.

Non-Destructive Testing: In accordance with AWS D1.1 Twenty-five percent (25%) of the total number of joints, as selected by the NPC, shall be tested. If more than 20 percent of welds contain defects identified by testing, then all welds shall be tested by radiographic or ultrasonic testing, and to be approved by the NPC. When all welds made are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

CW-7.4 Measurement and Payment

No separate measurement and payment will be made for the Structural Steel. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-8.0 GROUTING

CW-8.1 Scope

This specification covers the requirements for the furnishing and installation of 2 component concrete epoxy grout unless shown otherwise on the design drawings.

CW-8.2 Physical Properties

The cured product shall have the following properties:
Tensile Strength = 27.65 MPa (4000 psi) min.
Compressive Strength = 63.60 MPa (9200 psi)

CW-8.3 Submittals

The Contractor shall submit copies of brochures/specifications for NPC's approval.

CW-8.4 Measurement and Payment

No separate measurement and payment will be made for Grouting. The entire cost thereof shall be included in the various pay items in the Bill of Quantities.

CW-9.0 PAINTING REQUIREMENTS

CW-9.1 General

The steel structure and other surfaces shall be painted in accordance with first class standard practices suitable for the purpose.

All paints and shop primer to be used shall be of standard types of a well-known manufacturer subject to the approval of NPC.

CW-9.2 Surface Preparation

Prior to painting all weld spatter, mill scale, burrs, rust, loose particles, and flux shall be removed. Grinding and deburring shall be performed with a wheel that will assure a clearly cut surface.

Blast cleaning with iron-free sand or grit shall be used. The grit shall be new and unused. Surface preparation of external surface of steel that will be carried-out at the site shall be done by power tool cleaning to avoid scattering of abrasives caused by blast cleaning.

All cleaned surfaces shall be primed within six (6) hours or before any rust bloom forms on the blasted surface.

CW-9.3 Painting Application

Application of painting shall be in accordance with the Manufacturer's recommendations and standard practices. No painting shall be applied on wet or damp surfaces.

The overhead rails, lifting beam, column and girder assembly shall be painted to conform with the following:

a)	Primer Coat (50 microns DFT)	:	Zinc rich epoxy polyamide primer
b)	Intermediate Coat	:	Polyamide amine cured epoxy

	(100 microns DFT)		coating
c)	Final Coat	:	Polyamide amine cured epoxy
	(100 microns DFT)		coating

Final color of paint on external surfaces shall be silver or as directed by NPC.

CW-9.4 Measurement and Payment

Measurement for payment for Painting will be based on the number of square meter placed and accepted by NPC. Payment shall be made at the corresponding contract price for Painting shown in the Bill of Quantities. Payment shall include all costs including supply of labor and materials and other incidentals necessary for the completion of the work.

CW-10.0 STEEL POLE WITH CROSS-ARMS AND BRACES

CW-10.1 DESCRIPTION

This specification covers the technical and associated requirements for the supply and erection of steel pole complete with cross arms and braces.

CW-10.2 POLE REQUIREMENTS

30 ft. Steel Pole:

a.	Steel Material	:	ASTM A572
b.	Tip Diameter	:	200 mm
c.	Butt Diameter	:	260 mm
d.	Thickness	:	4 mm
e.	Shape	:	Octagonal
f.	Min. Yield Strength	:	345 MPa

The poles shall be manufactured and 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.

The tip and butt shall be covered with plate similar to body thickness.

Cross arm and brace members, if required in the Bid Drawings, shall be of the same material as pole body and shall conform to NPC's general arrangement drawings. The strength of the attachment of cross arms to the body shall be sufficient to develop the full capability of the cross arm.

Hole location and diameters for steel poles and cross-arms/braces shall be referred to EEICD drawings.

All structural steel, bolts, nuts and washers 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.

CW-10.3 POLE ERECTION

The Contractor shall use standard and accepted practice and method of erecting the poles depending on their location. The Contractor shall excavate holes for poles setting to a depth indicated below:

Depth of Pole Setting

Length of Poles		In Earth		In Rock	
Meter	Feet	Meter	Feet	Meter	Feet
9.15	30	1.52	5.0	1.22	4.0
7.50	25	1.40	4.7	1.22	4.0

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.

All poles shall be set truly vertical and exact in alignment. After the poles have been set and aligned properly, the holes shall be backfilled with materials consisting of 20% sand AND 80% gravel. 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.

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

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.

CW-10.4 MEASUREMENT AND PAYMENT

Measurement for payment for steel pole shall be based on the total quantity of steel pole supplied, erected and accepted by NPC.

Measurement for payment for crossarms and braces shall be on lot basis of crossarms and braces supplied, installed to the respective poles and accepted by NPC.

Payment will be made at the contract unit price for the items, Steel Pole and; Steel Crossarms and Braces in the Bill of Quantities, which payment shall

constitute full compensation for furnishing of all materials, labor and hardwares and accessories necessary to complete the items.

CW-11.0 SECLUSION FENCE

CW-11.1 SCOPE

In accordance with the specifications contained herein, the Contractor shall furnish all labor, materials, equipment and tools for the construction of seclusion fences, including the fabrication and installation of vehicular and pedestrian gates, to the length or extent shown on the drawing or as established in the field.

CW-11.2 MATERIALS

CW-11.2.1 CEMENT AND REINFORCING STEEL

Cement and reinforcing steel shall conform to the requirements set forth in CW-5.0 – Concrete. Class of concrete shall be 20.7 MPa or as shown on the drawings.

CW-11.2.2 CONCRETE HOLLOW BLOCKS (CHB)

Concrete hollow blocks shall be 150 mm x 200 mm x 400 mm (6"x 8"x 16") non-load bearing with a compressive strength of 3.10MPa. CHB units shall be free of chips, splits or other defects, which in the opinion of the NPC, might impair their strength and durability. At the option of the NPC, CHB units delivered to the site shall be tested to check on their specified strength. One specimen taken at random representing 500 units shall be tested. Sampling shall be done by the NPC. The group represented by a specimen that fails the compression test shall not be used in the work.

CW-11.2.3 FINE AND COARSE AGGREGATES AND WATER

Fine and coarse aggregates and water shall conform to the requirements stated in CW-5.0 – Concrete.

CW-11.2.4 STRUCTURAL STEEL

All structural steel (rolled shapes and plates) for the fabrication of the vehicular and pedestrian gates, unless otherwise specified on the drawings, shall conform to ASTM A36.

CW-11.2.5 HEAVY GALVANIZED CYCLONE WIRE

The material shall be made from steel wire helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling or of twisting and barbing the ends of the wires to form the selvage of the fabric. The base metal shall be steel of such quality and purity that, when drawn to the size of wire specified and coated with zinc either before or after fabrication, the finished fencing shall be or uniform quality and have the properties and characteristics conforming to ASTM

Designation A392. Fabric that is zinc coated after weaving and produced in accordance with this specification shall be hot-dip galvanized. Fabric that is zinc coated before waving may be either electronically or hot-dip galvanized.

CW-11.3 CONSTRUCTION

CW-11.3.1 GENERAL

Excavation, backfilling and concreting work shall be in accordance with the applicable provisions of CW-4.0 – Structural Excavation, Fill and Backfill, CW-5.0 – Concrete and CW-6.0 – Reinforcing Steel and as prescribed hereunder.

CW-11.3.2 CHB CONSTRUCTION

a) Laying

All masonry units shall be plumbed, leveled and accurately spaced. All units shall be wetted before laying. The block should be laid on full mortar bedding and in such a way that no cracks are formed between the blocks and the mortar at the time it is laid. Any horizontal and vertical CHB wall reinforcements shall be anchored to concrete works by means of 10 mm (3/8") round by 609 mm (24") long dowels. Embedding of anchor bolts, expansion shields, conduits, etc. shall be done as the erection progresses.

b) Cutting and Patching

Cutting and patching of masonry, as may be required to accommodate the work of other trades, shall be performed by masonry mechanics.

c) Finishing

All hollow block wall surfaces to be applied with cement plaster will be cleaned, evenly wet slushed with a wash of neat cement and sand followed by 1:2 cement mortar mix 10 mm (3/8") thick which shall be applied with a wooden float.

d) Mortar Proportions

Cement mortar for laying concrete hollow blocks shall consist of one (1) part Portland cement, one-fourth (1/4) part lime and three (3) part sand. Only sufficient water to make a workable mix will be permitted.

Masonry grout for filling cells of concrete hollow blocks shall consist of one (1) Portland cement, one-fourth (1/4) part lime, three (3) parts sand to which three (3) parts gravel is added by volume. Mortar materials shall be accurately measured by volume and thoroughly mixed until evenly distributed throughout the batch mechanical mix. The actual mixing time shall not less than two minutes.

e) Reinforcement

All horizontal reinforcement shall be tied to vertical reinforcement.

CW-11.3.3 VEHICULAR/PEDESTRIAN GATES

Fabrication and installation of vehicular and pedestrian gates shall conform to the requirements of the drawings or as directed by the NPC.

Welding Works

All welding work shall conform to the Specifications for Welded Highway and Railway Bridges of the American Welding Society (AWS).

Galvanized surfaces to be painted, in addition to being cleaned with mineral spirits or other solvents, will require surface treatment to which paint will adhere. The galvanized surfaces, therefore, shall be coated with a solution of 7.5 grams of copper sulfate to a liter of water, allowing the coating to remain on the surface of at least twelve (12) hours, and dusting off with stiff brushes.

Surfaces to be painted shall be clean, dry, smooth and free from dust, rust, grease or oil. Sufficient time shall be allowed between coats of paints to insure complete drying but in no case less than 24 hours. No painting shall take place during the presence of rain, fog, dew or where the surfaces may otherwise be damp. All work shall be done in a workmanlike manner, leaving finished surfaces free from runs and sags.

CW-11.3.4 CYCLONE AND BARBED WIRES

Fabrication and installation of the heavy galvanized cyclone wire seclusion fence and gate, including barbed and razor (line, single coil or cross coil) wires, shall be in accordance with the drawings or as directed by the NPC.

CW-11.4 MEASUREMENT AND PAYMENT

CW-11.4.1 PERIMETER FENCE

Measurement for payment for seclusion fence will be based on the number of linear meters of fence constructed and accepted or as indicated in the Bill of Quantities.

CW-11.4.3 CYCLONE AND BARBED WIRE FENCE(S)

Measurement for payment for cyclone and/or barbed wire fences will be based on the length of fence in linear meters furnished, installed and accepted including wire anchorage as indicated in the Bill of Quantities.

CW-11.4.4 VEHICULAR/PEDESTRIAN GATE

Unless otherwise indicated in the Bill of Quantities, no separate measurement and payment will be made for the fabrication and installation of vehicular and/or pedestrian gates. All costs hereof shall be included in the payment for perimeter or seclusion fences, as applicable, or as indicated in the Bill of Quantities.

CW-12.0 DOCUMENTS TO BE SUBMITTED DURING THE BID OPPENING

To be submitted with the bid/proposal for evaluation:

a. Site Inspection Certificate to be signed by NPC's authorized personnel;
b. Work Plan/Bar Chart;
c. Brochure for the following:
   - Gantry Crane
   - Grouting Materials
   - Water Level Sensor
   - Anti-Rust Coating
d. Authority to Bid from any of the following:
   Letter of Authorization and Brochures either from:
   1) Original Equipment/Material Manufacturer (OEM) or
   2) Certification/Agreement from OEM as a Licensee or
   3) Authorized Distributorship/Dealership from the OEM/Licensee of OEM.

   If from the Licensee, a Certification from the OEM as a Licensee or the Licensee agreement must also be submitted for the following:
   - Gantry Crane
   - Grouting Materials
   - Water Level Sensor/Monitoring
e. Laboratory Testing
   - Grouting Materials
   - Anti-Rust Coating
f. Duly signed and completely filled out Technical Data Sheet (TDS) for Mechanical Works.

SECTION VI

TECHNICAL SPECIFICATIONS

ELECTRICAL WORKS

PART I - TECHNICAL SPECIFICATION

EW-ELECTRICAL WORKS

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EW - ELECTRICAL WORKS

EW-1.0 GENERAL

This specification covers the technical requirements for the **Supply, Delivery, Installation and Commissioning of 25 Ton Gantry Crane at Tail Race Outlet Structure of Agus 4 HEP**

All materials to be used shall be new and have passed the manufacturer's quality control and standards. All works and specifications prior to installation shall be subject to the approval of NPC.

EW-2.0 SCOPE OF WORK

In accordance with the specification contained in this section and as shown on the bid drawings, the scope of this contract shall include all engineering services such as furnishing, installation, testing and commissioning of electrical devices including the installation/erection of distribution line materials.

The works required are as follows:

1. Supply, Delivery and Installation and Test of Water Level Monitoring and Data Logger including other accessories;

2. Supply, Laying and Test of Power of the Gantry Crane including ground conductors and other appurtenances required for the interfacing of supplied equipment;

3. Supply, Installation, Test and Commissioning of 1 x 150 kVA, 4160V/480V, 3-Phase, 60Hz Distribution Transformer;

4. Supply, Installation and Test of 15kV Fuse Disconnect Switch with Lightning Arrester combination;

5. Supply and Installation of Conduit System;

6. Clearing of right-of-way (6 meters) wide from the entire route;

7. Final survey and staking of steel poles;

8. Supply, Delivery and Erection/Installation of Steel Poles, Line Hardware, Insulators, Primary and Neutral Conductors, Dressing of Streel Poles, Guying, Ground Wires, etc.;

9. Stringing of Overhead and Neutral Conductor including Ratcheting, Installation of Armor Rods, Armor Tapes, Tie-wires, etc.;

10. Tapping connection to the existing three phase distribution line;

11. Testing and Commissioning of the Distribution Line System;

12. Supply of Lineman's Basic Equipment and Tools to be supplied as accessories and cost thereof shall be included in the bid; and

13. All other works and services including those not specifically detailed herein but are required to fully complete the project.

In addition, the following shall be provided by the Contractor:

1. Provision of services of a highly qualified and competent Electrical Engineer with experience in the implementation of electrical works to perform/direct supervision during installation and test of all supplied devices, including cabling works;

2. Conduct of inspection to verify and assess the extent of the related and incidental works needed to implement the project competently and efficiently; and

The Contractor shall bear full responsibility that the materials 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.

EW-3.0 STANDARD OF MATERIALS

All materials to be used in the work shall be new, of high quality, free from all defects and of proven acceptability for the intended purpose. Unless otherwise specified, materials shall conform to the latest applicable standard issued by the following authorities:

1. American National Standards Institute (ANSI)

2. International Electrotechnical Commission (IEC)

3. Institute of Electrical and Electronic Engineers (IEEE)

4. Underwriter's Laboratory (UL)

5. National Electrical Manufacturer's Association (NEMA)

6. National Electrical Code (NEC)

7. Philippine Electrical Code (PEC)

Other recognized national standards may be accepted if, in the opinion of NPC representatives, such will guarantee a quality not inferior to that guaranteed by the above standards.

In case of conflicting requirements between authorities cited above and those specified, such disagreement shall be resolved by representative of whose decision shall be final.

EW-4.0 WATER LEVEL MONITORING

The Water Level Monitoring System shall be threaded or locknut mounted with IP 68 protection.

Water level monitoring system shall have a minimum range of 15 meters with pulse measuring principle.

EW-5.0 DATA LOGGER

The Data logger shall consist of maximum 32 channels and having a 16 MB storage capacity. Allowing them to record while in transit and extended periods of time with 2 minutes cycle every time.

EW-6.0 PANELBOARD

The panelboard shall be surface mounted rated at 480V, 60Hz, weatherproof, operating on a three-phase system. The panelboard should have a grounding bus and properly connected in ground matting.

Circuit breaker shall be quick-make, quick-break, thermal magnetic and trip indicating type with rating as required by connected load.

Nameplate shall be black plastic with engraved white letter. The Contractor shall be responsible for the proper identification and labelling of all branch circuits.

EW-7.0 POWER, CONTROL, AND INSTRUMENTATION CABLES

This specification covers the technical and associated requirements of power, control and instrumentation cables, and medium voltage power cable for use in switchyards.

All cables shall be designed to withstand the short-circuit condition and voltage drop of 3% (max.).

EW-7.1 TECHNICAL CHARACTERISTICS AND REQUIREMENTS

The cables to be supplied shall have insulation levels able to withstand any voltage surges which are normally expected to occur in the power system in which the cable is to be used, due to switching operations, sudden load variations, faults, etc. The medium voltage XLPE power cable and the 600V power, control and instrumentation cable to be supplied shall be compliant to ICEA S-66-524 or IEC 60502-2 and UL 83, PNS 35, ICEA S-73-532 specification and requirements of PEC respectively.

The cables shall be selected to withstand without distress any short-circuit currents in the conductor and sheath related to the existing fault levels.

The cables and its accessories shall be manufactured to fulfill the requirements when operating with full load or at any load factor.

EW-7.1.1 Insulation

Insulation shall be of the type specified in the Technical Data Sheets.

EW-7.1.2 Jacket

A tough, ozone, low chlorine, heat, flame and moisture-resistant PVC or Nylon jacket capable of providing protection against sunlight, acids, alkalis and oils shall be furnished for all cables.

EW-7.1.3 Assembly

All multi-conductor cables shall be bundled together with non-hygroscopic fillers to assure a smooth circular assembly. A lapped core binding tape shall be applied over the assembly.

EW-7.1.4 Application

All cables shall be suitable for installation in cable tray, conduit, trench, underground duct in wet and dry locations, and above ground raceway in damp and dry locations.

EW-8.0 CONDUIT

All embedded and concealed in ceiling conduits, boxes and fitting required for the power and control conductors including all necessary hardware and accessories such as screws, bolts, concrete inserts, clamps, locknuts, couplings shall be furnished by the Contractor. The required quantities of various items of conduits and associated materials shall be furnished in accordance with the installation requirements.

During installation, due precaution shall be taken to protect the conduit and threads from mechanical injury. The ends of the conduit shall be sealed in an approved manner. Conduit runs shall be sealed using caps and discs or plugs. The seals shall be maintained, except during inspection and tests, until the conductor is pulled in. Conduit shall be checked to be free from obstructions by pulling a wooden mandrel of appropriate size through the conduit.

Conduits running in floors and terminating at equipment mounted on concrete bases shall be brought up to the equipment within the concrete bases, wherever possible.

All joints between lengths of conduits and threaded connection to boxes, fittings and equipment enclosures shall be made watertight.

Conduits installed outdoors running underground shall be buried to a minimum of 0.6 m.

Non-Metallic Conduits

Non-metallic conduit shall be made of un-plasticized polyvinyl chloride (uPVC) smooth walled inside and outside, coloured red-orange, schedule 40.

The uPVC conduits shall be non-corrosive and weatherproof, resistant to the attacks of acids and alkalis and must have a self-extinguishing property hence shall not support combustion. It shall resist corrosion, rust, and scale.

Metallic Conduits

Rigid steel conduits shall be hot-dipped galvanized. The inside of the conduit shall have stove enamelled coating to prevent erosion and assure smooth wire pulling.

Metal fittings and cover shall have the same property and finish as that of the metallic conduits.

Rigid metal expansion joints, where required, shall be of standard manufactured product, of watertight construction, equipped with approved means to provide electrical continuity of the conduit runs, zinc-coated, and so designed as to prevent damaged to the cables. They shall permit a small amount of transverse movement as well as the longitudinal movement.

EW-9.0 TRANSFORMERS

EW-9.1 GENERAL

This specification covers the technical and associated requirements for the generator step-up transformer and accessories for use in electric generating plants.

EW-9.2 TECHNICAL DESCRIPTION

The transformer(s) covered by this specification is (are) for use in an electric generating station. The application details are stated in the Technical Data Sheets.

EW-9.3 DESIGN REQUIREMENTS

EW-9.3.1 Rating

Transformer rating, specified in the Technical Data Sheets shall be the basis of the Supplier's guarantee as to performance and temperature rise. The ratings indicated are based on actual load requirements at the service and operating conditions specified herein.

EW-9.3.2 Voltage

The transformer to be supplied shall be designed to withstand the over voltages for the duration of voltage excursions which may be expected as a result of full load rejection of the generator.

EW-9.3.3 Frequency

Frequency for operation shall be 60 Hz.

EW-9.3.4 Overload Requirement

The overload rating and operation shall be in accordance with all cyclic loading duties as specified in IEC 60354. The overload capability of any auxiliary equipment such as bushings, LTC's, CT's, oil expansion tanks, leads, etc. shall not be less than the transformer overload rating. If other considerations will limit the overload capability of the transformer, the Supplier shall specify these limitations in his proposal.

EW-9.3.5 Short Circuit Withstand Capability

The transformer shall withstand the mechanical and thermal stresses produced by external short-circuit currents specified in IEEE Std. 57.12.00 (latest revision).

EW-9.3.6 Transformer Loss Evaluation

Depending on the requirement stated in the Technical Data Sheets, the Supplier is required to fill-in all the information for the transformer losses in the Technical Data Sheets for the generator step-up transformer in order for the NPC to fully determine the most cost effective of the proposed transformer(s) to be supplied considering both cost of losses and first cost.

Failure of the Supplier to completely fill- in all the information needed for proper evaluation by the NPC shall be a ground for rejection of his bid.
The transformer shall be designed for the most economical loss ratio (copper loss/iron loss) for the application as specified in the Technical Data Sheets for the transformer.

EW-9.3.7 Impedance and Reactance

The impedance and reactance shall be stated in the Proposal.

EW-9.3.8 Audible Sound Level

Sound levels decibels (dB) at rated voltage and frequency for liquid immersed generator step-up and station service transformers shall be as below. The average sound level of the transformer shall not exceed these values when measured in accordance with the conditions outlined in the latest ANSI/IEEE C57.12.90 or IEC 60551 for oil-immersed transformers or ANSI/IEEE C57.12.91 or IEC 60726 for dry-type transformers.

Equivalent Two-winding, kVA	Average Sound Level, dB
1-50	48
51-100	51
101-300	55
301-500	56
750	57
1000	58
1500	60
2000	61
2500	62

EW-9.3.9 Tolerances

The transformer shall be designed and manufactured with tolerances in accordance with applicable ANSI/IEC/IEEE standards.

EW-9.3.10 Electrical Insulating Oil

The Supplier shall furnish oil with quality suitable as an insulant and coolant for transformers. The oil shall be new naphthenic based mineral oil meeting the requirements of the latest ASTM D3487 (Specification of Mineral Insulating Oil Used in Electrical Apparatus).

Insulating liquid must not contain more than 2PPM of Polychlorinated Biphenyl (PCB), classified as "PCB free".

A Certification from the Manufacturer that the insulating oil is PCB free and laboratory analysis results conducted on a DENR-accredited laboratory shall be submitted to NPC.

EW-9.4 DESIGN AND CONSTRUCTION FEATURES

EW-9.4.1 General

The transformer design, manufacture and assembly shall minimize vibration and shall prevent damage by inherent vibration and stress during operation, transportation and short circuits.

EW-9.4.2 Cores

Cores for the transformers shall be constructed of the highest quality, non-aging high permeability grain-oriented silicon steel. The steel shall be in thin laminations, annealed after cutting and rolled to ensure smooth surface at the edges.

The laminations must be free from impurities and must receive stress relief treatment after punching. The laminations shall be accurately flattened, especially at the edges and insulated by suitable procedures with long life heat resistant insulating coat.

Both sides of each sheet shall be insulated with a durable, heat resistant insulation. The cores shall be held firmly by core clamp and brace to ensure adequate mechanical strength to support the winding and to withstand without damage or deformation, the forces, caused by short circuit stresses, transportation or handling to prevent shifting of the core laminations.

The core shall be solidly grounded to the tank and shall be provided with approved lifting devices or lifting lugs at suitable points of the core assembly for core lifting.

EW-9.4.3 Windings

Windings for transformer shall be of the best modern design of conductor having constant cross-section and uniform insulation or graded insulation

as required. The coils shall be wound and supported in a manner to provide sufficient oil ducts which will be maintained without constriction.

End coils shall have extra insulation. Coils shall be made up, shaped and braced to provide for expansion and contraction due to temperature changes in order to avoid abrasion of insulation and provide rigidity to resist movement and distortion caused by abnormal operating conditions.

Adequate barriers shall be provided between windings and core and between high and low voltage windings. End coils shall have extra protection against abnormal line disturbances. Permanent current-carrying joint for splices shall be welded or brazed, properly formed and finished, and insulated to conform to the basic insulation.

Winding conductor shall be free from scars, burrs and splinters and shall be uniformly insulated. Permanent current-carrying joint for splices shall be welded or brazed, properly formed and finished, and insulated to conform to the basic insulation.

The completed assembly of core and coils shall be vacuum dried, immediately impregnated and immersed in dry oil. They shall be adequately braced to withstand ocean shipment, short-circuit forces and earthquakes.

EW-9.4.4 Bushing

All porcelains used in bushing shall be wet process, homogenous, and free from cavities or other flaws. The glazing shall be uniform in color and free from blisters, burrs and other defects. All porcelain parts shall be one piece. The bushings of the same rating shall be interchangeable.

Bushing up to 110 kV BIL shall be porcelain bulk type whereas bushings above 110 kV BIL shall be condenser-type. In the latter case, the bushing shall be provided with capacitance test tap.

Bushings shall have the continuous current-carrying capacity necessary to carry the full 65^0C rise current. The bushings shall also be capable of carrying overload currents as required by EW-5.3.4.

The terminal pads shall be of high conductivity bronze or copper and shall be plated with hot flowed electro silver or electro-tin. Whenever a larger terminal pad is required for higher current rating, the mounting holes shall conform to NEMA Standards.

The HV and LV terminations of the generator step-up transformer shall be fitted with suitable insulating shroud. The insulating shrouds shall be manufactured through dip molding process and shall be made from flexible polyvinyl chloride (PVC) material, suitable for low voltage to high voltage applications. The insulating shroud shall be flame retardant, conforming with the UL 94 Standards. They shall be type tested for electric strength in accordance with IEC 60243 - 1 or approved equivalent standards.

EW-9.4.5 Gasket

Gaskets shall be unaffected by hot insulating oil, retain their resiliency during the life of the associated equipment, and be unaffected by weather while maintaining oil and gas tightness. Nitrile rubber gaskets are acceptable. Gaskets of neoprene and/or any kind of impregnated/bonded cork or cork only are not acceptable. Gasket flanges shall have grooves or metal stops to prevent over compression of gaskets. All bolted transformer tank or accessory openings shall be gasketed.

EW-9.4.6 Tank

The transformers shall be housed in a steel tank with all permanent joints molded, backed up by a sturdy steel structure as required to obtain the desired rigidity and strength. The material shall be of high-grade steel plate having good welding qualities. All seams, flanges, lifting and jacking lugs, braces and other parts attached to the tank shall be welded. No rivets shall be used. The cover shall be bolted type. The tank shall be able to withstand an internal pressure with oil at operating level.

All openings such as joint between the case and cover, bushings insulation mountings, etc., shall have welded on flanges to provide gaskets surfaces and allow for bolt holes. No bolts shall pass to the inside of the case and cover. Flanges shall have gaskets which will remain oil-tight and will not deteriorate under severe conditions. The tank with radiator fitted shall be tested for leaks before painting.

For station service transformer, if to be provided, the transformer tank shall be made of steel. It shall be of sealed-type construction with a steel cover. The tank cover shall be provided with a reusable gasket. The tank cover shall be grounded to the tank body using a copper strap adequately sized for the short-circuit of the transformer. The tank shall be provided with a tank grounding connector located near the base of the tank. The connector shall be eyebolt-type, made from tinned copper alloy material. Standard support lugs shall be provided on the tank wall for securely mounting the transformer on the pole. The type support lug to be provided corresponding to the transformer size shall be as shown in IEEE Std. C57.12.20, latest revision. Lifting lugs shall be permanently attached near the top of the transformer tank to allow for balanced vertical lift. The design of the lifting lugs shall incorporate a safety factor of 5. Lifting facilities for the core-oil assembly shall be provided.

EW-9.4.7 Radiators

Radiators, if to be provided, shall be bolted to the main transformer tank and readily detachable. Isolation valves shall be fitted to the tank to permit radiator removal without draining the main tank. Separate filling plugs, air bleed plugs and drain plugs shall be fitted to each radiator section. Radiators shall be galvanized externally prior to etching and painting. Particular attention shall be given to their internal cleaning and painting to ensure that the radiators arrive in a serviceable condition. All radiators shall be completely sealed with blanking plates and neoprene seals for transport. They shall be thoroughly dried before shipment.

EW-9.4.8 Hardware

All energized hardware, i.e., bolts, nuts and washers shall be made of tinned copper alloy material such as silicon bronze or equivalent. All other hardware shall be hot dip galvanized.

EW-9.5 FITTINGS AND ACCESSORIES

The following transformer accessories shall be included:

1. HV Bushing
2. Oil Level Indicator
3. Oil Sampling Plug
4. Oil Drain Valve
5. Oil Temperature Indicator
6. Pressure Relief Valve
7. Lifting Lugs
8. Anchor Bolts
9. Earthing Terminals
10. HV/LV Insulating shroud

EW-9.6 EQUIPMENT AND MARKING

The transformer shall be provided with a stainless-steel nameplate in accordance with the latest standard of IEC60076-1, fitted in a visible position showing the information indicated below. The entries on the plate shall be indelibly marked.

1. Kind of transformer
2. Number of this standard
3. Manufacturer's name
4. Manufacturer's serial number
5. Year of manufacture
6. Number of phases
7. Rated power (in kVA or MVA)
8. Rated frequency (in Hz)
9. Rated voltages (in V or kV) and tapping range
10. Rated currents (in A or kA)
11. Connection symbol
12. Connection diagram
13. Short circuit impedance (in %Z)
14. Type of cooling (i.e. OA, ONAN, etc.)
15. Insulation voltage (withstand voltages)
16. Insulating liquid
17. Temperature rise (in °C)
18. Total mass, kg
19. Mass of insulating oil

The minimum recommended dielectric strength of oil filling the transformer shall also be engraved on this plate. The rating plate and any other instructions or designations shall be in the English language.

EW-9.7 STANDARD AND COMMON TOOLS

The Manufacturer of transformer shall provide standard/common tools for use in the installation of transformer.

EW-9.8 TESTS

All tests shall be performed as per latest revision of ANSI C57.12.90 Factory Test shall include, but not limited to the following:

EW-9.8.1 ROUTINE TEST

1. Ratio, Polarity and Phase Relation Test
2. No Load Losses and Excitation Current at rated Voltage and Frequency
3. Induced Potential Test (Low-frequency Dielectric Test)
4. Mechanical (Leak Test)

EW-9.8.2 Design Test

1. Winding Resistance Measurement Test
2. Impedance Voltage and Load Loss Measurement
3. Temperature Rise
4. Lightning Impulse
5. Audible Sound Level
6. Mechanical (Lifting & Moving Devices, Pressure Test)

EW-9.8.3 Miscellaneous Test

1. Insulation Power Factor
2. Insulation Resistance
3. Short Circuit Capability

EW-9.8.4 Site Test

The Supplier shall perform all tests specified by the equipment Manufacturer, applicable standards and as necessary to verify the proper operation of the equipment in the presence of NPC representatives.

1. Check level and alignment of the installed transformer;
2. Check tightness of connections and fastenings;
3. Check proper grounding;
4. Check oil level monitors, nameplate, vent plugs;
5. Check wire and cable connections;
6. Check cable glands and entrance; and
7. Check on the proper installation of transformer accessories.
8. Winding resistance
9. Insulation Resistance & Polarity Index/Dielectric Absorption Ratio
10. Transformer Turns Ratio
11. Oil Dielectric Breakdown Voltage Test

EW-9.9 FAILURE TO MEET GUARANTEES

Depending on the requirement stated in the Technical Data Sheets, the transformer will be tested for compliance with the Manufacturer's guaranteed losses. If the transformer losses, as determined by test, at

rated voltage, frequency and 100% rated kVA exceed the guaranteed total losses, the excess in losses shall be evaluated at the following rated cost and the resulting amount shall be deducted from the contract price.

$$S = 2 [(N_{L-L}) (N_{LM} - N_{LG}) + (L_L) (L_{LM} - L_{LG})]$$

Where:

S	=	Amount to be deducted from the Contract Price
N_{L-L}	=	Cost of No load losses equivalent to Php 300/Watt
N_{LM}	=	Measured no-load losses expressed in Watt
N_{LG}	=	Guaranteed no-load losses as stated on the Technical Data Sheets
L_L	=	Cost of Load Losses equivalent to Php 250/Watt
L_{LM}	=	Measured load losses expressed in Watt
L_{LG}	=	Guaranteed load losses as stated on the Technical Data Sheets

When the excess of the total losses reaches five percent (5%), NPC shall have the right to reject the transformer for which such excess is verified during the factory acceptance test.

Successful Bidder shall promptly provide NPC one (1) original and three (3) certified copies of all test data and reports on the transformer.

EW-9.10 DATA AND INFORMATION TO BE SUBMITTED AFTER AWARD OF CONTRACT

The following documents shall be submitted after award of contract for NPC's review and approval prior to procurement and installation of the supplied equipment and materials:

1. Brochure/Catalogues of the transformer;

2. Manufacturer's Technical Data Sheets of the transformer in accordance with EW-14.3;

3. Outline drawings of transformer and accessories showing the following:

    a. General Dimensional Drawing
    b. Sectional Drawing
    c. Nameplate Drawing
    d. Marshaling box with connection diagram

4. Description and instructions covering the installation, operation and maintenance of the transformer and accessories;

5. Duly signed Routine Test Results; and

6. Field Test to be Performed and Certified Test and Inspection Reports duly signed and witnessed by NPC representative.

EW-10.0 FUSE CUTOUT WITH LIGHTNING ARRESTER COMBINATION

This specification covers the supply and delivery of fuse cutout with lightning arrester combination for use in 4.16 kV distribution line.

The materials furnished shall be in accordance with, but not limited to, the latest issues of the Applicable Codes and Standards, including all addenda, in effect at time of purchase order unless otherwise stated herein.

EW-10.1 TECHNICAL CHARACTERISTICS AND REQUIREMENTS

Fuse Cut-Out

a.	Type	:	Open drop out and expulsion fuse cut out
b.	Rated Voltage, kV	:	15
c.	Rated Frequency, Hz	:	60
d.	BIL, kV	:	110

Fuse cut-outs shall be satisfactory use in a tropical climate with high relative humidity. The cut-outs will be mounted by means of steel brackets on steel poles cross arms.

The cut-outs are intended for use with button head type fuse links and must be able to accommodate fuse links meeting the interchangeability requirements of ANSI standard.

The cut-outs to be supplied shall include the following:

1. Fuse Support Assembly
2. Fuse Holder Assembly
3. Mounting Bracket
4. Lock Washers

Fuse Link

a.	Type	:	Universal button head
b.	Rated Voltage, kV	:	15
c.	Continuous current rating, A	:	Refer to Staking Sheet

The fuse link to be supplied shall be universal button head type with tin fuse element suitable for 15 kV open type distribution cutout to be used in the overcurrent protection of circuits and are intended to coordinate with automatic circuit re-closer and transformer protection equipment. The fuse link shall meet the electrical and mechanical interchangeability requirement in accordance with ANSI standard.

Lightning Arrester

a.	Type	:	Metal oxide varistor (MOV), gapless type
b.	Duty cycle voltage, kV	:	12
c.	Maximum continuous operating voltage, kV phase to ground		10.2
d.	Frequency, Hz	:	60
e.	BIL, kV	:	110

Gapless arresters shall have elements fabricated from non-linear resistance metal oxide materials to perform both the surge discharge and power frequency reseal functions.

Arresters of this type shall be protected in a hermetically sealed wet-process porcelain jacket, which shall have a high creepage distance and a high dielectric strength.

Both line lead and isolator terminals shall accommodate 1/0 AWG to 2/0 AWG ACSR.

The arrester shall be supplied with a bracket suitable for the intended applications as shown in the Bid Drawings that conforms with the requirements of NEMA or with appropriate bracket as a cutout arrester combination on it.

All mounting bolts and conductor connection requires lock washer. Lock washers shall be fabricated from material that complies with the requirements as per ANSI standard.

All exposed steel or iron part of the arrester shall be hot-dipped galvanized in accordance with ASTM standard.

EW-10.2 TEST AND EXPERIENCE REQUIREMENTS

Test report on design and routine tests performed in accordance with ANSI and/or IEC standard shall be submitted to NPC for evaluation and approval.

Equipment and Manufacturer's Experience

a.	The Manufacturer should have been in the business of manufacturing the equipment of the same voltage level for not less than: years	:	10

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

EW-11.0 LINE MATERIALS

EW-11.1 SCOPE

This section covers the line material specification for 4.16 kV distribution line in accordance with the requirements specified hereunder and as shown on the drawings.

EW-11.2 LINE MATERIALS SPECIFICATIONS

Describe herein is the general specification of the line materials and equipment to be supplied for this project.

EW-11.2.1 Cross arms

The cross arms to be supplied for this project shall be in accordance to ASCE manual 72 "Design of Steel Transmission Pole Structures". The materials shall meet ASTM A-570 specification (36 KSI min. steel strength) while the galvanizing shall be in accordance with ASTM A-123 specification.

EW-11.2.2 Conductors

The conductors to be furnished shall be in accordance with, but not limited to, the latest issues of approved standards for ACSR conductors.

EW-11.2.3 Insulators

Insulators to be utilized in the project shall be in accordance to ANSI Class 55-4 and 56-2 for pin, Class 52-1 for suspension, Class 53-2 and Class 53-4 for spool standard as to material, ultimate tensile strength, leakage, distance, etc.

EW-11.2.4 Line Hardware

Line hardware shall be made either of aluminum alloy, malleable iron or ductile iron with tensile strength in accordance with ANSI standard.

EW-11.2.5 Bolts

All bolts such as carriage, double arming, oval, machine, etc. shall be hot dip galvanized as per ASTM A-153.

EW-11.3 TESTS

All materials to be supplied under this specification shall comply with test criteria and NPC's acceptance of the conductors, insulators, line hardware and accessories and its components and shall not relieve the Contractor of his responsibility for meeting all the requirements of this specification.

The Contractor shall carry out at his own expense all tests necessary to ensure the satisfactory design and manufacture of line transformer, line materials and its components in accordance with the applicable standards mentioned herein in the specification.

All tests required in the applicable standards for the equipment shall be witnessed by NPC representative unless otherwise waived. No line hardware and accessories shall be shipped until release for shipment by the NPC.

EW-11.3.1 Testing of Conductors

Power conductors or cables shall be subjected to factory routine tests in accordance with IEC 1089 or applicable standards.

EW-11.3.2 Testing of Insulators

Insulator units shall be subjected to factory routine test in accordance with ANSI Standards for wet process porcelain insulator.

EW-11.3.3 Testing of Line Hardware

Line hardware and accessories shall be subjected to factory routine tests in accordance with applicable ASTM or IEC Standards.

EW-11.4 MANUFACTURER'S EXPERIENCE

a. The Manufacturer should have been in the business of manufacturing the equipment of the same voltage level for not less than: years	:	10
b. The same type of equipment being 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 equipment being offered.

The Contractor shall submit for approval the brochures and/or catalogues with complete technical specification of the conductors, insulators, line hardware and accessories and its components to be supplied prior to fabrication and/or delivery at site.

EW-12.0 POLE ERECTION AND LINE MATERIAL INSTALLATION

EW-12.1 SCOPE

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.

If poles are stored after delivery, it shall be arranged with care and shall be placed so that no pole will come in contact with water on the ground. 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:

Length of Poles		Depth of Pole Setting In Earth		In Rock	
Meter	Feet	Meter	Feet	Meter	Feet
7.62	25	1.37	4.5	1.22	4.0
9.15	30	1.52	5.0	1.22	4.0
10.67	35	1.68	5.5	1.22	4.0
12.19	40	1.83	6.0	1.22	4.0
13.72	45	1.98	6.5	1.37	4.5
15.24	50	2.13	7.0	1.52	5.0

The Contractor shall excavate holes for pole setting to a depth indicated in table 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.

All poles shall be set truly vertical and exact in alignment.

After the poles have been set and aligned properly, the holes shall be backfilled with materials consisting of 80% gravel whose sizes ranges from 7.6 cm to 10 cm 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 tampering 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.

In section of the line where the soil bearing capacity is reduced or where special conditions so require, the Contractor shall furnish and place concrete foundation subject to the approval of NPC.

EW-12.1.1 Pole Numbering

The Contractor shall number each structure for ground patrol with the numbering indicated on the plan and profile drawings (staking sheets) or as instructed. Numbers shall be printed in 100 mm (4") black letters on a yellow background on the pole surface. The reflectorized paint shall be weather resistant approved by NPC. The numbers shall be painted approximately 3.0 meters from the ground vertically on the flat surface of the poles.

The cost of labor shall be included in the unit bid price for the supply, delivery and erection of different length of poles.

EW-12.2 STRUCTURE DRESSINGS / INSULATOR ASSEMBLIES

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

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

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

The number of suspension insulators to be used for a single string of strain assembly shall be as indicated in the drawing.

EW-12.3 GUY AND ANCHOR ASSEMBLIES

Guy and anchor assemblies shall be installed where required in accordance with the details shown in the drawings. However, NPC reserves the right to direct the Contractor to change the location of the guy and anchor 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 six (6) inches vertically or diagonally above the ground line when installed. The guy wire loop end shall be protected by a serving sleeves for holding down the loose end of guy strand beyond the guy clamp.

EW-12.4 CONDUCTORS (INCLUDING COMPRESSION JOINTS, ARMOR RODS, REPAIR SLEEVES AND JUMPERS) REQUIREMENT

The Contractor shall install, join, string and sag the conductor in accordance with the drawings.

EW-12.4.1 Tools and Special Equipment

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

EW-12.4.2 Compression Joints

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.

The Contractor shall furnish all necessary accessories, special tools, compressors, 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.

EW-12.4.3 Armor Rods

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.

EW-12.4.4 Equipment Stringing

The stringing operation shall be conducted using method which will not injure 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.

EW-12.4.5 Sagging

<u>General</u>

All distribution 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.

<u>Check</u>

a) Tension

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.

b) Sags

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 (51mm), 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.

c) Sagging Information

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

1. Date
2. Type of conductor or shield wire sagged
3. Span sagged
4. Measured sag, in meters
5. Temperature in °C or °F
6. Relative elevations of point of supports.

EW-12.4.6 Jumper Connection

At all dead-end structures or angle structures, where required, the jumper connections shall be formed in a neat and workmanlike manner.

EW-12.4.7 Repair Sleeves

Compression type repair sleeves may be used to repair minor damage to the conductor. Provided that:

1) 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

2) 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 the damage strands is not reduced by more than twenty-five percent (25%)

EW-13.0 FACTORY ASSEMBLY AND TESTS

EW-13.1 GENERAL

The Contractor shall carry out at his own expense, all tests necessary to ensure the satisfactory design and manufacture of all equipment in accordance with relevant ANSI and IEC standard.

All parts shall be properly marked for ease of assembly in the field. Test report on design and routine tests performed in accordance with ANSI or IEC standard shall be submitted to NPC for evaluation and approval.

The test equipment, test method, measurements and computations shall be in accordance with the latest applicable requirements of ANSI and IEC standard.

EW-13.2 SHOP TEST

Routine, design, quality and conformance test and other necessary tests shall be performed in accordance with ANSI Standard or equivalent IEC Standard. Design tests is required if the equipment is manufacturer's new design or previous design with significant design changes. In this case, certified test report of duplicated production type is acceptable.

The Contractor shall make all preparation for tests and provide the required test apparatus and personnel and shall notify NPC in advance of the test schedule.

The test methods, measurements and computation shall be in accordance with the latest applicable requirements of ANSI and IEC standard and shall be submitted for NPC's approval.

EW-13.3 FIELD AND ACCEPTANCE TEST

Field tests and acceptance tests shall be performed by the Contractor to be witnessed by NPC on the various components of the distribution line to determine whether requirements of the specification have been fulfilled. The Contractor shall provide instructions and acceptance criteria for field testing and commissioning for NPC's reference and application for the distribution line system.

Four (4) certified copies of the reports of all routine tests mentioned herein based on specification standard 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.

If however, 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.

If any of the distribution line component i.e., steel poles, insulators, conductors, 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 distribution 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.

EW-13.4 FINAL COMPLETION OF WORK

After all the conductors and neutral wires are completely strung, Contractor and NPC shall conduct a joint final inspection from tapping point to receiving end of the line. The Contractor must satisfy NPC that all minimum requirements indicated on the General Design Data for 4.16 kV, Single Circuit, Steel Pole Distribution Line had been met, especially the minimum clearance to ground of the conductor. A continuity test of the line from the tapping point to the receiving end must also be conducted in order to ensure that the entire line is continuous. The decision made by NPC in any defect as found by him shall be final and all the requirements must be complied by the contractor after receipt of official written communication before a Certificate of Final Completion of work is to be provided.

EW-14.0 DATA AND DOCUMENTATION REQUIREMENTS

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

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

EW-15.0 MEASUREMENT OF PAYMENT

Measurement of payment for all electrical works shall be based on the bid price of each item as shown in the Bill of Quantities – Electrical Works, Section VII of the Bid Document. The cost of each item shall cover all works required and described in the pertinent provisions of the specifications.

SECTION VI - TECHNICAL SPECIFICATIONS

PART II - TECHNICAL DATA SHEETS

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SECTION VI - TECHNICAL SPECIFICATIONS

PART II - TECHNICAL DATA SHEETS

GANTRY CRANE

a) The Bidder shall complete this technical data sheet and submit the filled-up form with the technical proposal. The Bidder shall use continuation sheets as necessary for any other additional information keeping to the format shown herein or by reproducing the same.

b) NPC reserves the right to reject Bids without proper and/or specific data and information as required herein.

c) The data required are technical features and characteristics of the Equipment/component/material to be provided by the bidder. Bidder's proposal shall at least be equal or superior to the requirements specified by NPC.

EQUIPMENT/COMPONENT DATA

1.0 Gantry Crane

ITEM	DESCRIPTION	NPC REQUIREMENT	CONTRACTOR's DATA
1.0	**Water Level Monitoring Sensor**		
1.2	Manufacturer	By Contractor	
1.3	Brand/Model	By Contractor	
1.4	Place of Manufacture	By Contractor	
1.5	Measuring Principle	Pulse	
1.6	Range	0-15 meters	
1.7	Frequency	80 GHz	
1.8	Accuracy	± 2mm	
1.9	Signal Resolution	0.3 micro-A	
1.10	Power Supply	12-24V DC	
1.11	Output	2-20 mA	
1.12	Mounting	Thread/Locknut	
1.13	Dimension	60mm x 109mm	
1.14	Protection	IP68	
1.15	Operating Temperature	-40 - +80 °C	
2.0	**Data Logger**		
2.1	Manufacturer	By Contractor	
2.2	Brand/Model	By Contractor	
2.3	Place of Manufacture	By Contractor	
2.4	Storage Capacity	16 MB (approx. 1,120,00 measuring values)	
2.5	Cycle	2 minutes	

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ITEM	DESCRIPTION	NPC REQUIREMENT	CONTRACTOR's DATA
2.6	Channels	Max. 32	
3.0	**Controller**		
3.1	Flash Controller	32 bits	
3.2	Watch-dog Function	RTC-IC (real-time clock)	
3.3	Interface	1 x RS232	
3.3	Housing	Polycarbonate, IP65	
3.4	Dimension	157x126x60mm	
3.5	Supported Networks	GPRS/EDGE/UMTS	
3.6	Power	12V,	
3.7	Active Power Consumption	Max. 400mA	
3.8	Software	Compatible Windows 7/10 ASCII-storage	

2.0 DISTRIBUTION POWER SUPPLY

ITEM	DESCRIPTION	NPC REQUIREMENT	CONTRACTOR's DATA
1.0	**Distribution Transformer**		
1.1	Manufacturer	By Supplier	
1.2	Place of Manufacture	By Supplier	
1.3	Transformer Model	By Supplier	
1.4	Minimum Rated Capacity, kVA	150 KVA	
1.5	No. of Phase	3	
1.6	Rated Voltage		
	a. Primary, kV	4.16	
	b. Secondary, kV	0.48	
1.7	Transformer Guaranteed Losses at Rated kVA, Voltage, Frequency and Temperature		
	a. No-Load Losses, Watts	By Supplier	
	b. Load Losses, Watts	By Supplier	
	c. Total Losses (a+b), Watts	By Supplier	
1.8	Vector Group	DYn11	
1.9	Sudden Pressure Relay	To be Provided	
2.0	**Power, Control, and Instrumentation Cable**		
2.1	15kV Power Cable		
2.1.1	Manufacturer	By Supplier	
2.1.2	Continuous current carrying capacity of conductor at 90°C Operating Temperature	Manufacturer's Data	
2.1.3	Conductor Cross-Section,	Refer to	

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ITEM	DESCRIPTION	NPC REQUIREMENT	CONTRACTOR's DATA
	mm^2	Single Line Diagram	
2.1.4	Conductor Material	Annealed Copper	
2.1.5	Insulation Material	Cross-linked polyethylene (XLPE)	
2.2	600V Power, Instrumentation and Control Cable		
2.2.1	Manufacturer	By Supplier	
2.2.2	Type		
	a. Power	THHN/THWN-2	
2.2.3	Continuous current carrying capacity of conductor at 75°C Operating Temperature		
	a. THHN/THWN-2	Refer to Single Line Diagram	
2.2.4	Conductor Material	Annealed Copper	
3.0	**Primary/Bus Conductor**		
3.1	Manufacturer	By Contractor	
3.2	Place of Manufacture	By Contractor	
3.3	Type	1/0 AWG ACSR	
3.4	Code Word	"Raven"	
3.5	Total Cross-sectional area, mm^2	62.44 (approx.)	
3.6	Outer Layers:		
	a. Material	Aluminum	
	b. Cross sectional area, mm^2	53.52	
	c. Stranding No./dia., mm	6 / 3.37	
3.7	Core:	Steel	
	a. Material	8.92 (approx.)	
	b. Cross sectional area, mm^2	1 / 3.37	
	c. Stranding No./dia., mm	9.35 (approx.)	
3.8	Conductor overall diameter, mm	19.04 (approx.)	
3.9	Ultimate Breaking Strength, kN	0.5343 (approx.)	
3.10	Rated DC Resistance at 20°, Ω/km	0.216 (approx.)	
3.11	Weight of Conductor, kg/m	Steel	
3.12	Test Requirements:		
	a. Stress –Strain Test and Report Required	Yes	
	b. Breaking Strength test and Report Required	Yes	
	c. Certified Stress-Strain Test Reports on a	Yes	

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ITEM	DESCRIPTION	NPC REQUIREMENT	CONTRACTOR's DATA
	Cable identical to the specified conductor are acceptable		
4.0	**Primary Neutral Conductor**		
4.1	Manufacturer	By Contractor	
4.2	Place of Manufacture	By Contractor	
4.3	Type	#2 AWG ACSR	
4.4	Code Word	"Sparrow"	
4.5	Stranding No./dia., mm	6-Al. & 1-Stl / 2.67	
4.6	Ultimate Breaking Strength, kN	By Contractor	
4.7	Manufacturer's Experience:		
	a. The manufacturer should have been in the business of manufacturing the conductor for not less than: years	10	
	b. The materials offered should have been in the actual service for not less than: years	5	
5.0	**Grounding System**		
5.1	Grounding connection	Exothermic	
5.2	Permissible temperature rises of grid copper conductor, ^{o}C	300	
5.3	Grid conductor		
	a. Manufacturer	By Supplier	
	b. Minimum Size, mm^2	100	
	c. Material	tin-annealed copper stranded conductor (bare)	
5.4	Bonding Conductor		
	a. Manufacturer	By Supplier	
	b. Size, mm^2	100, 50 & 22	
	c. Material	tin-annealed copper stranded conductor with 1.2 kV PVC Insulation	
5.5	Copper Ground Rod		
	a. Manufacturer	By Supplier	
	b. Diameter, mm	$\geq$ 19 mm	
	c. Length/section, m	> 3 m	
6.0	**Fuse Disconnect Switch with Lighting Arrester Combination**		
6.1	Manufacturer	By Supplier	

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ITEM	DESCRIPTION	NPC REQUIREMENT	CONTRACTOR's DATA
6.2	Rated voltage, kV	15	
6.3	Frequency, Hz	60	
6.4	BIL, kV	110	
6.5	Ampere Frame	100	
6.6	Interrupting Capacity, kA	10	
6.7	Fuse Link		
	a. Type	Universal button head design	
	b. Current Rating, A	Refer to Single Line Diagram and Staking Sheet	
	c. Interrupting rating, kA	8	
6.8	Lightning Arrester		
	a. Type	Metal Oxide Varistor (MOV), gapless	
	b. Material	Porcelain	
	c. Creepage length, mm	≥465	
	d. Duty cycle voltage rating, kV	12	
	e. Maximum continuous operation voltage (MCOV), kV	10.2	
	f. Basic insulation level (BIL), kV	110	
6.9	Mounting brackets, connectors, bolts, nuts, and other accessories	Included	

Name of Firm | Name & Signature of Representative | Designation

SECTION VI

TECHNICAL SPECIFICATIONS

MECHANICAL WORKS

PART I - TECHNICAL SPECIFICATIONS

MW - MECHANICAL WORKS

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PART I - TECHNICAL SPECIFICATIONS

MW - MECHANICAL WORKS

MW-1.0 GENERAL

The work to be done under this section shall include the furnishing of all labor, materials, equipment, tools and other incidentals for all mechanical works for the Supply, Delivery, Installation, Test and Commissioning of 25-Ton Gantry Crane at Tailrace Outlet Structure of Agus 4 HEP.

All equipment and materials to be supplied shall be new and unused. They shall be suitable for their intended purpose and shall comply with all applicable regulations, quality and dimension standards.

The work shall be performed and completed with high quality workmanship in in accordance with generally accepted modern practice in installation and erection works.

In the event that any such damage should occur due to the carelessness, negligence or fault of the Contractor, the Contractor shall repair or replace all damaged items at his own expense and to the satisfaction of NPC.

The Contractor shall accept full responsibility for his works including performance qualifications, documentation, reports, cleaning, corrosion protection, installation, shop testing, field testing, warranty provisions and compliance with the applicable codes and standards, statutes, and ordinances and the requirements of this Specification.

The Contractor shall strictly observe the requirement specified in this Specific Technical Specification (Mechanical Works) in conjunction with the General Technical Specification (Project Highlights). In case of any contradiction, the requirement specified in this Specification shall take precedence over the General Technical Specifications.

MW-2.0 SCOPE OF WORK

The Contractor scope of work covers the design, manufacture/fabrication, supply, delivery, installation, testing and commissioning of 25-Tons Capacity Gantry Crane complete with electric motor-operated trolley, electric hoist, and associated mechanical devices for the project in accordance with the requirements of the Specifications.

The works and services to be performed under this contract shall essentially consist of but not limited to the following:

a) Conduct actual site inspection/verification to have clear view and understanding of the Agus 4 HEP Management requirements;

b) Provide the services of a competent technical personnel who shall be responsible for the supervision of installation/erection, test and commissioning;

c) Design/prepare detailed drawings. The drawing shall be approved by NPC designated representative before start of fabrication and/or installation;

d) Provide tools, equipment and materials/consumables during the conduct of test and commissioning;

e) Restore all affected structures to the satisfaction of the Agus 4 HEP/NPC;

f) Conduct training of Agus 4 HEP personnel in the operation and maintenance of the Gantry Crane;

g) Supply of spare parts for One (1) year including quarterly check-up and repair/maintenance;

h) Submission of mechanical drawings, brochures/catalogues, operations and maintenance manual and spare parts;

i) Render maintenance services upon request of NPC in the event of any abnormality occur within the warranty period; and

j) Corrosion protection and painting.

The Contractor shall also provide all other related works not specifically mentioned in the Specifications but are necessary to complete the works so as to be ready for commercial operation in accordance with the intent of the contract. It is understood that all costs pertinent thereto are included in the Bill of Quantities.

MW-3.0 APPLICABLE CODES AND STANDARDS

The supply of equipment and materials shall conform to the latest specifications and provisions of the following engineering societies or other internationally accepted standards. Other standards which ensure equal or higher quality than the standards mentioned below will be accepted provided they meet the requirements of existing laws and regulations of the Government of the Republic of the Philippines.

AGMA	-	American Gear Manufacturers Standards
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standard Institute
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society of Testing Materials
AWS	-	American Welding Society
CMAA	-	Crane Manufacturers Association of America
FM	-	Factory Mutual Engineering
HIS	-	Hydraulic Institute Standards
HMI	-	Hoist Manufacturers Institute
NEC	-	National Electric Code
NEMA	-	National Electrical Manufacturer's Association
NFPA	-	National Fire Protection Association
OSHA	-	Occupational Safety Health Act of 1970

SSPC	-	Steel Structures Painting Council
NEC	-	National Electrical Code
NESC	-	National Electrical Safety Code
PEC-I	-	Philippine Electrical Code – Part I
PEC-II	-	Philippine Electrical Code – Part II
AMCA	-	Air Moving & Conditioning Association

In the event of any conflict among the above listed codes or this Specification, Appendices and Attachments, the bidder shall refer the conflict to NPC for written resolution. In addition to the above codes and standards, the bidder shall comply with all applicable state and local laws and regulations.

In addition to the above codes and standards, the Supplier shall comply with all applicable national and local laws, codes, regulations, statutes and ordinances. The latest edition of each standard shall mean the latest edition available at the date of contract signing.

Other internationally recognized national standards may be accepted, if in the opinion of NPC, such will guarantee a quality not inferior to that guaranteed by the above standards. The list of these alternative standards which the bidder proposes to adopt must be attached to his Bid for acceptance. In every case, bidders must list fully the standards they will conform to for this Contract.

In case of conflicting requirements between authorities cited above or between authorities cited and those specified, such disagreement shall be resolved by NPC and its decision shall be final. The responsibility shall be on the bidder to show the suitability of any alternative standards he may wish to use.

All units, dimensions and calculations shall be in metric system.

MW-4.0 MATERIALS AND EQUIPMENT

MW-4.1 General

All materials, equipment/component/devices and accessories to be supplied under this contract shall be new and unused, free from defects and imperfections, and best suited for the purpose intended.

Materials and components/devices used in the manufacture and assembly of the specified mechanical works shall be essentially the current design products of a reputable manufacturer regularly engaged in the production of such equipment. It shall be designed and manufactured for maximum safety and reliability in accordance with applicable codes and standards.

All equipment or substitute materials to be used shall conform to the latest specifications and provisions of approved standards of engineering societies or other equivalent standards approved by NPC.

All materials, parts and assemblies to be used shall be tested conforming to the latest specifications and provisions of approved Standards of Testing Materials. Results of the test shall be made to provide means of determining compliance with the applicable specifications. When requested, all tests or trials shall be made in the presence of NPC's duly authorized representative.

The relative experience of the Manufacturer for the Gantry Crane shall comply with the following:

a) The Manufacturer should have been in the business of manufacturing the equipment for not less than Ten (10) years; and

b) The Model/Type of gantry crane being offered should have been in the actual service for not less than three (3) years.

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

MW-5.0 WORKMANSHIP

Workmanship shall be of high quality and in accordance with the best modern engineering practice for the manufacture/fabrication, assembly, installation and testing of all mechanical equipment/component/devices. All works shall be done by personnel skilled in the related professions and trade. All parts shall be made accurately to the standard gauges so as to facilitate replacement and repairs. All special gauges and templates necessary for field erection/installation shall become the property of NPC.

Like parts and spare parts shall be interchangeable. Machining of fits on renewable parts shall be accurate and to specified dimensions so that replacement parts may be readily installed.

The parts or components shall be designed and arranged so that they can be easily inspected, cleaned, erected and dismantled without involving large scale dismantling.

MW-6.0 ACKNOWLEDGEMENT TO SITE CONDITIONS

The Contractor shall be responsible for visiting the plant site and take particular reference to accessibility to the site. The Contractor shall thoroughly investigate and familiarize himself with all the conditions at the site, the surrounding area, means of communication and transportation, and all other factors that could hamper the smooth execution of the contract.

Any and/or all expenses arising through the lack of knowledge or understanding regarding the existing conditions of the sites shall be the responsibility of the Contractor and no additional payment thereof shall be made by NPC.

MW-7.0 DESIGN REQUIREMENTS

MW-7.1 General

The 25-Tons Capacity Gantry Crane shall be designed, installed, tested and commissioned in accordance with international codes and standards. The Gantry Crane Motors and accessories shall conform to the following general requirements:

PARTICULAR	REQUIREMENT
1.0 Gantry Crane	
1.1 Capacity	25 tons
1.2 Application	Outdoor
1.3 Hoist	
1.3.1 Duty Cycle	Fem 3 m
1.3.2 Lifting Height	20.10 m
1.3.3 Lifting Speed	3.8/0.5 m/min
1.3.4 Motor Power	18/3 kW 60%ED (Duty Cycle)
1.3.5 Brake	Disc Brake
1.3.6 Motor Protection	IP55
1.3.7 Motor Class	F – Class
1.3.8 Cross Travel	Inverter
1.4 Trolley	
1.4.1 Trolley Speed	3.75 - 15 m/min
1.4.2 Motor Power	2 x 1.5 kW 60%ED (Duty Cycle)
1.5 Carriage	
1.5.1 End Carriage	Inverter (Travelling Machinery w/ gearbox)
1.5.2 Carriage Wheel Diameter	320mm
1.5.3 End Carriage Speed Control	Double Speed
1.5.4 End Carriage Bridge Travel Speed	7.5 – 30 m/min
1.5.5 Carriage Motor Power	1.5 kW 2 pcs motor 60%ED (Duty Cycle)
1.5.6 Max Wheel Load	16,700 kg
1.6 Main Power Supply	440V/3Ø/60 hertz
1.7 Control Voltage	110 V
1.8 Protection Accessories	• Complete with overload protection device with condition monitoring system; • Complete with hoist upper and lower limit switch; • Complete with 2 step cross travel limit switch;

PARTICULAR	REQUIREMENT
	• Complete with galvanized wire rope & cast iron wire rope guide; • Complete with standby heater for panel & motors; and • Complete with rain cover for hoist
1.9 Control	Pendant Push Button along crane girder w/ remote controller
1.10 Cable System	Festoon Flat Cable (7 meters span) bridge control panel, c-rail rack
1.11 Cable Reel with Accessories	Spring Type, 30 meters travel length
1.12 Manufacturer Standard	ISO 9001

The Contractor shall be responsible for a well-coordinated, complete and adequate design of the Gantry Crane in accordance with the load requirements as stated in this specification.

MW-7.1 Structural Requirements

MW-7.1.1 General

The Gantry Crane construction shall generally conform to the requirements of the latest edition of CMAA Specification No. 70 – Specifications for Electric Overhead Traveling Cranes, or B.S. 466 – Specifications for Power Driven Overhead Traveling Cranes including other standards specified in Clause MW-3.0.

The Gantry Crane and its components shall be designed and fabricated to adequate strength, stiffness and lateral rigidity to withstand all vertical, lateral and torsional forces resulting from operation of the crane under service conditions. Allowance shall be made for impact and lateral loads arising from acceleration and deceleration of the crane rails and from seismic force as specified, torsion from starting and stopping of the gantry crane motors, and from the eccentric action of vertical and horizontal forces. Allowance shall also be made for loads arising from collision with the stops.

MW-7.1.2 Construction

The structure shall be welded construction but all field connections shall be made by precision high strength bolting and these bolts shall be fitted into reamed holes. Bolted joints shall have a calculated strength not less than 125% of the net strength of the member.

The frame and bridge shall be heavy duty welded steel construction and shall be of rigid design to transmit the load without undue deflection.

The bridge rails shall be of first class quality and shall be of the type most suited to the particular crane model being proposed. Bridge rails shall be securely fastened in place to maintain center to center distance of rails by welding or by other means whichever is standard to the crane manufacturer.

MW-7.1.3 End Stops

Rigid end stops shall be provided at both ends of the trolley and runway rails. The end stops shall be of height not less than one half diameter of the driving wheel.

MW-7.1.4 Bumpers

Spring or rubber bumpers shall be provided at the ends of the trolley and crane frames to prevent damage when in collision with the stops.

MW-7.1.5 Drum Position

The electric hoisting drum shall be arranged on the trolley so that the hook is on the centerline of the crane. The horizontal distance between a vertical line through the hook is not to be greater than 1.0 meter.

MW-7.1.6 Rails

The runway and trolley rails shall be of first class quality conforming to the requirements of applicable standards. The section and weight of the rails shall be adequate for the wheel load. The rails shall be installed by welded connection made at appropriate staggered locations and securely fastened in place to maintain center distance of rails. The ends of rail shall be cut diagonal and the sections joined shall have no opening between ends.

Manufacturers are to state the tolerance position required in both the horizontal and vertical directions for the operations of the crane.

MW-7.2 Mechanical Requirements

MW-7.2.1 Hoist Drum

The hoist drum shall be made of cast and /or welded steel construction with heavy section and shall be reinforced to sustain the concentrated loads due to the rope pulls. The drum shall be made of such diameter and length that will take the full length of the ropes for the lift required plus the extra turns of each end, with not more than four layers of windings. Right and left hand helical grooves shall be machined on the surface of the drum to receive the two (2) hoisting ropes. The depths of the grooves shall not be less than 30 percent of the diameter of the rope. The rope attachments to the drum shall be simple and secure so that adjustments and replacement of the ropes may be accomplished without dismantling the parts. The drum shall be in the true running balance, and the gears shall be pressed or shrunk onto the drum and provided with standard rectangular keys or dowels. The pitch diameter of drum shall be not less than 20 times the outside diameter of the rope.

MW-7.2.2 Rope Sheaves

The rope sheaves shall be made of wrought steel with turned rope grooves with suitable tolerance. The pitch diameter of the rope grooves for all moving sheaves shall be not less than 20 times the nominal diameter of the rope. All revolving sheaves shall be in true running balance. The sheaves on the block and the sheaves leading to the hoist drum shall be bronze bearing mounted. If fleeting sheaves are used, they shall be bronze bushed and provided with grease grooves. Pressure grease fittings shall be provided on all sheaves.

MW-7.2.3 Wire Ropes

The wire ropes shall be cut from a common master run and match marked to exact length while under tension. The wire ropes shall be supplied by a reputable manufacturer of hoisting wire ropes. The wire ropes shall be adjusted so that each individual wire rope will carry its proportionate share of the total load. An equalizer shall be furnished if multi-wiring system is adopted. The wire ropes shall have sufficient length to provide the required lift, plus two turns on the drums in addition to adequate length for attaching to the drums. This safety factor of wire rope shall not be less than 5.

Hoist rope shall be equipped with overload device to prevent lifting loads in excess of 125%. Hoist shall also be equipped with upper and lower limit switches which are adjustable to set the extreme upper and lower limits of hook travel.

MW-7.2.4 Lifting Hooks and Blocks

The blocks shall be arranged to lift without twisting and sideways pull of the load, and dead end ropes shall be avoided. The blocks shall be provided with a hook which shall be drop-forged and heat-treated. The lifting hook with factor of safety not less than 5.0 shall be swiveled on an anti-friction thrust bearing and shall be annealed forged ally or carbon steel.

The bearings shall be totally enclosed, dust tight, and arranged to prevent leakage of grease. The hook under maximum load shall be easily rotated by hand on its bearing. The hook for the hoist shall be of the single hook type. The cross head shall be made of annealed carbon or alloy steel and shall have such proportions as to provide ample sheave bearing area.

The block shall be constructed so as to guard the hoisting ropes fully and prevent them from leaving the sheaves under any operating condition. The guards shall be made of cast steel or plate steel, shall be fitted close to the periphery of the sheaves, and shall be arranged for proper drainage.

MW-7.2.5 Gear Reducers

The gear reducer for the hoist and trolley shall be completely enclosed grease lubricating construction. All gears shall have standard involute teeth, machine cut from the cast or forged steel solid rim of adequate strength and durability to meet the requirements for the intended class of service and designed in accordance with American Gear Manufacturer's Association Standards or equivalent approved standards. All bearings shall be of the ball or roller type, and shall be designed to permit easy removal of the shaft and gears.

MW-7.2.6 Brakes

Brakes shall be provided so that the crane is capable of raising or lowering smoothly or holding in any position at any load up to and including the test load.

The hoist shall be provided with spring sets, electrical release thrust type magnetic brake with a rated capacity of not less than 150 percent of the rated full load torque of the hoist motor. The thrust brake shall be arranged to set when the motor power supply is cut off or fails, and to release when the hoist motor is operated. The brake enclosed shall be of weather-proof construction with convenient access to the enclosed mechanism. The magnetic coil shall be of moisture and fungus-proof construction. Means shall be provided for auto-adjusting to compensate for wear.

Nameplates shall be provided for each brake and attached to a part of the brake which ordinarily will not be rendered during its service life. Each nameplate shall conform to standard practice and clearly indicate the manufacturer's name, identification symbols, serial number and salient design features such as type, frame, torque rating and voltage.

MW-7.2.7 Travelling Wheels

The traveling wheels shall be made from the solid wrought or rolled steel wheel blanks machined accurately to size and the flanges tapered and radiused. The wheels shall be properly heat-treated to carry the maximum rated load under normal conditions without undue wear.

MW-7.2.8 Drum

The drum shall be steel or minimum ASTM Grade A48-64 Class 40 Cast Iron or equal materials as specified by the crane manufacturer. It shall be designed to withstand combined crushing and bending loads.

MW-7.2.9 Bolts and Set Screws

Bolts and Set Screws in rotating parts shall be locked, but this provision does not apply to set screws used for locking purposes.

MW-7.2.10 Lubrication

Service lubrication of all bearings shall be by means of manual grease central feed systems with individual lubrication lines to each bearing. Ball and roller bearings shall be suitably lubricated before assembly.

MW-7.2.11 Pendant Station

The crane operation shall be controlled by a weather-proof pendant mounted push-button switches suspended from the crane. The pendant shall be able to move along the crane bridge during operation. The weather-proof pendant shall be located in the control platform (see attached civil drawings).

The control pendant shall be equipped with an emergency cut-out button, key-operated buttons, signal lights for start-stop operation and a common switch for the crane's load lighting. The enclosure shall have durable, clearly marked legend plates, guards to protect switches from damage or accidental actuation and shall allow for right or left hand operation.

MW-7.3 Electrical and Civil Works Requirements

The Contractor shall furnish and mount all electrical equipment required for Gantry Crane electric including motors for trolley, hoist, brakes, controllers, and resistors with magnetic contactors where necessary, overload relays or fuse panels, limit switches, lights and wiring complete with hardware, controls and conduits in accordance with the Crane Manufacturer's Standard. Supplier shall state in his proposal the description, rating and type of motors, enclosures, brakes and controls and in accordance with the requirements specified in the relevant Electrical Technical Specifications.

The Contractor shall furnish labor, materials, equipment, tools and other incidentals for the Structural Supports in accordance with the requirements of the relevant Civil Technical Specifications.

MW-7.4 Painting Requirements

MW-7.4.1 General

The crane structural surfaces and associated mechanical/electrical equipment shall be painted in accordance with first class standard practice suitable for the purpose.

All paint and shop primer to be used shall be of standard types of a well-known manufacturer subject to the approval of NPC.

MW-7.4.2 Color Schedule

All surfaces to be painted shall be applied with minimum of one (1) coat (80 microns) zinc rich epoxy primer and two (2) coats of chlorinated rubber of 80 microns DFT each coating. Final color of paint shall conform to the following:

	Color Munsell No.
Overhead Crane Structures	7.5Y 9/12
Lower Pulley Block	Black & Yellow Stripe
Motors	7.5Y R 7.5/16

MW-8.0 SPARE PARTS AND TOOLS

The Contractor shall furnish spare parts required for regular maintenance during the one-year warranty period and complete set of tools per manufacturer's standard. The required Spare Parts and Tools shall be specified in the Forms attached in Part II – Technical Data Sheets of this Section VI, (Technical Specifications).

The Contractor shall supply any special tools and instrument required for start-up, test and commissioning, operation and normal maintenance of all the mechanical equipment/component/devices and auxiliaries supplied by the Contractor.

Each tool or appliance supplied by the Contractor is to be clearly marked with its sign and purpose identifying the function of each tool and the specific item(s) for which it is used. Each set of tools and appliances shall be fitted in a custom built lockable box clearly marked with the name of the item or equipment for which they are used and with a list of the tools contained, stamped and attached on an attached metal tab.

Every special tool and instrument shall be accompanied or furnished with maintenance or instruction manuals in English language.

All tools and appliances supplied shall be handed over to NPC in perfect condition at the time of taking over.

MW-9.0 INSPECTION AND TEST

MW-9.1 Material Tests

The Contractor shall furnish NPC with five (5) copies of certified mill and mechanical test reports covering crane hooks, hoist ropes and structural steel.

Properties of materials (e.g. material specifications, yield strength, elongation at yield, ultimate strength) and maximum calculated stresses of the following components shall also be submitted in tabular form;

1. Main structural members
2. Axles
3. Gears
4. Drums, sheaves pins and associated fittings
5. Hooks
6. Wheels
7. Rails

MW-9.2 Shop Assembly and Tests

The crane shall be completely assembled in the shop to ensure that the parts are properly fitted. The crane shall be centered upon and supported by two parallel and level rails to simulate the runway. After accurately aligning all shafts, couplings, bearings and gears, the motor bases, bearings, gear cases and structural supports shall be solidly doweled. All mating gears and especially the open gears shall be evenly across the entire tooth faces, and distance of mating gears and their shafts shall be accurate to a tolerance of 0.16 mm per meter. Shims used in shop alignment shall be left bolted or welded in place. The hoist, trolley and bridge drives shall be operated by power to check the operation of the gearing. The hoist shall be operated for 15 minutes in the slowest speed step to demonstrate that the control equipment has been designed for continuous duty.

MW-9.3 Field Testing

The crane shall be tested by the Contractor in the presence of NPC and at such time as will be directed by NPC. Before testing, the hoist shall be operated under light load for a period of time equivalent to several hours of continuous operation to run-in the gearing and ensure that all parts are properly lubricated. After this run-in period, the crane shall be inspected to see that all parts have remained in alignment and that no excessive wear has occurred. Adjustments shall be made in accordance with the manufacturer's recommendations or standard practice. All tests instruments and weights shall be furnished by the Contractor. At least two observations or readings shall be made and recorded for each test. During all the tests, volts, amperes and watts input for each applicable motor shall be recorded.

On compliance of the tests the crane will be inspected for misalignment, breakage, and undue wear.

All equipment of the crane shall operate without undue noise or vibration.

a) Overload Test

Hoist shall be tested in an overload condition as follows:

The hoist shall raise, lower and hold in any position a test load of 125% of its rated capacity. Second hoisting position shall raise this load, and it shall not be lower than the first hoisting position. Trolley and crane shall transport at full speed, or as directed, along full runway length a test load of 125% rated capacity.

b) Hoisting Test

With rated load on the lifting hook, the following tests shall be made:

b.1 "Inch" the load both in the hoisting and lowering direction. Determine and record the vertical movement of the hook for each direction.

b.2 Determine and record the hook speed for each point of the controller which will move the load both in the hoisting and lowering direction.

b.3 Permissible temperature rise of eddy current brakes or other speed controlling equipment shall not be exceeded when rated load on the hook is lowered through the full length of travel with controller in first lowering position. With no load on the hook determine and record the hook speeds for each point of the controller which will move the hook both in the hoisting and lowering directions.

c) Trolley and Crane Travel Test

The following tests will be conducted separately with the rated load on the hook:

c.1 "Inch" the trolley in each direction of travel and determine/record the distance of the trolley travels in each direction. When starting from standstill it shall be possible to limit the movement of the crane to 6 mm.

c.2 Determine and record the trolley speed for each point of the controller which will move the trolley. This test is to be conducted for both directions of travel.

The first controller point shall release the trolley brake, and the second controller point shall move the trolley at not more than fifty percent (50%) of the designed maximum trolley speed by approximately equal increments to the full-rated speed on the last point. Tests will be conducted for both directions of travel.

c.3 "Inch" the bridge in each direction of travel and determine/record the distance of the bridge moves in each direction. When starting from standstill it shall be possible to limit the movement of the bridge to 6 mm.

c.4 Determine and record the speed for each point of the controller which will move the bridge. This test is to be conducted for both directions of travel.

The first controller point shall move the bridge at a speed of not more than fifty percent (50%) of the designed maximum bridge speed. Successive points shall increase the speed by approximately equal increments to the full-rated speed on the last point.

With no load on the hook, determine and record the trolley and crane bridge speeds in both directions for each point of the controller which will move the trolley and bridge.

d) Speeds and Electrical Characteristics

Test the electric hoist under loads of 100, 75, 50 and 25 percent of rated capacity to determine and record electrical characteristics as directed by NPC.

Any defect or improper operation discovered during the test due to design deficiency will be corrected by the Contractor to the satisfaction of the NPC.

In the above outline of tests the work "inch" is used to denote the minimum movement possible.

MW-10.0 DRAWINGS AND INFORMATION

MW-10.1 General

In addition to the requirements stated elsewhere in this Specification the Contractor shall submit, as a minimum requirement, the following drawings, calculations as required and information to demonstrate compliance with this Specification.

MW-10.2 Drawings

a) Drawings with full dimensions, construction details and arrangements of:

- a.1 Complete assembly
- a.2 Main crane girders
- a.3 End truck girders
- a.4 Trolley
- a.5 Hook and block
- a.6 End stops and attachment loads
- a.7 Electrical motors and equipment (motor ratings and power requirements to be shown)
- a.8 Motor mounting details
- a.9 Braking systems
- a.10 Gearing and gear boxes

b) Wiring diagrams including full cable schedules for:

- b.1 Complete wiring system
- b.2 Control wiring
- b.3 Installation wiring
- b.4 Logic diagrams in a flow chart presentation showing automatic and manual sequence steps.

MW-10.3 Operation and Maintenance Manuals

The Contractor shall provide three (3) sets of comprehensive manuals to fully describe all aspects of design, operation and maintenance of the crane components and equipment.

MW-11.0 TRAINING OF NPC PERSONNEL

The Contractor shall conduct training of at least four (4) engineers/ operators/technicians of NPC on operation and maintenance of the systems including management and trouble shooting at site starting from start of Test and Commissioning until completion of the Work.

The Contractor shall prepare and submit a training program and schedule to NPC for approval.

The program shall cover on the techniques of safe operation, daily and monthly inspections and troubleshooting.

Training at site shall consist of having the operators actually operate the crane and perform a daily inspection. If necessary, a written exam shall be conducted to insure the operator's understanding and compliance with the required codes of conduct.

MW-12.0 CLEAN UP

When the Works are completed and before the issuance of Certificate of Completion, the Contractor shall remove from the Site, without expense to NPC, all temporary structures, all materials and rubbish of every sort, shall fill all holes and cavities made for his convenience, and shall leave the whole area in good order and condition, all as required and directed by NPC.

All excess materials, devices and component which form part of the equipment supply and identified to be no longer required for installation, shall remain at site and properly turned over to NPC.

MW-13.0 MEASUREMENT OF PAYMENT

Measurement of payment for all works shall be based on the bid price of each item as shown in the Bill of Quantities including all incidental components/parts necessary for the complete installation/assembly/erection of the mechanical works. The cost shall cover all works required and described in the pertinent provisions of the specifications.

MW-14.0 GUARANTEE

The Contractor shall guarantee that he will repair and/or replace at his own cost, the supplied equipment/component/devices against defect in workmanship and materials for a period of one (1) year after issuance of Acceptance Certificate by NPC.

The Contractor shall submit a Warranty Certificate effective from the date of acceptance by NPC.

After the lapse of the warranty period, provided that there are no defects found, NPC shall release the warranty security/certificate.

SECTION VI - TECHNICAL SPECIFICATIONS

PART II - TECHNICAL DATA SHEETS

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SECTION VI - TECHNICAL SPECIFICATIONS

PART II - TECHNICAL DATA SHEETS

GANTRY CRANE

a) The Bidder shall complete this technical data sheet and submit the filled-up form with the technical proposal. The Bidder shall use continuation sheets as necessary for any other additional information keeping to the format shown herein or by reproducing the same.

b) NPC reserves the right to reject Bids without proper and/or specific data and information as required herein.

c) The data required are technical features and characteristics of the Equipment/component/material to be provided by the bidder. Bidder's proposal shall at least be equal or superior to the requirements specified by NPC.

1.0 EQUIPMENT/COMPONENT DATA

ITEM	DESCRIPTION	UNIT	NPC REQUIREMENT	CONTRACTOR's DATA
	25 Tons Capacity Gantry Crane			
1.1	Type		Gantry Crane with Electric Hoist, Outdoor	
1.2	Manufacturer		By Contractor	
1.3	Brand/Model		By Contractor	
1.4	Place of Manufacture		By Contractor	
1.5	Gantry Crane Manufacturer's Experience	year	10	
1.6	Quantity	unit	1	
1.7	Capacity	tons	25	
1.8	Hoist			
1.8.1	Duty Cycle		Fem 3m	
1.8.2	Lifting Height	m	20.10	
1.8.3	Lifting Speed	m/min	3.8/0.5	
1.8.4	Motor Power		18/3 kW 60%ED (Duty Cycle	
1.8.5	Brake		Disc Brake	
1.8.6	Motor Protection		IP55	
1.8.7	Motor Class		F – Class	
1.8.8	Cross Travel		Inverter	
1.9	Trolley			
1.9.1	Trolley Speed	m/min	3.75 – 15	
1.9.2	Motor Power		2 x 1.5 kW 60%ED (Duty Cycle)	

Name of Firm | Name & Signature of Representative | Designation

1.0 EQUIPMENT/COMPONENT DATA *(Cont'd...)*

ITEM	DESCRIPTION	UNIT	NPC REQUIREMENT	CONTRACTOR's DATA
1.10	Carriage			
1.10.1	End Carriage		Inverter (Travelling Machinery w/ gearbox)	
1.10.2	Carriage Wheel Diameter	mm	320	
1.10.3	End Carriage Speed Control		Double Speed	
1.10.4	End Carriage Bridge Travel Speed	m/min	7.5 – 30	
1.10.5	Carriage Motor Power		1.5 kW 2pcs motor 60%ED (Duty Cycle)	
1.10.6	Max Wheel Load	kg	16,700	
1.11	Main Power Supply	V / ∅ / Hz	440 / 3 / 60	
1.12	Control Voltage	V	10	
1.13	Protection Accessories		• Complete with overload protection device with condition monitoring system; • Complete with hoist upper and lower limit switch; • Complete with 2 step cross travel limit switch; • Complete with galvanized wire rope & cast iron wire rope guide; • Complete with standby heater for panel & motors; and • Complete with rain cover for hoist	
1.14	Control		Pendant Push Button along crane girder with remote controller	
1.15	Cable System		Festoon Flat Cable (7 meters span) bridge control panel, c-rail rack	
1.16	Cable Reel w/ Accessories		Spring Type, 30 meters travel length	
1.17	Manufacturer Quality/System		ISO 9001	
1.18	Quality Standard		UL or CE	
1.19	Basic Standard		EN or IEC	
1.20	Standard Conformity		EU or RoHs	

Name of Firm | Name & Signature of Representative | Designation

2.0 SPARE PARTS

SPARE PARTS FOR GANTRY CRANE DURING THE WARRANTY PERIOD
(Per Manufacturer's Standard and Recommended Spare Parts)

ITEM	DESCRIPTION	PART NO.	QUANTITY*
2.1	Limit switches		
2.2	Bearings		
2.3	Brake end cap		
2.4	Friction disc		
2.5	Fuses		
2.6	Rope guide		
2.7	Push button contact block		
2.8	Contactors		
2.9	Gear box gasket		
2.10	Other spare parts recommended by Manufacturer for 1 year operation		

NOTES: ****Contractor to provide minimum quantity required per Manufacturer's/Contractor's recommendation during the warranty period.***

Name of Firm | Name & Signature of Representative | Designation

3.0 TOOLS LIST

TOOLS AND APPLIANCES INCLUDING SPECIAL TOOLS FOR GANTRY CRANE (Per Manufacturer's Standard and Recommended Tools and Appliances)

ITEM	DESCRIPTION	QUANTITY
3.1		
3.2		
3.3		
3.4		
3.5		
3.6		
3.7		
3.8		
3.9		
3.10		

Name of Firm | Name & Signature of Representative | Designation

SECTION VII

BILL OF QUANTITIES

SECTION VII

BILL OF QUANTITIES
CIVIL WORKS

SECTION VII

BILL OF QUANTITIES
ELECTRICAL WORKS

SECTION VII

BILL OF QUANTITIES
MECHANICAL WORKS

SECTION VII - BILL OF QUANTITIES
GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

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)
CW-1.0	**GRADING WORKS**						
1.1	Stripping	excavate & reuse	Refer to NPC TS & Drawing	cu.m.	**28**	_____ _____(P_____)	_____(P_____)
1.2	Grading Fill	furnish, spread & compact	Refer to NPC TS & Drawing	cu.m.	**55**	_____ _____(P_____)	_____(P_____)
CW-2.0	**Lifting Beam Accessories** Roller guide assembly, Lifting Hook, Interlinking mechanism Interlinking counter weight, Lifting pin hoist to complete the existing lifting beam	furnish, fabricate & install	Refer to NPC TS & Drawing	lot	**1**	_____ _____(P_____)	_____(P_____)
CW-3.0	**Chipping of Abutment & Concrete Pouring** chipping of abutment for the column foundation, drilling of rebar on the side for shear reinforcement & concrete pouring / restoration (3000psi Concrete)	chipping & restoration	Refer to NPC TS & Drawing	lot	**1**	_____ _____(P_____)	_____(P_____)
CW-4.0	**Column & Runway Girder, Girder Assembly (including roof truss of overhead crane & concrete foundation)** (A36 steel)	design, furnish, fabricate & construct	Refer to NPC TS & Drawing	lot	**1**	_____ _____(P_____)	_____(P_____)
CW-5.0	**Painting (including surface preparation)** painting furnish & apply including surface preparation	furnish & apply	Refer to NPC TS & Drawing	lot	**1**	_____ _____(P_____)	_____(P_____)

_____
Name of Firm

_____
Name and Signature of Authorized Representative

_____
Designation

SECTION VII - BILL OF QUANTITIES
GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

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)
CW-6.0	**Seclusion Fence** (including pedestrian gate and weep holes)	furnish & construct	Refer to NPC TS & Drawing	l.m	**24**	_____ _____(P_____)	_____(P_____)
CW-7.0	**Gravel Surfacing**	furnish, place, spread & compact	Refer to NPC TS & Drawing	cu.m	**6**	_____ _____(P_____)	_____(P_____)
CW-8.0	**Steel Pole (30ft.)**	furnish, erect & install	Refer to NPC TS & Drawing	pc	**1**	_____ _____(P_____)	_____(P_____)
CW-9.0	**Transformer Concrete Pad** (including excavation, bedding & anchor bolts)	design, furnish & construct	Refer to NPC TS & Drawing	pc	**1**	_____ _____(P_____)	_____(P_____)
	SUB-TOTAL AMOUNT OF BID (CIVIL WORKS)					_____ _____(P_____)	_____(P_____)

_____
Name of Firm

_____
Name and Signature of Authorized Representative

_____
Designation

ELECTRICAL WORKS

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)
EW-1.1	25-Tons Gantry Crane Controller with water level monitoring sensor, data logger and associated electrical devices; 1 x 150 KVA, 4160/480V, 3-phase, 60Hz distribution transfromer and take-off structure; 3-phase distribution line system, steel poles, line hardwares, insulators, conductors; power and control cables; conduit; distribution panel boards and gronding and other accessories and appurtenances including test and commissioning and other works and services as described in the technical specification and bid drawings.	Supply, Erection/ Install, Test and Commissioning	EW-TS & TDS	lot	1	_____ _____(P_____)	_____(P_____)
	TOTAL ELECTRICAL WORKS					_____ _____(P_____)	(P_____)

Name of Firm

Name and Signature of Authorized Representative

Designation

MECHANICAL WORKS

Item No.	Description of Work or Materials	Work to be Done	Ref.	Unit	Estimated Quantity	Unit Price in Pesos (Words and Figures)	Total Amount
1.0	25-Tons Gantry Crane complete with electric motor-operated trolley, electric hoist, and associated mechanical devices; required spare parts during the warranty period; standard and special tools; electrical controls and protection system; switches, push button pendant; power and control cables; conduit; grounding and other accessories and appurtenaces including test and commissioning and other works and services as described in the technical specification.	Supply, Install, Test and Commissioning	MW-7.0	lot	1	_____ (₱ _____)	₱ _____
	TOTAL MECHANICAL WORKS					_____ (₱ _____)	₱ _____

Name of Firm

Name and Signature of Authorized Representative

Designation

SECTION VIII

BIDDING FORMS

SECTION VIII – BIDDING FORMS

TABLE OF CONTENTS

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/Purchase Order
- 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

(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

- Documents to be submitted with the bid/proposal for evaluation as specified in Clause CW-12.0 of Section VI – Technical Specifications

- 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	%		
Government						
Private						
					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.	₱
2.	₱

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]

If the bidder is a joint venture, one of the requirements is the submission of a valid joint venture agreement.

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 that the difference between the amount of the said Principal's Bid and the amount of the Bid that is accepted by the Employer.

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, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP (PR NO.: MG-A5M22-042)

To: **National Power Corporation**
BIR Road cor. Quezon Ave.
Diliman, Quezon City

I/We[1], 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*
3. *Certificate of Employment, Bio Data and accreditation from DPWH as Materials Engineer for the Materials Engineer*

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).

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
Page 2 of 2

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, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP (PR NO.: MG-A5M22-042)**.

(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, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP (PR NO.: MG-A5M22-042)** 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-14

DETAILED COST ESTIMATE FORM

Name of Bidder : _____

Item No.	Item Description	Unit of Measure	Direct Cost			Mark-Up		VAT	Unit Cost	Total Price
			Materials	Labor	Equipment	OCM	Profit			

_____ Name, Signature of Authorized Representative

_____ Designation

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 IX

BID DRAWINGS

CIVIL WORKS

SECTION VI – BID/REFERENCE DRAWINGS
CW – CIVIL WORKS

DRAWING NO.	TITLE
AFGC-BDC-03-001	General Notes
AFGC-BDC-03-002	Vicinity Plan
AFGC-BDC-03-003	Foundation and Structural Framing Plan
AFGC-BDC-03-004	Column and Runway Girder Assembly (Front Elevation)
AFGC-BDC-03-005	Column and Girder Assembly (Elevation)
AFGC-BDC-03-006	Column and Runway Girder Assembly (Connection and Details)
AFGC-BDC-03-007	Foundation Details
AFGC-BDC-03-008	Transformer Pad (Plan, Section and Details)
AFGC-BDC-03-009	Direct Buried Steel Pole (Details)
AFGC-BDC-03-010	Seclusion Fence and Pedestrian Gate (plan, Section and Details)
AFGC-BDC-03-011	7.97/13.8kV Direct Buried Steel Pole (Elevation, Section and Details)
AFGC-BDC-03-012	7.97/13.8kV Direct Buried Steel Pole (3 Phase)

GENERAL CONSTRUCTION NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. VERIFY ACTUAL FIELD DIMENSIONS AND SITE CONDITIONS (ACTUAL WIDTH OF STOP LOG GUIDE, ACTUAL SPANNING OF THE STEEL RUNWAY GIRDER ASSEMBLY, MINIMUM POSSIBLE DISTANCE FROM STEEL COLUMN TO STOP LOG GUIDE & MINIMUM POSSIBLE HEIGHT OF STEEL COLUMN) BEFORE PURCHASE OF STEEL MEMBERS AND HOISTING EQUIPMENTS.
3. UNLESS OTHERWISE INDICATED SPECIFIC DRAWING STRUCTURE OR COMPONENT, ALLOWABLE BEARING CAPACITY OF SOIL SHALL NOT BE LESS THAN 143.9 KPa.
4. ALL STRUCTURAL STEEL SHALL BE HOT-DIPPED GALVANIZED WITH MINIMUM COATING OF 100 MICRONS AND SHALL CONFORM TO THE REQUIREMENTS OF ASTM A36 UNLESS OTHERWISE SPECIFIED.
5. ALL BOLTS FOR USE IN STRUCTURAL CONNECTIONS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 BOLTS. ALL BOLTS SHALL BE HEAVY HEX STRUCTURAL BOLT, TYPE 1, ASTM 325 EACH WITH COMPRESSIBLE WASHER, ASTM F436, TYPE 1 AND ONE HEAVY HEX NUTS, ASTM A563 GRADE DH, EACH COMPONENT HOT-DIP ZINC-COATED.
6. ALL STRUCTURAL JOINTS SHALL BE FULLY WELDED UNLESS OTHERWISE INDICATED. THE CONTRACTOR SHALL SUBMIT DETAILS OF STRUCTURAL CONNECTIONS NOT SHOWN ON CONSTRUCTION DRAWINGS INCLUDING METHODOLOGY PRIOR TO FABRICATION AND SHALL BE SUBJECT FOR THE APPROVAL OF NPC.
7. CONCRETE EPOXY FOR ANCHOR BOLTS/REBAR SHALL BE HIGH VISCOSITY TWO-COMPONENT CONCRETE AND MASONRY EPOXY WITH MINIMUM TENSILE STRENGTH OF 27.65MPa, MINIMUM COMPRESSIVE STRENGTH OF 63.60MPa, MINIMUM FLEXURAL STRENGTH OF 48.3MPa, HARDNESS OF 86 AND NEGLIGIBLE SHRINKAGE AT CURED STATE.
8. UNLESS OTHERWISE INDICATED SPECIFIC DRAWING STRUCTURE OR COMPONENT, MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE f'c= 20.7 MPa (3000 psi) AT 28-DAY PERIOD.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dinaculan, Lanao Del Norte.

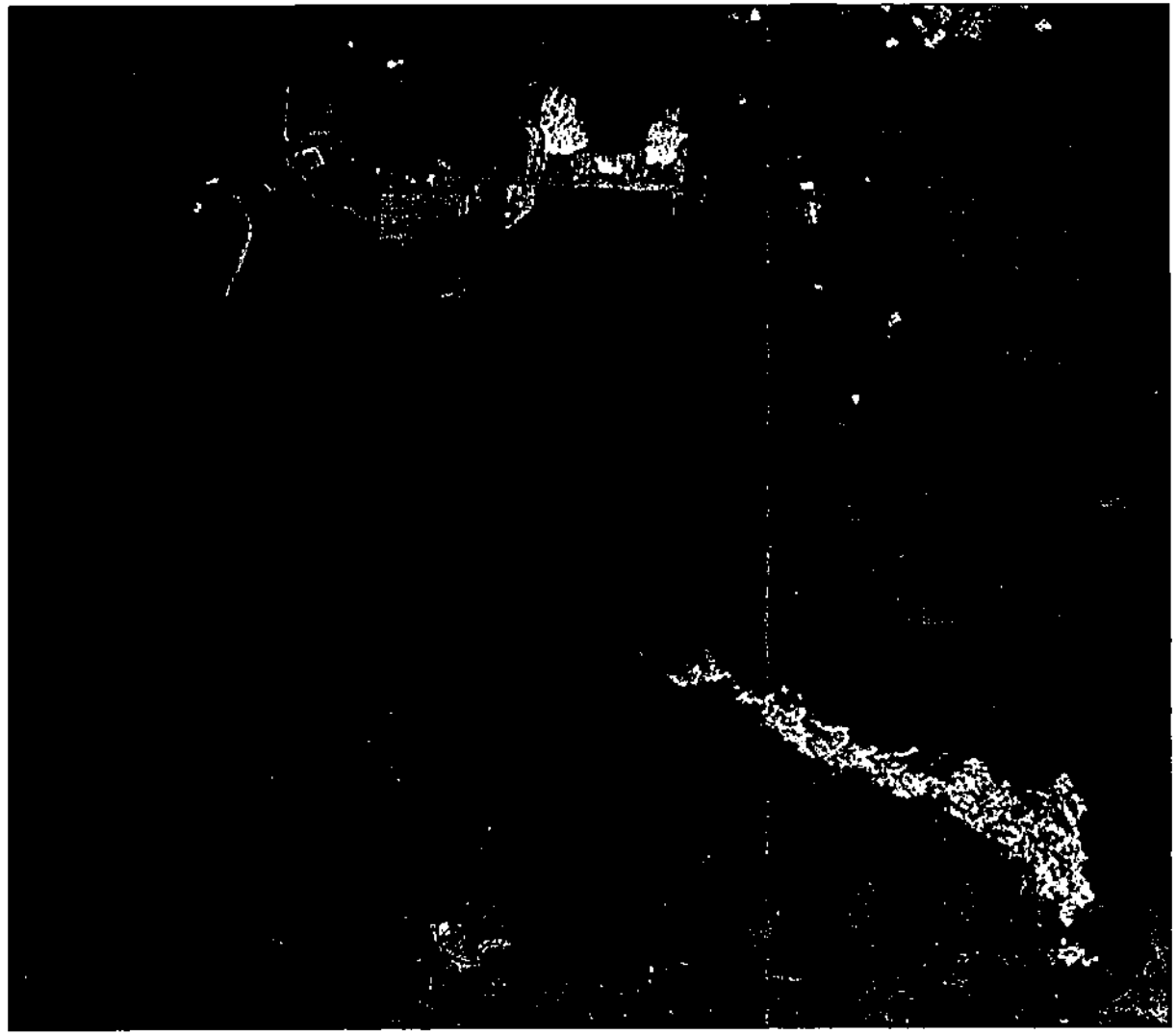
TITLE: **GENERAL NOTES**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

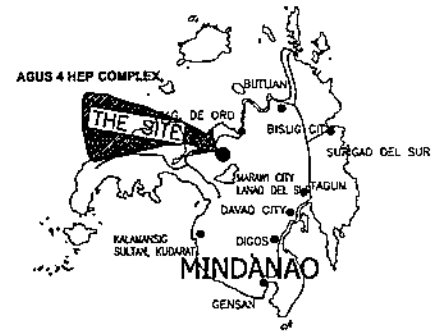
SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPIRITU, Manager, CEAD
APPROVED: N. G. SOMOZA, Manager, DDD

DWG. NO. A4GC-BDC-03.001 | PR NO. MG-A5M22-042

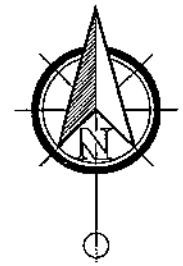
SCALE: NTS | **BID DRAWING** | REV. 0



VICINITY PLAN
SCALE 1:100



LOCATION PLAN
NOT TO SCALE



OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte.

TITLE: **VICINITY PLAN**

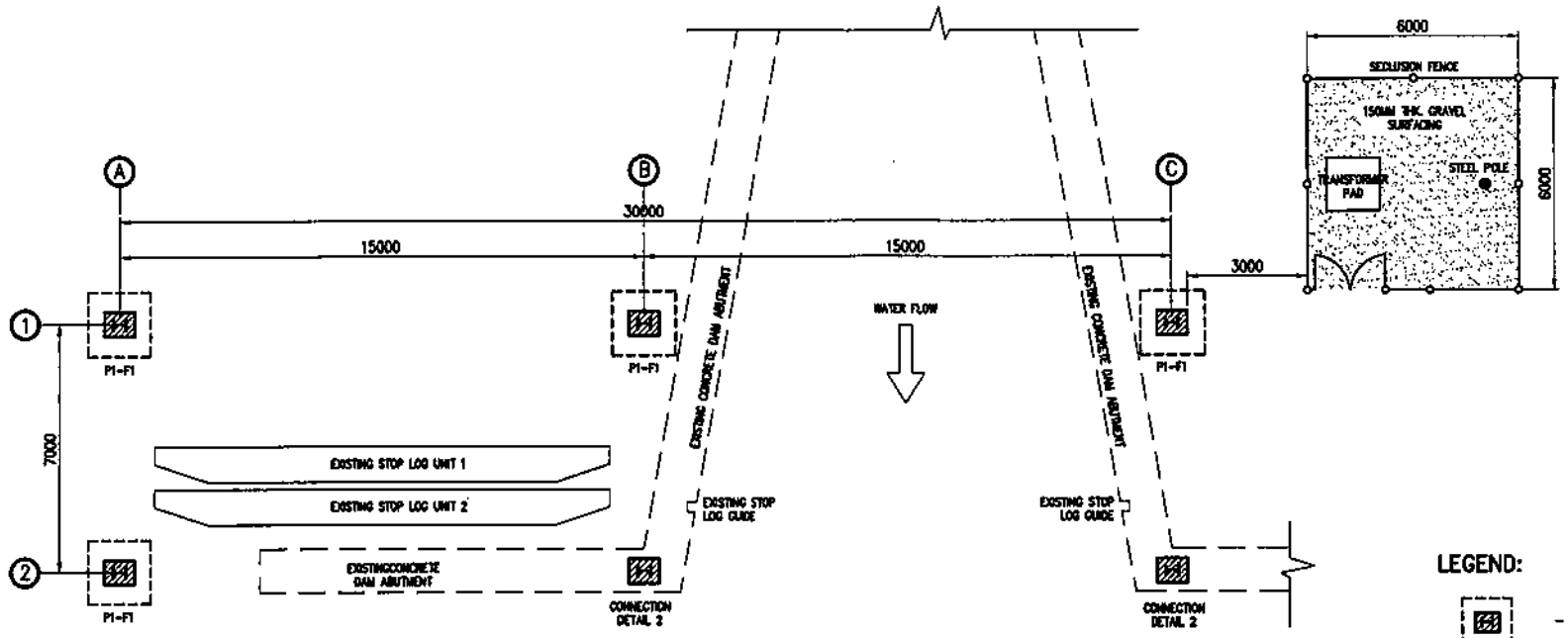
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPIRITU, Division Chief, CEAD
APPROVED: N. G. SEMBRANO, Manager, CEAD

DWG. NO. A4GC-BDC-03.002 | PR NO. MG-A5M22-042

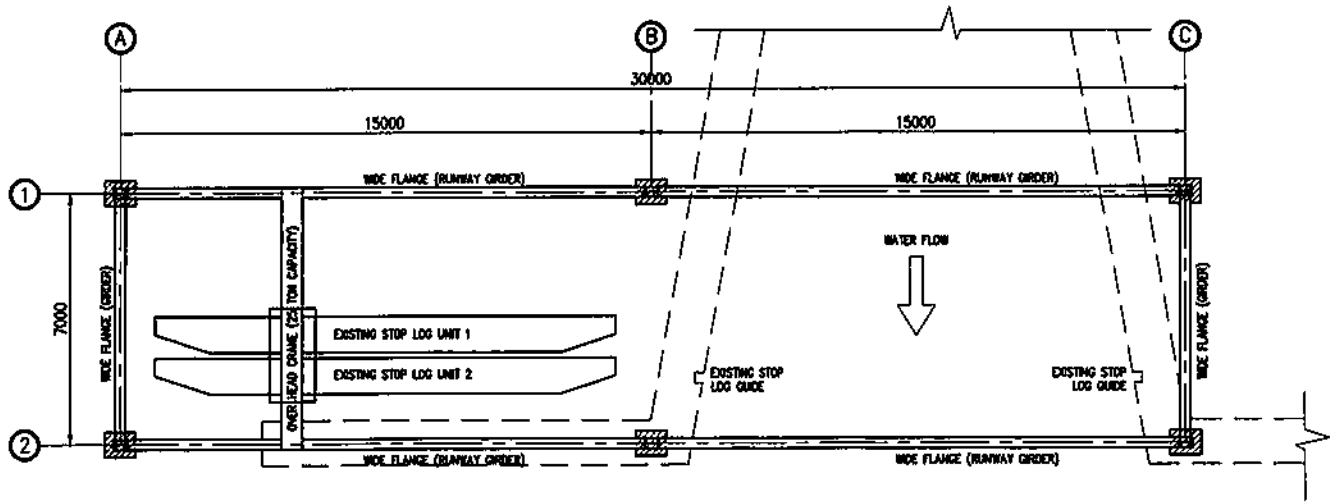
SCALE: 1:100 | **BID DRAWING** | REV. 0

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



FOUNDATION PLAN

SCALE 1:150



STRUCTURAL FRAMING PLAN

SCALE 1:150

LEGEND:

- FOUNDATION (P1-F1)
- SEE CONNECTION DETAIL 2
- EXISTING CONCRETE DAM ABUTMENT

NOTES:

1. ALL THE DETAILS ARE CONCEPTUAL DESIGN ONLY, THE CONTRACTOR SHALL CONDUCT SITE INSPECTION TO SUIT THE ACTUAL FIELD CONDITION AND SUBMIT DESIGN CALCULATION AND DETAILED DRAWINGS OF GANTRY CRANE INCLUDING CONNECTIONS FOR APPROVAL OF NPC.
2. PROVIDE SHELTER FOR OVERHEAD CRANE
3. WORK THIS WITH ELECTRICAL DRAWINGS

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dibucolan, Lanao Del Norte.

TITLE: **FOUNDATION AND STRUCTURAL FRAMING PLAN**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD

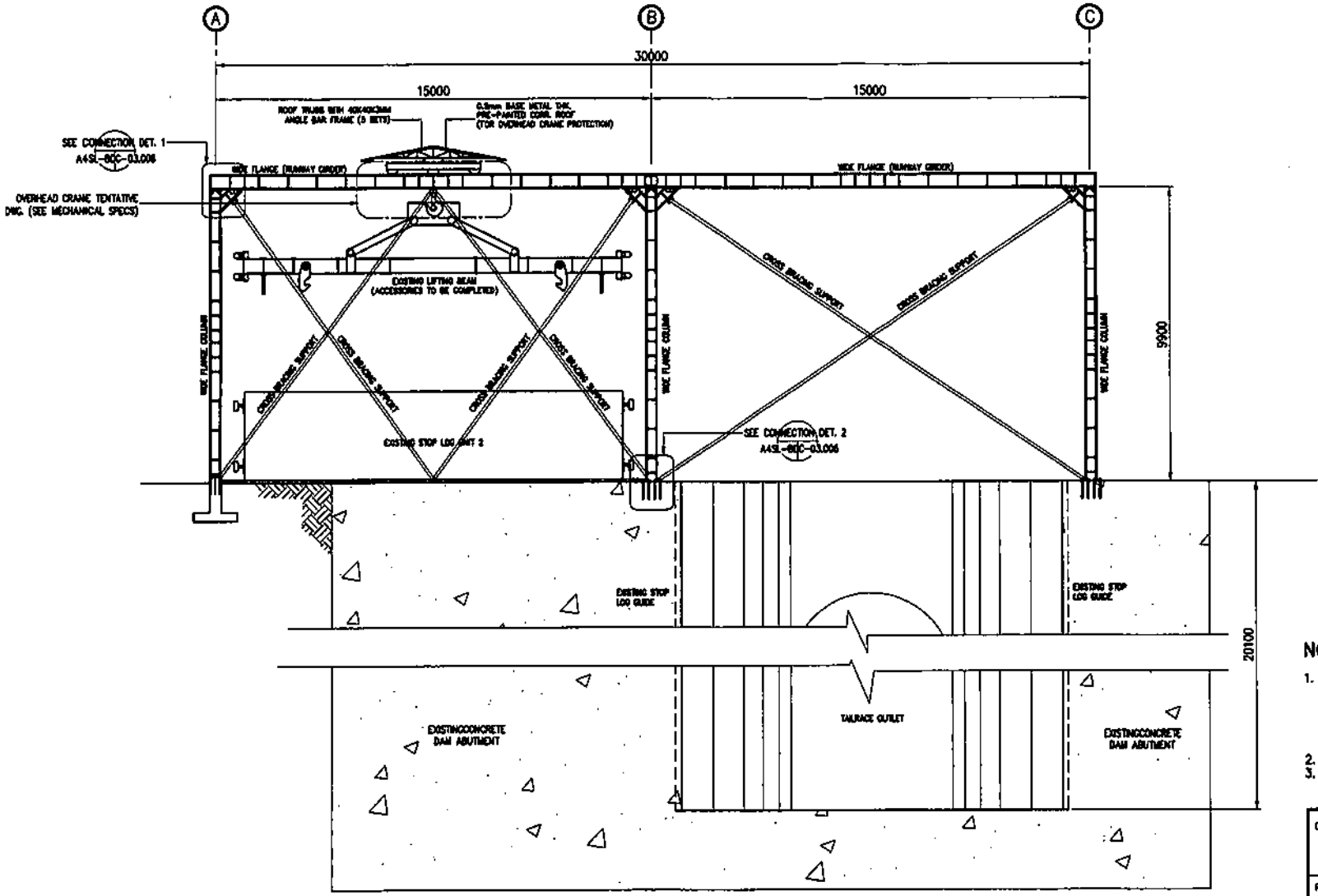
RECOMMENDED: A. CESPEDES, Manager, CEAD

APPROVED: [illegible], Manager, DDD

DWG. NO. A4GC-BDC-03.003 PR NO. MG-A5M22-042

SCALE: 1:150 **BID DRAWING** REV. 0

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



COLUMN AND RUNWAY GIRDER ASSEMBLY (ELEVATION 2)

SCALE 1:150

NOTES:

1. ALL THE DETAILS ARE CONCEPTUAL DESIGN ONLY, THE CONTRACTOR SHALL CONDUCT SITE INSPECTION TO SUIT THE ACTUAL FIELD CONDITION AND SUBMIT DESIGN CALCULATION AND DETAILED DRAWINGS OF GANTRY CRANE INCLUDING CONNECTIONS FOR APPROVAL OF NPC.
2. PROVIDE SHELTER FOR OVERHEAD CRANE
3. WORK THIS WITH ELECTRICAL DRAWINGS

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilaccalan, Lanao Del Norte.

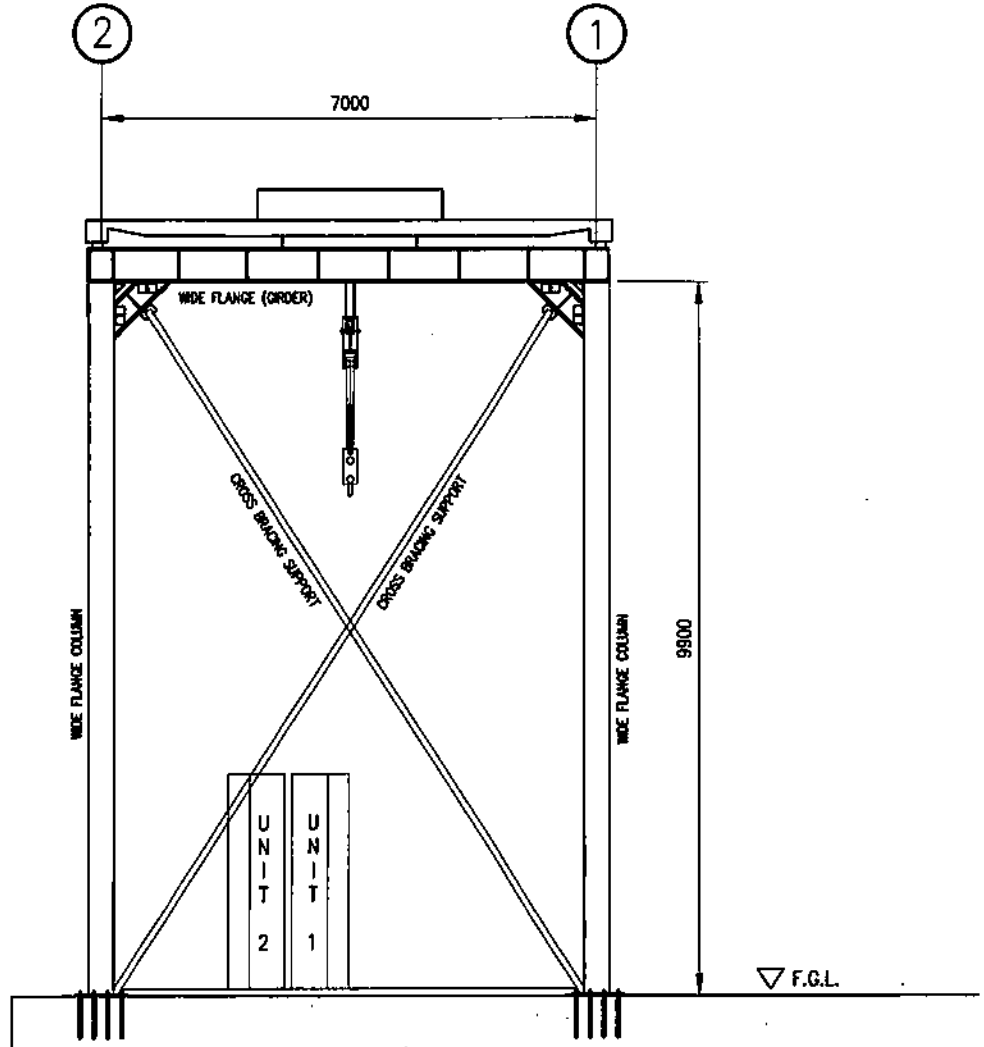
TITLE: **COLUMN AND RUNWAY GIRDER ASSEMBLY (ELEVATION 2)**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPIRITU, Manager, CEAD
APPROVED: H. C. [illegible]ERRA, Manager, EDD

DWG. NO. A4GC-BDC-03.004 PR NO. MG-A5M22-042

SCALE: 1:150 **BID DRAWING** REV. 0



COLUMN AND RUNWAY GIRDER ASSEMBLY
(ELEVATION C)

SCALE 1:75

NOTES:

1. ALL THE DETAILS ARE CONCEPTUAL DESIGN ONLY, THE CONTRACTOR SHALL CONDUCT SITE INSPECTION TO SUIT THE ACTUAL FIELD CONDITION AND SUBMIT DESIGN CALCULATION AND DETAILED DRAWINGS OF GANTRY CRANE INCLUDING CONNECTIONS FOR APPROVAL OF NPC.
2. PROVIDE SHELTER FOR OVERHEAD CRANE
3. WORK THIS WITH ELECTRICAL DRAWINGS

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: **SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP**

LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte.

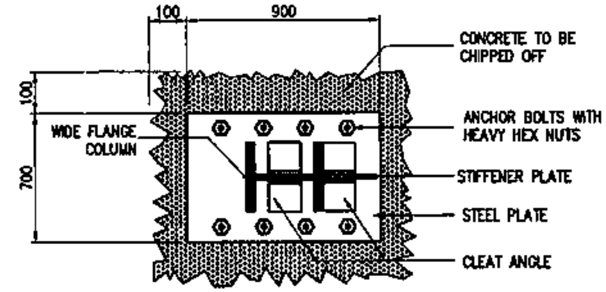
TITLE: **COLUMN AND GIRDER ASSEMBLY (ELEVATION C)**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

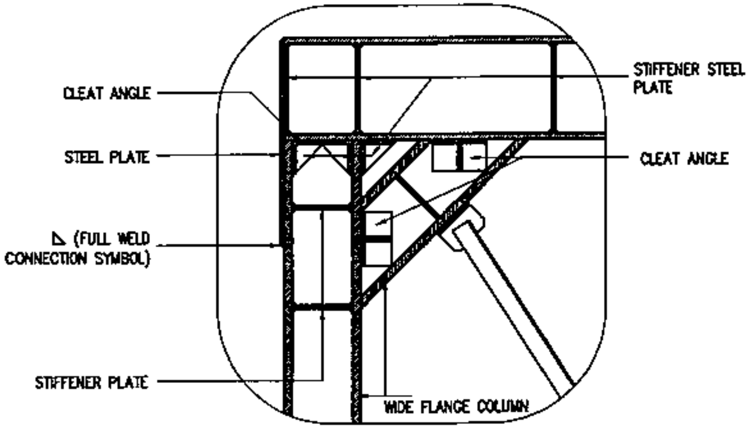
SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPIRITU, Manager, CEAD
APPROVED: [illegible] RA, Manager, DDD

DWG. NO. A4GC-BDC-03.005 PR NO. MG-ASM22-042

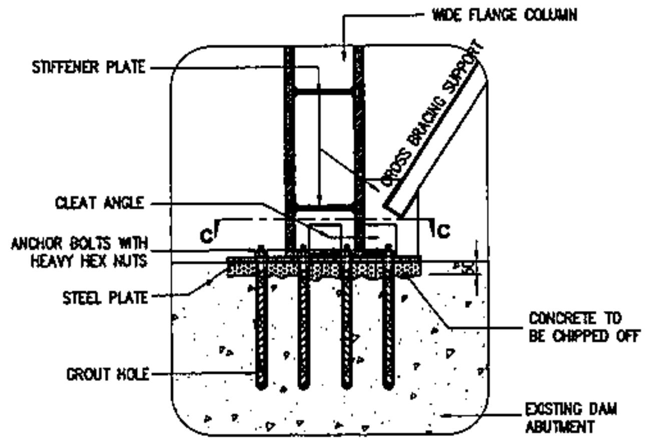
SCALE: 1:75 **BID DRAWING** REV. 0



SECTION C-C



CONNECTION DETAIL 1
SCALE 1:25



CONNECTION DETAIL 2
SCALE 1:25

NOTES:

1. ALL THE DETAILS ARE CONCEPTUAL DESIGN ONLY. THE CONTRACTOR SHALL CONDUCT SITE INSPECTION TO SUIT THE ACTUAL FIELD CONDITION AND SUBMIT DESIGN CALCULATION AND DETAILED DRAWINGS OF GANTRY CRANE INCLUDING CONNECTIONS FOR APPROVAL OF NPC.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

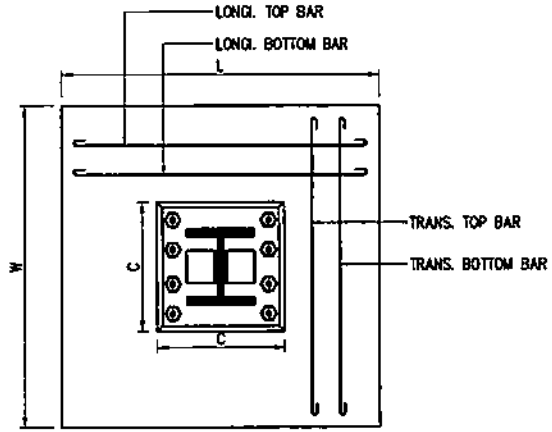
PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP
LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte

TITLE: **COLUMN AND RUNWAY GIRDER ASSEMBLY (CONNECTION & DETAILS)**

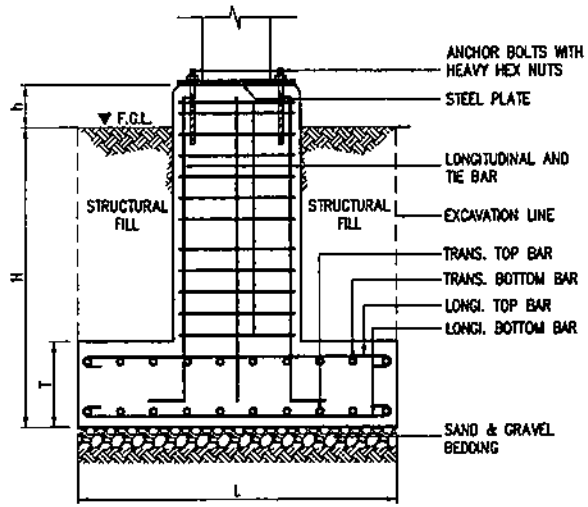
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPIRITU, Manager, CEAD
APPROVED: N. G. SOMOSIERRA, Manager, DDD

DWG. NO. A4GC-BDC-03.006 | PR NO. MG-A5M22-042
SCALE: AS SHOWN | **BID DRAWING** | REV. 0



PLAN



FOUNDATION (P1-F1)

SCALE 1:25

NOTES:

1. ALL THE DETAILS ARE CONCEPTUAL DESIGN ONLY, THE CONTRACTOR SHALL CONDUCT SITE INSPECTION TO SUIT THE ACTUAL FIELD CONDITION AND SUBMIT DESIGN CALCULATION AND DETAILED DRAWINGS OF GANTRY CRANE INCLUDING FOUNDATION AND CONNECTIONS FOR APPROVAL OF NPC.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte.

TITLE: **FOUNDATION DETAILS**

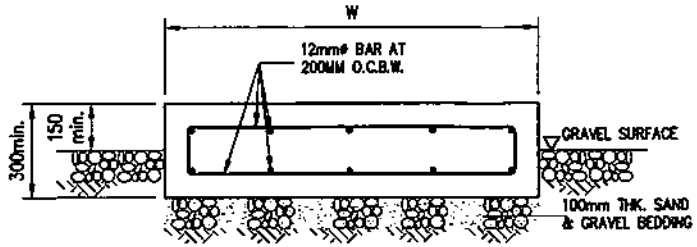
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, DEAD
RECOMMENDED: A. C. ESPIRITU, Manager, DEAD
APPROVED: N. G. [illegible], Manager, DDD

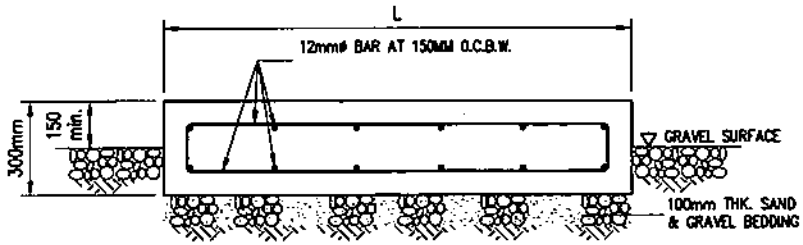
DWG. NO. A4GC-BDC-03.007 PR NO. MG-A5M22-042

SCALE: AS SHOWN **BID DRAWING** REV. 0

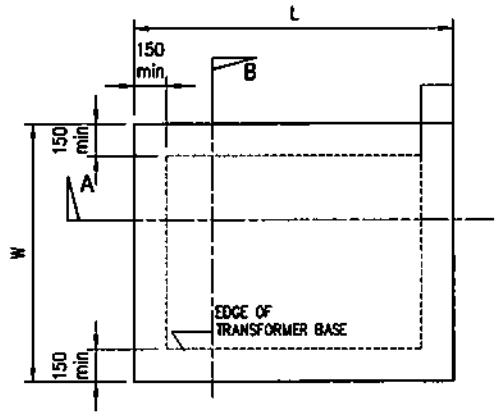
REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



SECTION A



SECTION B



PLAN

TRANSFORMER PAD
SCALE NTS

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dituculan, Lanao Del Norte.

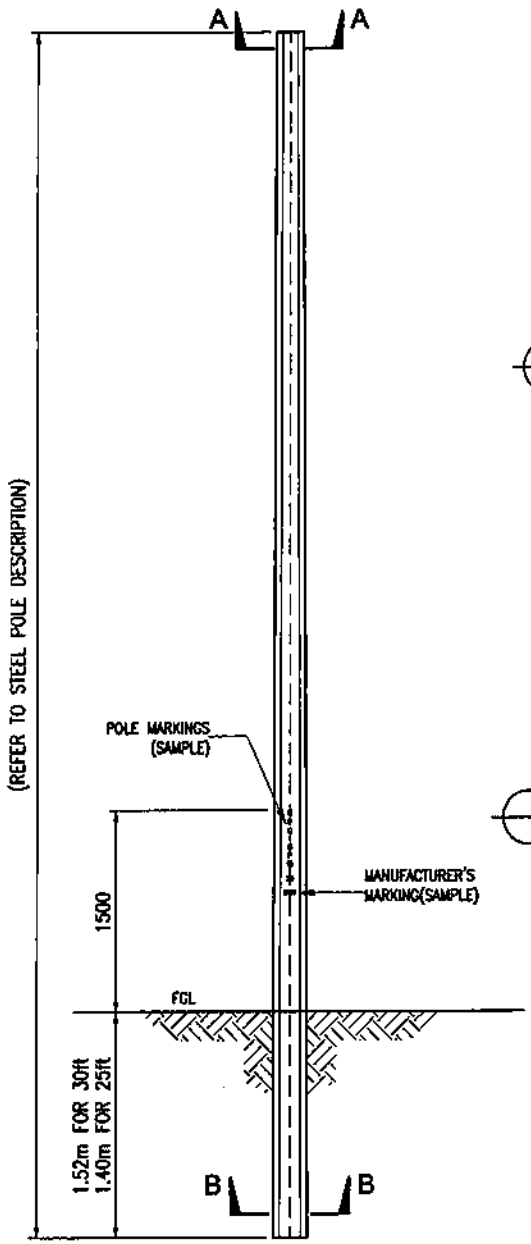
TITLE: TRANSFORMER PAD (PLAN, SECTIONS & DETAILS)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

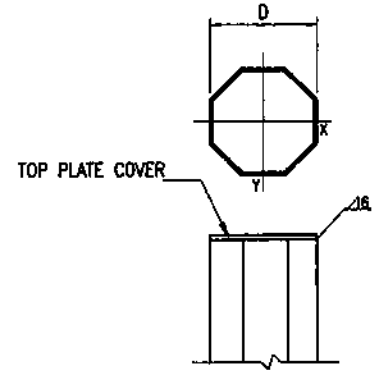
SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPIRITU, Section Head
APPROVED: N. G. [illegible]RRA, Manager, DDO

DWG. NO. A4GC-BDC-03.008 PR NO. MG-A5M22-042

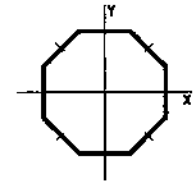
SCALE: NTS BID DRAWING REV. 0



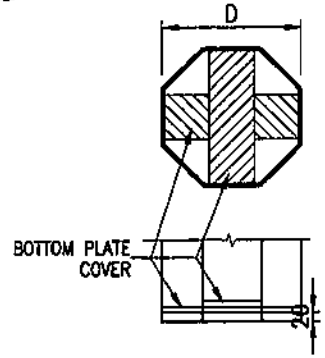
ELEVATION OF STEEL POLE
SCALE 1:40



TOP PLATE (SECTION A-A)
SCALE NTS



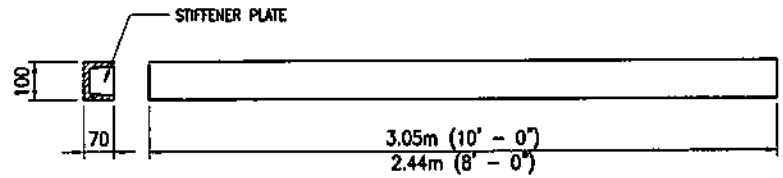
HOLE PLANES
SCALE NTS



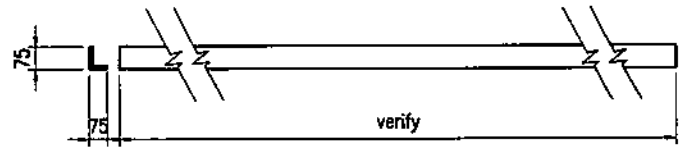
BOTTOM PLATE (SECTION B-B)
SCALE NTS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. DRILL HOLES ON CENTERLINE OF POLE FACES.
3. HOLE LOCATION AND DIAMETER SHALL BE PREFERRED TO EEICD DRAWINGS FOR DIFFERENT TYPES OF POLE.
4. POLES SHALL BE OCTAGONAL (8 SIDES) AND THE DIAMETERS ARE MEASURED ON THE OUTSIDE AND ACROSS THE FLAT SURFACES.
5. THE MATERIAL FOR POLE SHALL BE 345MPa (50ksi) MINIMUM YIELD STRENGTH OF ROLLED STEEL PLATE.
6. ALL POLES ARE HOT DIP GALVANIZED IN ACCORDING WITH ASTM A123M WITH MINIMUM COATING THICKNESS OF 85 MICRONS.
7. TIP AND BUTT OF POLES SHALL BE COVERED WITH PLATE SIMILAR TO SHAFT BODY THICKNESS.
8. CROSSARMS SHALL BE 6MM THICK BENDED CHANNEL SECTION PROVIDED WITH 6MM THICK STIFFENER PLATE WELDED AT 300MM ON CENTERS.
9. CROSS BRACES SHALL BE 6MM THICK ANGULAR SECTION. LENGTHS AND HOLE LOCATIONS SHALL BE REFERRED TO ELECTRICAL DRAWINGS.



CROSS ARM DET.
SCALE NTS



CROSS BRACE DET.
SCALE NTS

SHAFT INFORMATION

LENGTH / DESCRIPTION	30 ft.
TIP DIAMETER	200mm
BUTT DIAMETER	260mm
THICKNESS	4mm

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilasalan, Lanao Del Norte.

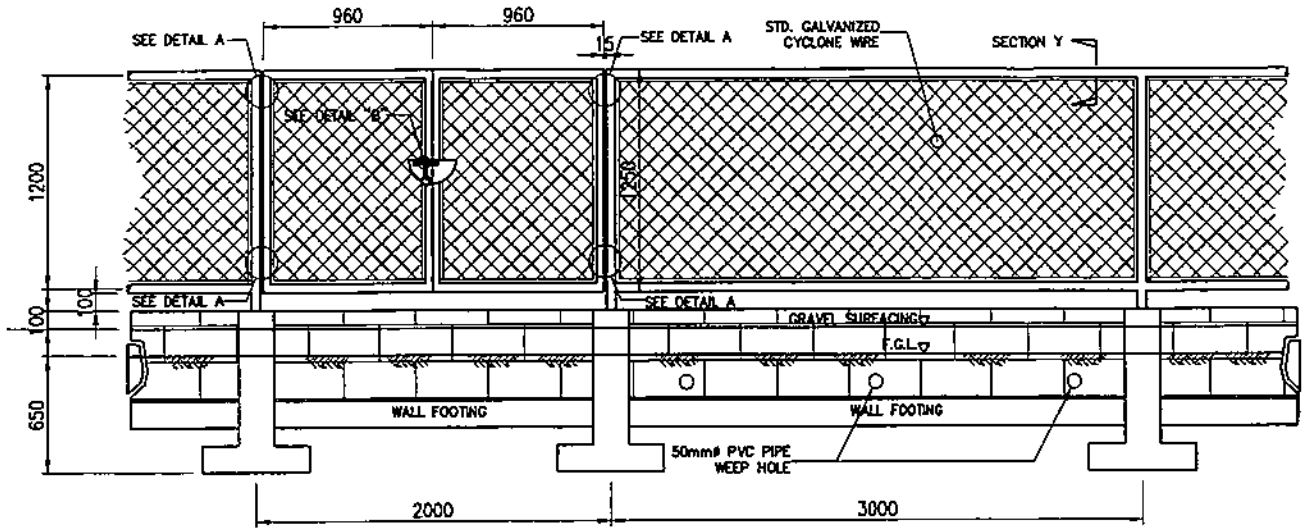
TITLE: DIRECT BURIED STEEL POLE (DETAILS)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. C. ESPARTU, Manager, CEAD
APPROVED: [illegible], Manager, DDD

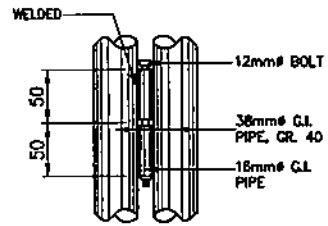
DWG. NO. A4GC-BDC-03.009 PR.NO. MG-A5M22-042

SCALE: AS SHOWN BID DRAWING REV. 0

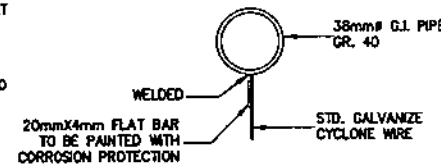


SECLUSION FENCE ELEVATION

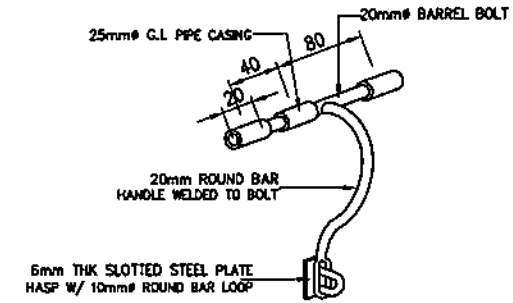
SCALE 1:30



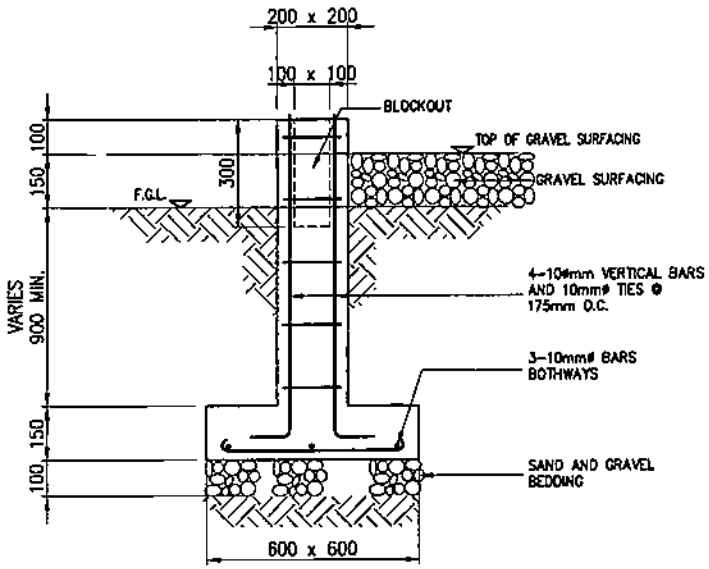
DETAIL 'A'



SECTION Y

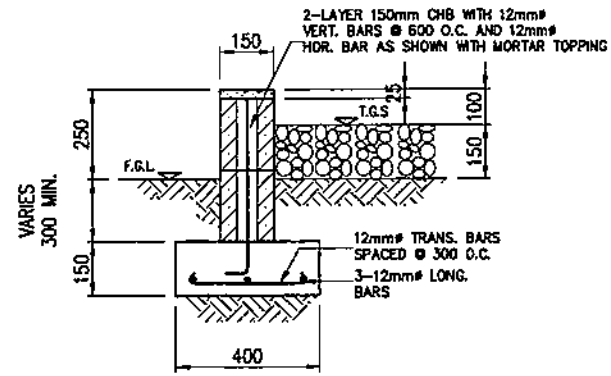


DETAIL 'B'



PEDESTAL FOOTING

SCALE 1:15



WALL FOOTING

SCALE 1:15

NOTES:

1. ALL DIMESIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. REFER TO FOUNDATION AND STRUCTURAL PLAN FOR THE LOCATION OF SECLUSION FENCE.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Diterukan, Lanao Del Norte.

TITLE: **SECLUSION FENCE & PEDESTRIAN GATE (PLAN, SECTION & DETAILS)**

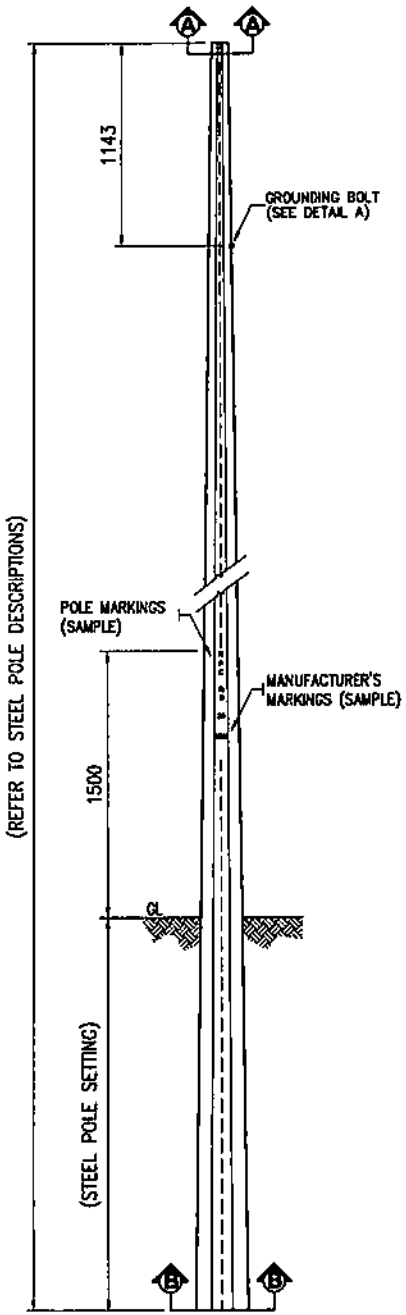
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT.			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD
RECOMMENDED: A. O. ESPIRITU, Manager, CEAD
APPROVED: N. G. SERRA, Manager, CDD

DWG. NO. A4GC-BDC-03.010 PR NO. MG-A5M22-042

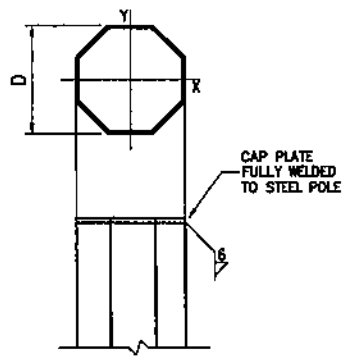
SCALE: AS SHOWN **BID DRAWING** REV. 0

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



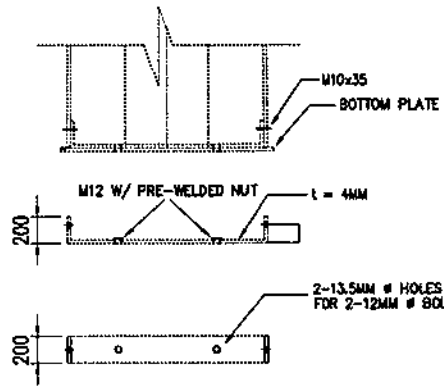
ELEVATION STEEL POLE

SCALE NTS



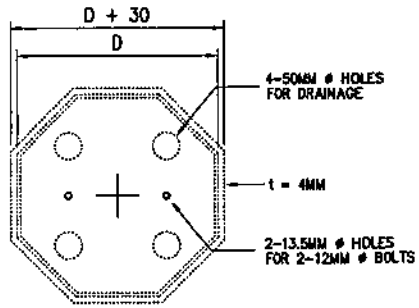
TOP PLATE (SECTION A-A)

SCALE NTS



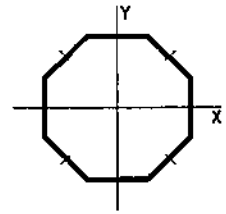
BOTTOM PLATE CONNECTOR

SCALE NTS



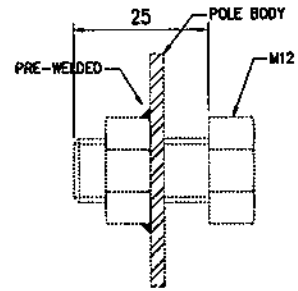
BOTTOM PLATE (SECTION B-B)

SCALE NTS



HOLE PLANES

SCALE NTS



DETAIL A

SCALE NTS

NOTES:

1. ALL DIMENSIONS ARE MILLIMETERS.
2. POLE SHAFT MATERIALS SHALL CONFORM TO ASTM A572 WITH MINIMUM YIELD STRENGTH OF 345 MPa (50 ksi).
3. DRILL HOLES ON CENTERLINES OF POLE FACES.
4. HOLE DIAMETER AND LOCATION SHALL BE REFERRED TO ELECTRICAL DRAWINGS.
5. ALL THREADS MUST BE HAND-TAPPED AFTER GALVANIZING.
6. POLES SHALL BE OCTAGONAL (8 SIDES) AND THE DIAMETERS ARE MEASURED ON THE OUTSIDE AND ACROSS THE FLAT SURFACE.
7. ALL POLES ARE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A123M WITH MINIMUM COATING THICKNESS OF 85 MICRONS. TIP AND BUTT OF POLES SHALL BE COVERED WITH PLATE SIMILAR TO SHAFT BODY THICKNESS.
8. REFER TO ELECTRICAL DRAWING FOR THE LOCATIONS OF STEEL POLES.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte

TITLE: **7.97/13.8kV DIRECT BURIED STEEL POLE (ELEVATION, SECTIONS AND DETAIL)**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, CEAD

RECOMMENDED: A. C. ESPIRITU, Supervising CEAD

APPROVED: N. G. [illegible], Manager, CDD

DWG. NO. A4GC-BDC-03.011 PR NO. MG-A5M22-042

SCALE: AS SHOWN **BID DRAWING** REV. 0

7.97/13.8 KV STEEL POLE DESCRIPTIONS

Length / Type of Pole	30 ft / 9.10 m	35 ft / 10.65 m	40 ft / 12.15 m	45 ft / 13.70 m	50 ft / 15.20 m
QNC (0°–5°)					
Tip Diameters (mm)	200	200	200	200	200
Butt Diameter (mm)	260	270	285	300	320
Thickness (mm)	4	4	4	4	4
Embedded to Ground (m)	1.50	1.65	1.80	1.95	2.10
RNC (5°–30°)					
Tip Diameters (mm)	200	200	200	200	200
Butt Diameter (mm)	310	340	365	380	420
Thickness (mm)	4	4	4	4	4
Embedded to Ground (m)	1.50	1.65	1.80	1.95	2.10
SNC (30°–60°)					
Tip Diameters (mm)	200	200	200	200	200
Butt Diameter (mm)	370	400	435	470	510
Thickness (mm)	4	4	4	4	4
Embedded to Ground (m)	1.50	1.65	1.80	1.95	2.10
TNC (60°–90°)					
Tip Diameters (mm)	200	200	200	200	200
Butt Diameter (mm)	390	425	455	495	535
Thickness (mm)	4	4	4	4	4
Embedded to Ground (m)	1.50	1.65	1.80	1.95	2.10

3 PHASE

NOTES:

1. PLATES MATERIALS FOR STEEL POLE SHALL BE 345MPa (50 ksi) MINIMUM YIELD STRENGTH.
2. STEEL POLE TYPES AND LENGTHS SHALL BE MARKED LEGIBLY ON THE BODY AS SPECIFIED IN THE SPECIFICATIONS.
3. STEEL POLE TIPS & BUTTS SHALL BE COVERED WITH PLATES SIMILAR TO SHAFT BODY THICKNESS.
4. STEEL POLES SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A123M WITH MINIMUM COATING THICKNESS OF 85 MICRONS.
5. STEEL POLES SHALL BE OCTAGONAL AND THE DIAMETERS ARE MEASURED ON THE OUTSIDE SURFACE & ACROSS THE FLATS.
6. REFER TO ELECTRICAL DRAWING FOR THE LOCATIONS OF STEEL POLES.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE OF AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilmoplan, Lanao Del Norte.

TITLE: **7.97/13.8kV DIRECT BURIED STEEL POLE (2 PHASE AND 3 PHASE)**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: H. L. MENDOZA, Principal Engineer A, OIAD
RECOMMENDED: E. C. ESPIRITU, Manager, OIAD
APPROVED: M. G. [illegible], Manager, OIAD

DWG. NO. A4GC-BDC-03.012 | PR NO. MG-A5M22-042

SCALE: AS SHOWN | **BID DRAWING** | REV. 0

SECTION IX

BID DRAWINGS

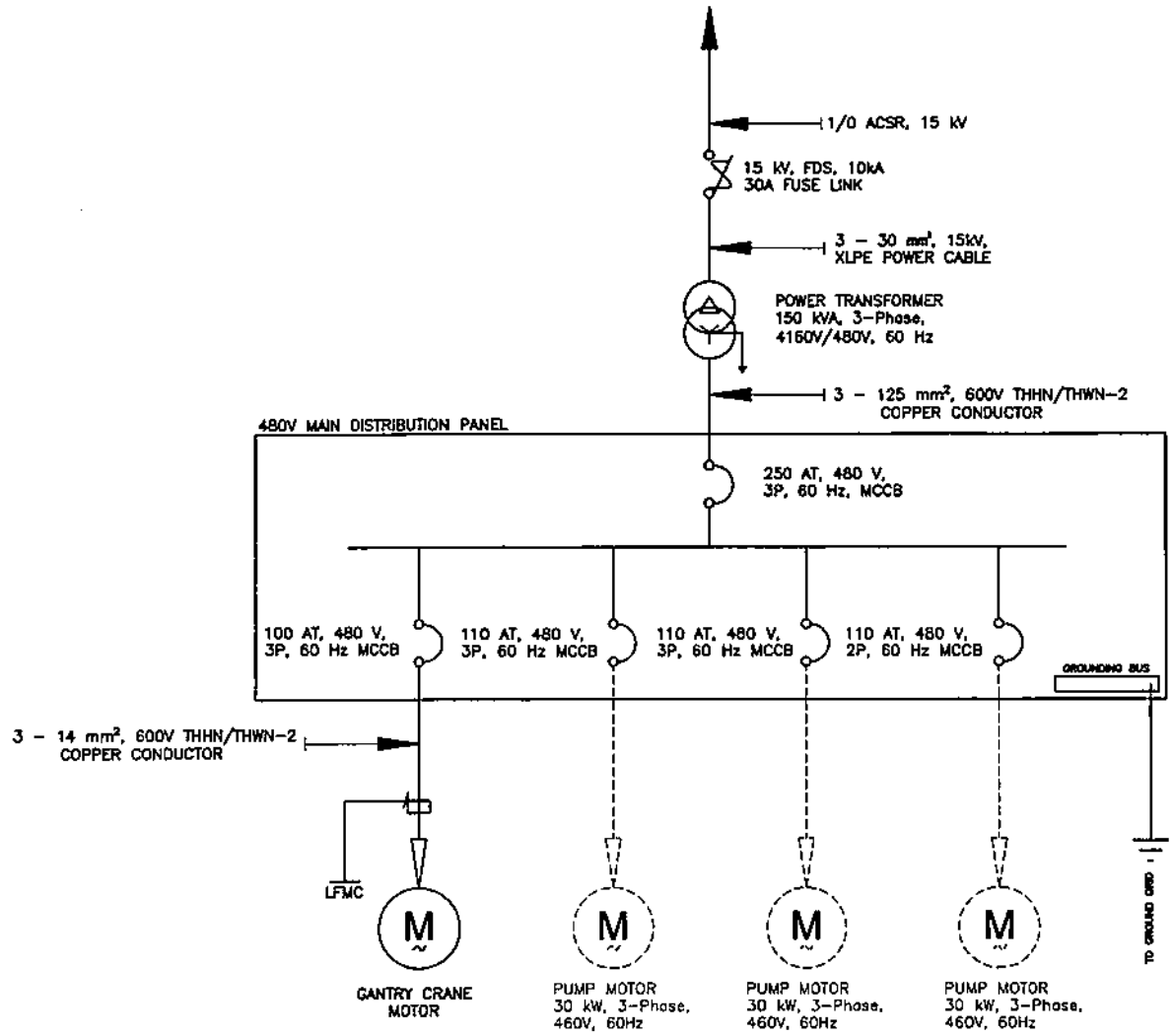
ELECTRICAL WORKS

SECTION IX - BID DRAWINGS

EW - ELECTRICAL DRAWINGS

DRAWING NO.	TITLE
A4GC-BDE-03.001	Single Line Diagram
A4GC-BDE-03.002	Equipment Layout
A4GC-BDE-03.003	Conduit And Cable Tray Layout
A4GC-BDE-03.004	Grounding System
A4GC-BDE-03.005	Details Of Take-Off Structure
A4GC-BDE-03.006	System Configuration
A4GC-BDE-03.007	Grounding Connection Details
A4GC-BDE-03.008	Distribution Line Route and Plant
A4GC-BDE-03.009	Distribution Line "Steel Pole"Three Phase (C1)
A4GC-BDE-03.010	Distribution Line "Steel Pole"Three Phase (C2)
A4GC-BDE-03.011	Distribution Line "Steel Pole"Three Phase (C7)
A4GC-BDE-03.012	Distribution Line "Steel Pole"Three Phase (C7-2)
A4GC-BDE-03.013	Distribution Line Single Down Guy, Through Bolt Type & Anchor Log Detail (E1-2 & F2-2)

A4GC-BDE-03.014	Distribution Line Truss Guy & Anchor Log Details (E1-2A & F2-2A)
A4GC-BDE-03.015	Distribution Line "Steel Pole" General Design Data
A4GC-BDE-03.016	Distribution Line "Steel Pole" Standard Pole Location
A4GC-BDE-03.017	Distribution Line Crossarm Drilling Guide



NOTES:

1. BURDENS AND RATINGS INCLUDING CIRCUIT PROTECTIONS OF INSTRUMENT TRANSFORMER SHALL BE DETERMINED BY THE SUPPLIER.
2. ALL EQUIPMENT IN THE SHADED AREA ARE EXISTING. ALL OTHERS ARE NEW AND TO BE FURNISHED BY THE SUPPLIER.
3. ALL THE EQUIPMENT TO BE SUPPLIED SHALL BE TESTED AND PROVEN PASSED IN ACCORDANCE TO THE REQUIREMENTS OF SECTION VI – TECHNICAL SPECIFICATIONS.

LEGENDS AND SYMBOLS:

- (M) — CRANE MOTOR
- — DISTRIBUTION TRANSFORMER
- — CIRCUIT BREAKER
- — FUSE DISCONNECT SWITCH
- — LIGHTNING ARRESTER
- — EARTHGROUND
- FDS — FUSE DISCONNECT SWITCH
- ACSR — ALUMINUM CONDUCTOR STEEL REINFORCED
- LFMC — LIQUIDTIGHT FLEXIBLE METAL CONDUIT

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Dlaudan, Lanao Del Norte.

TITLE: SINGLE LINE DIAGRAM

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R.P. VERAR, Project Engineer A, DOD
RECOMMENDED: C. Z. C. LUGOD JR., Manager, DOD
APPROVED: N. G. SORIANO JR., Manager, DOD

DWG. NO. A4GC-BDE-03.001 | PR NO. MG-A5M22-042
SCALE: NTS | BID DRAWING | REV. 0

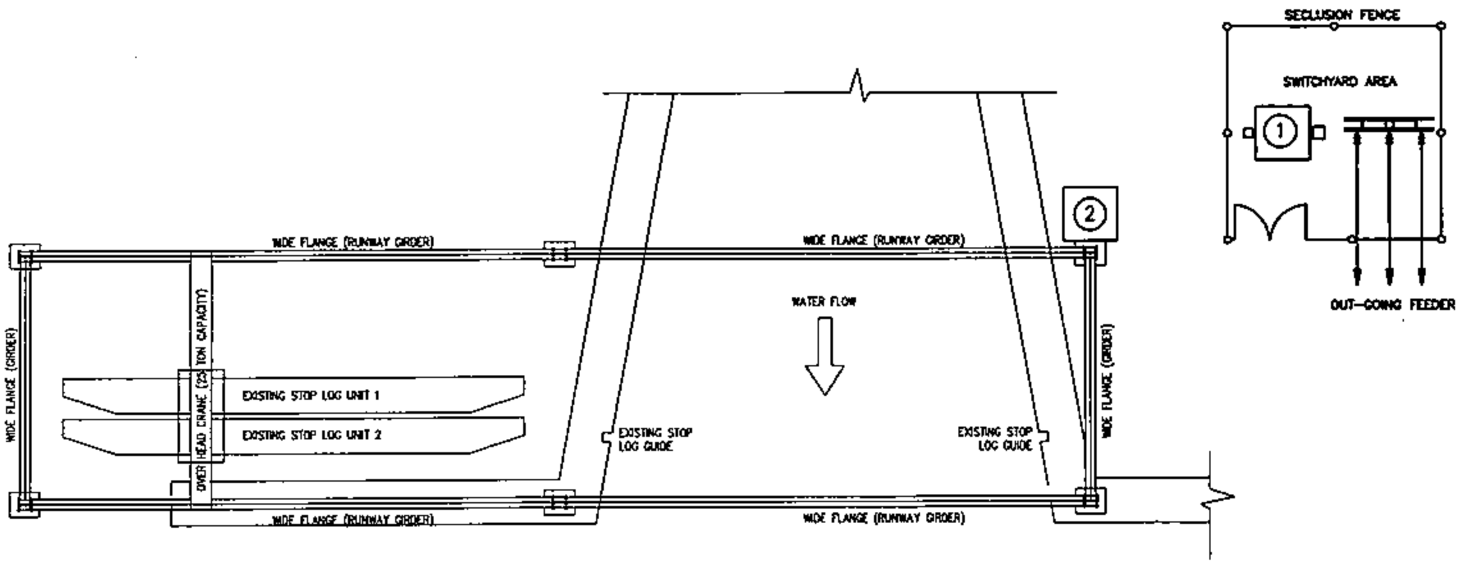
NOTES:

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. THE EQUIPMENT SHALL BE NEW AND TO BE FURNISHED BY THE SUPPLIER.
3. ALL NECESSARY MODIFICATIONS/ADJUSTMENTS AND FINAL LOCATIONS OF EQUIPMENT AND ACCESSORIES/APPURTENANCES TO BE SUPPLIED, INSTALLED OR CONSTRUCTED BY THE SUPPLIER SHALL BE CLOSELY COORDINATED WITH PLANT HEAD/PLANT-IN-CHARGE TO SUIT ACTUAL SITE CONDITIONS PRIOR TO DELIVERY/INSTALLATION/CONSTRUCTION FOR THE TIMELY AND EFFICIENT IMPLEMENTATION OF THE PROJECT.
4. ALL EQUIPMENT AND METALLIC STRUCTURES SHALL BE PROPERLY GROUNDED.
5. THIS DRAWING SHALL BE WORKED WITH CIVIL AND MECHANICAL BID DRAWINGS.

LEGEND:

① – DISTRIBUTION TRANSFORMER

② – 480V MAIN DISTRIBUTION PANEL



REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECO.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN QUEZON CITY

PROJECT: **SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP**
LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte.

TITLE: **EQUIPMENT LAYOUT**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR, Principal Engineer A, EBICD
RECOMMENDED: C. Z. C. LUGOD, JR., Manager, EBICD
APPROVED: N. G. [illegible], Manager, DDD

DWG. NO. **A4GC-BDE-03.002** | PR NO. **MG-A5M22-042**

SCALE: NTS | **BID DRAWING** | REV. 0

NOTES:

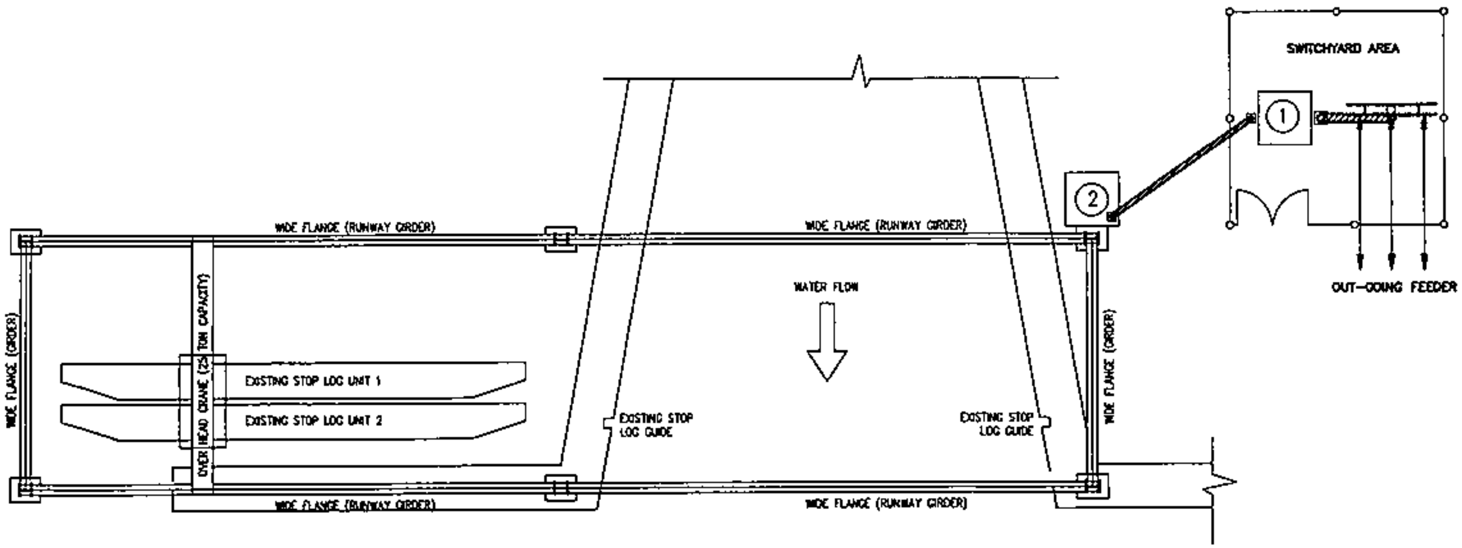
1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CONDUIT RUNS ARE INDICATIVE ONLY. ACTUAL LOCATION AND MEASUREMENT SHALL BE VERIFIED ON SITE.
3. PULL BOXES SHALL BE PROVIDED WHENEVER DEEMED NECESSARY.
4. uPVC CONDUITS SHALL BE PROVIDED AS FOLLOWS:
   a. 110mmø uPVC FOR 30mm² 15kV POWER CABLES
   b. 32mmø uPVC FOR 22mm² 600V POWER CABLES
5. THIS DRAWING SHALL BE WORKED WITH CIVIL BID DRAWINGS.

LEGEND:

① – DISTRIBUTION TRANSFORMER

② – 480V MAIN MAIN DISTRIBUTION PANEL

▨ – uPVC CONDUIT



REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte.

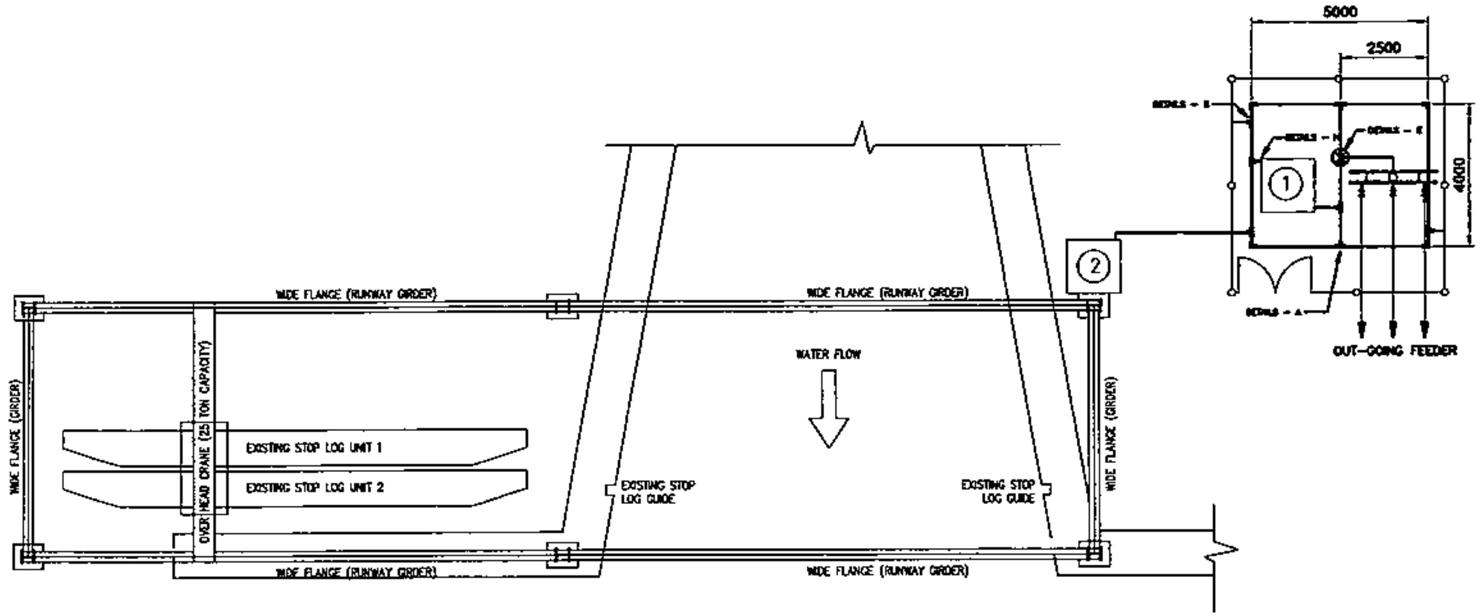
TITLE: **CONDUIT AND CABLE TRAY LAYOUT**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR, Principal Engineer A, ...
RECOMMENDED: C. Z. C. LUGOD, JR., Manager, ...
APPROVED: N. G. SOMBRERRA, Manager, DCO

DWG. NO. A4GC-BDE-03.003 | PR NO. MG-A5M22-042

SCALE: NTS | **BID DRAWING** | REV. 0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED
2. GROUNDING GRID CONDUCTORS INCLUDING ALL GROUND RODS AS SHOWN SHALL BE BURIED, INSTALLED, & TESTED BY THE SUPPLIER
3. ALL GROUNDING CONNECTION BELOW GROUND SHALL BE EXOTHERMIC WELD TYPE
4. GRID RESISTANCE TEST AFTER THE INSTALLATION OF GROUNDING GRID SYSTEM SHALL BE CONDUCTED BY THE SUPPLIER. THE RESULT SHALL BE SUBMITTED TO NPC FOR REFERENCE AND FURTHER CONSIDERATION
5. GROUNDING GRID CONDUCTOR SHALL BE BURIED AT LEAST 0.6M FROM FINISHED GROUND LINE
6. ALL RISER CONDUCTOR SHALL HAVE COLOR GREEN INSULATION
7. REFER TO DWG NO. A4GC-BDE-03.007 FOR REFERENCE.

LEGENDS:

- ✚ — EXOTHERMIC WELD, CROSS-CONNECTION
- ┤├ — EXOTHERMIC WELD, TEE-CONNECTION
- ⊗ — EXOTHERMIC WELD, GROUND ROD CONNECTION
- —— 100MM² BARE COPPER GRID CONDUCTOR
- —— 100MM² INSULATED RISER CONDUCTOR:
  - TRANSFORMERS
  - STEEL POLES
- —— 22MM² INSULATED RISER CONDUCTOR:
  - SECLUSION/PERIMETER FENCE
  - PROTECTION PANEL

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte

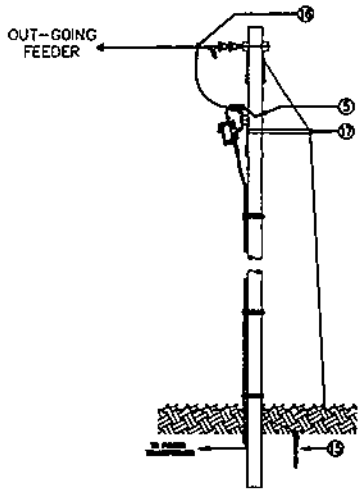
TITLE: **GROUNDING SYSTEM**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

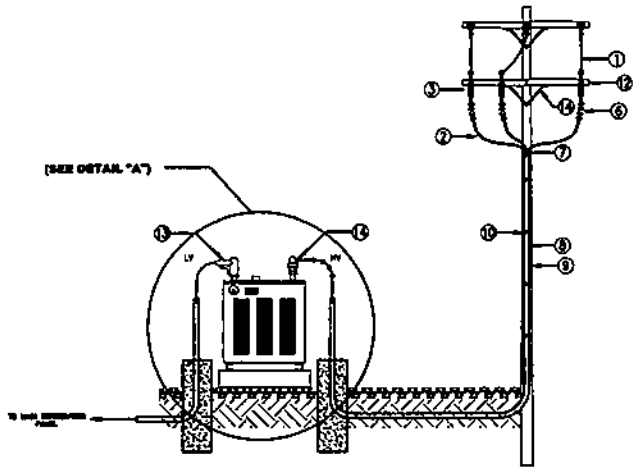
SUBMITTED: R. P. VERAR
RECOMMENDED: C. Z. C. LUGOD, JR., Manager, MECO
APPROVED: N. G. SONSOBERRA, Manager, DDO

DWG. NO. A4GC-BDE-03.004 | PR NO. MG-A5M22-042

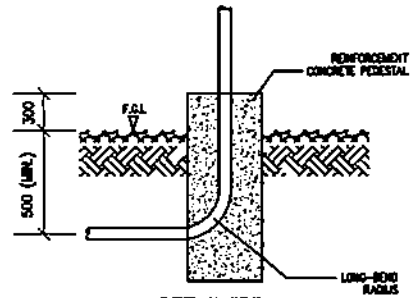
SCALE: NTS | **BID DRAWING** | REV. 0



SECTION A - A
A4GC-BDE-03.005 SCALE NTS



SECTION B - B
A4GC-BDE-03.005 NTS



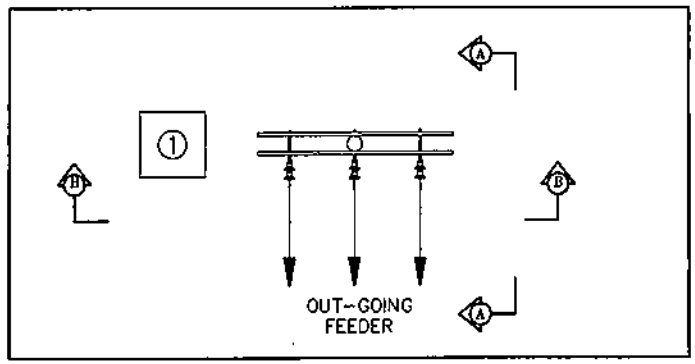
DETAIL "B"

NOTES:

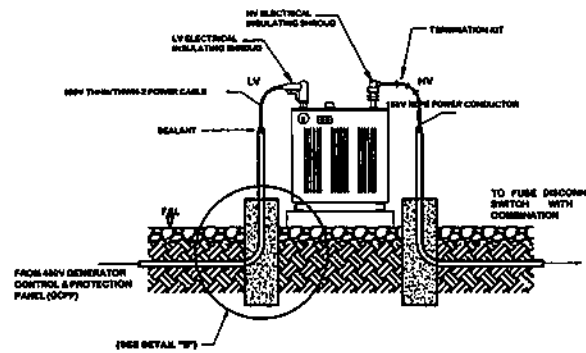
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED
2. GROUNDING SYSTEM AS SHOWN SHALL BE BONDED USING EXOTHERMIC WELDING TO THE PLANT GROUNDING GRID SYSTEM
3. ALL LINE HARDWARE SUCH BOLTS, NUTS, WASHERS, ETC. TO COMPLETE THE ASSEMBLY AND/OR INSTALLATION AS SHOWN SHALL BE DETERMINED BY THE SUPPLIER
4. CONDUIT SUPPORT SHALL BE PROVIDED BY THE SUPPLIER. CONDUIT SHALL BE SUPPORTED AT INTERVAL NOT EXCEEDING 600MM

LEGEND:

① — 1/0 AWG, 15kV ACSR
② — 15kV XLPE POWER CABLE
③ — 15kV FUSE DISCONNECT SWITCH WITH LA COMBINATION
④ — INSULATOR
⑤ — GROUND CLAMP
⑥ — TERMINATION KIT
⑦ — SEALANT
⑧ — 110MM DIA. uPVC CONDUIT
⑨ — CONDUIT SUPPORT
⑩ — 30FT. STEEL POLE
⑪ — CROSSARM, STEEL, HDG
⑫ — BRACE, STEEL, HDG
⑬ — LV INSULATING SHROUD
⑭ — HV INSULATING SHROUD
⑮ — GROUNDING ROD
⑯ — CLAMP, HOTLINE
⑰ — GUYING



SWITCHYARD
A4GC-BDE-03.005 NTS



DETAIL "A"

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN QUEZON CITY

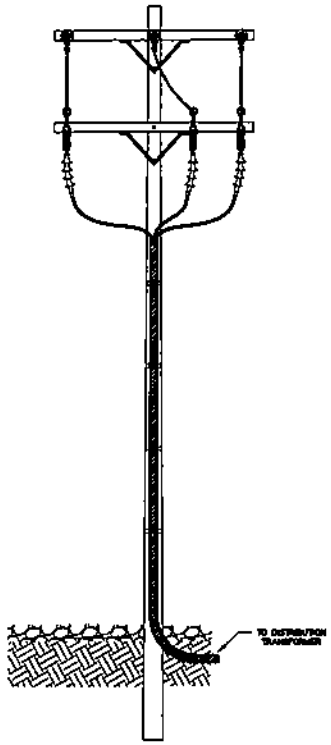
PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte.

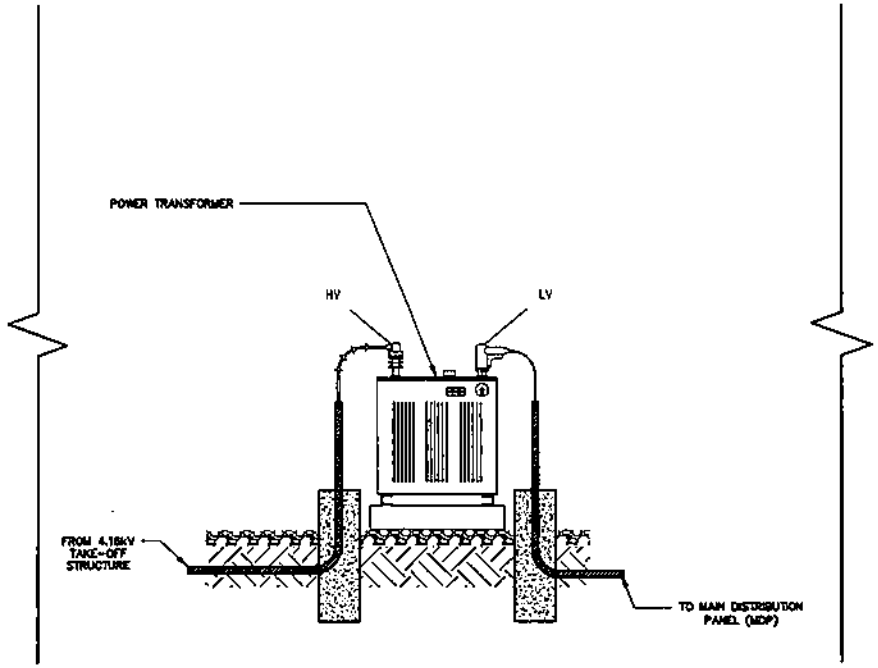
TITLE: DETAILS OF TAKE-OFF STRUCTURE

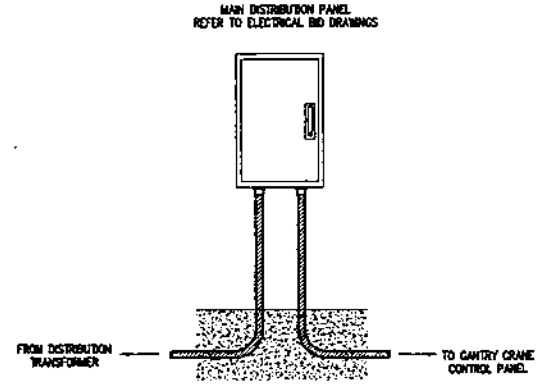
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR
RECOMMENDED: C. Z. C. LUGOD, JR.
APPROVED: N. G. SCHMIDSIERRA

DWG. NO. A4GC-BDE-03.005 PR NO. MG-A5M22-042
SCALE: NTS BID DRAWING REV. 0







NOTES:

1. THIS DRAWING IS INTENDED FOR BIDDING PURPOSES ONLY. THE LOCATION AND LAYOUT OF ALL THE EQUIPMENT TO BE SUPPLIED SHALL BE REFERRED TO THE CIVIL, MECHANICAL AND ELECTRICAL BID DRAWINGS.
2. ALL THE DETAILS OF THE FOLLOWING EQUIPMENT SHALL BE IN ACCORDANCE WITH ALL THE TECHNICAL SPECIFICATIONS INDICATED IN THIS DOCUMENT. NON-COMPLIANCE TO THE REQUIREMENTS SHALL BE GROUNDS FOR DISQUALIFICATION.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte.

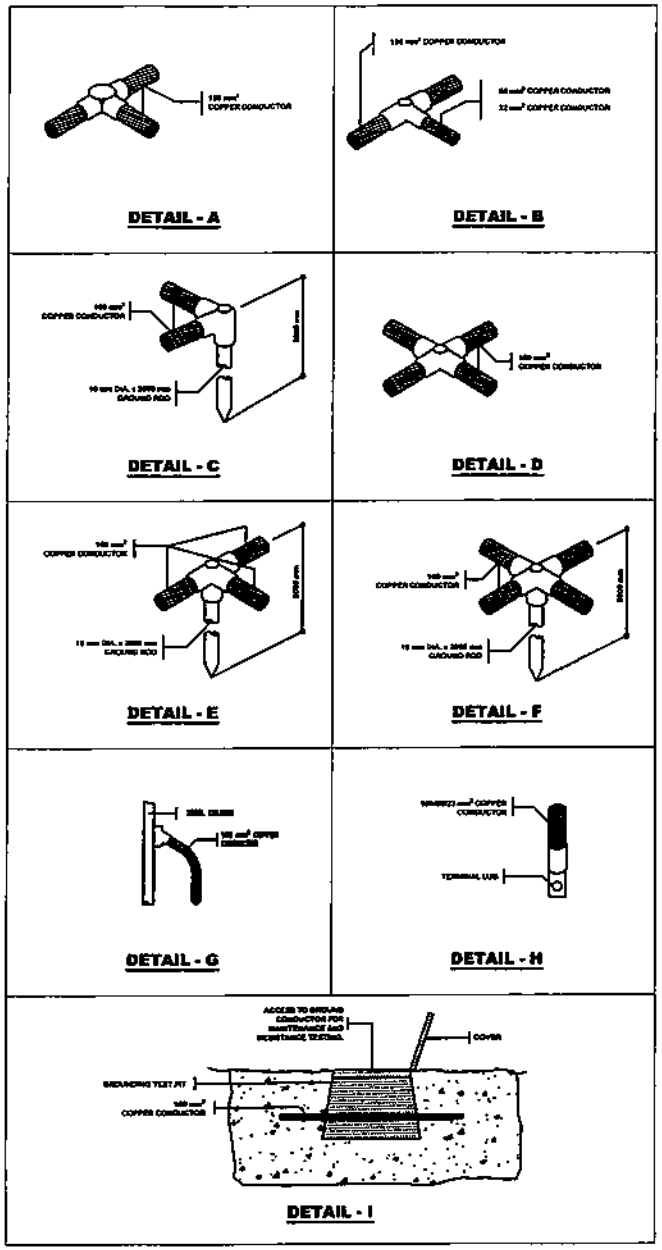
TITLE: **SYSTEM CONFIGURATION**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. C. VERAR
RECOMMENDING: C. Z. C. LUGOD, JR.
APPROVED: N. G. SERROSIERRA
Manager, DDD

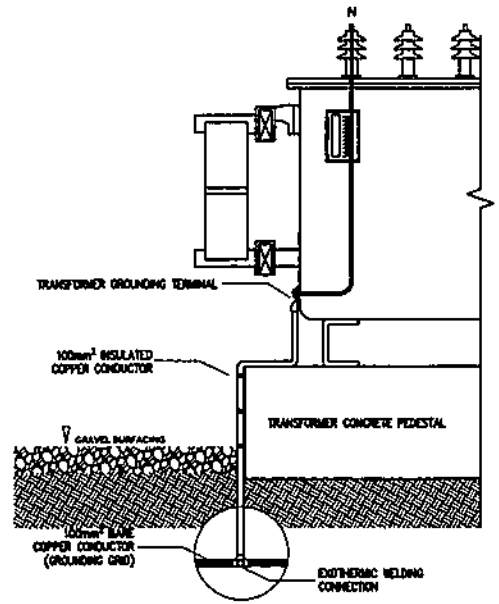
DWG. NO. A4GC-BDE-03.006 | PR.NO. MG-A5M22-042

SCALE: NTS | **BID DRAWING** | REV. 0



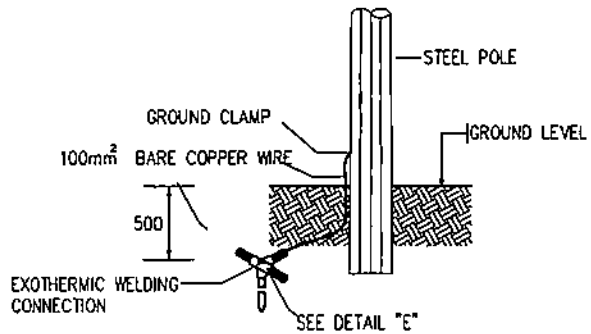
DETAILS OF EXOTHERMIC WELDING CONNECTION

SCALE NTS



EQUIPMENT GROUNDING CONNECTION

SCALE NTS



STEEL POLE GROUNDING CONNECTION

SCALE NTS

NOTES:

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. GROUNDING CONDUCTOR SHALL BE EMBEDDED AT LEAST 0.60m.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilmalan, Lanao Del Norte.

TITLE: GROUND CONNECTION DETAILS

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR, Principal Engineer, EEDD

RECOMMENDED: C. Z. C. LUCDO, JR., Manager, EEDD

APPROVED: N. G. SOMOSIERRA, Manager, DDD

DWG. NO. A4GC-BDE-03.007 PR NO. MG-A5M22-042

SCALE: NTS BID DRAWING REV. 0

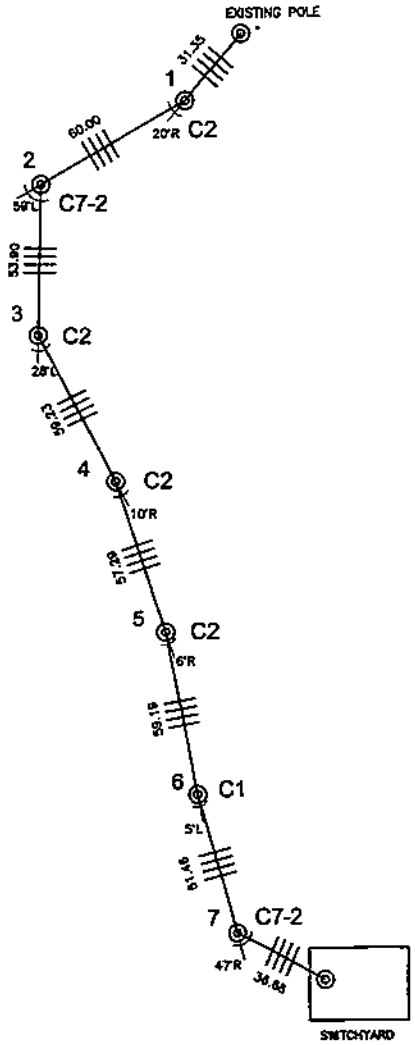
REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECO.	APPD.

NOTES:

1. ALL DIMENSIONS/CLEARANCES AS SHOWN ARE IN METERS UNLESS OTHERWISE SPECIFIED
2. THE SUPPLIER SHALL BE REQUIRED TO CONDUCT AN ACTUAL SITE INSPECTION/SURVEY TO DETERMINE THE FULL EXTENT OF THE PROJECT
3. NECESSARY CALCULATION SUCH AS VOLTAGE DROP, CONDUCTOR SAG, ETC. SHALL BE DONE BY THE SUPPLIER SUBJECT TO NPC'S REVIEW AND APPROVAL
4. POLE DESIGNATIONS/NUMBERINGS AS SHOWN ARE TENTATIVE AND FOR BIDDING PURPOSES ONLY. NEW POLE DESIGNATION/NUMBERING SHALL BE CONSISTENT WITH THE EXISTING POLE DESIGNATION/NUMBERING (IF ANY) OR AS PER DIRECTED/INSTRUCTED BY THE DISTRIBUTION LINE SYSTEM END-USER
5. REFER TO DWG NO. A4GC-BDE-03.009, 010, 011, 012 FOR REFERENCE OF STRUCTURE DRESSING.
6. REFER TO DWG NO. A4GC-BDE-03.014, 013, FOR REFERENCE OF GUYING AND ANCHORING.

LEGENDS:

- POLE / NUMBER
- DEFLECTION ANGLE
- THREE PHASE DISTRIBUTION LINE
- TAPPING/STARTING POINT
- C2 — TYPES OF STEEL POLE DRESSING



POLE NO.	DEF. ANGLE	POLE LENGTH	GUYING ASSEMBLY
1	20'R	40 FT	1-(E1-2 & F2-2)
2	59'L	40 FT	1-(E1-2 & F2-2)
3	28'L	35 FT	2-(E1-2A & F2-2A)
4	10'R	35 FT	1-(E1-2A & F2-2A)
5	6'R	35 FT	1-(E1-2A & F2-2A)
6	5'L	35 FT	1-(E1-2A & F2-2A)
7	47'R	35 FT	2-(E1-2A & F2-2A)

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Otacalan, Lanao Del Norte

TITLE: **DISTRIBUTION LINE ROUTE AND PLAN**

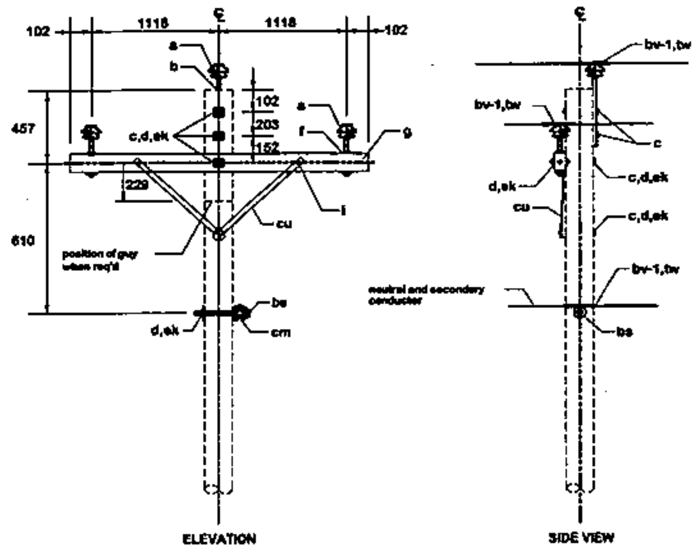
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIV/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R.P. VELAR, Project Engineer
RECOMMENDED: C. Z. C. LUGOD JR., Manager, DDD
APPROVED: N. O. [illegible], Manager, DDD

DWG. NO. A4GC-BDE-03.008 PR NO. MG-A5M22-042

SCALE: BID DRAWING REV. 0

BILL OF MATERIALS		
Three Phase Crossarm Cons't Single Support Type NC1 (C1) - 0°-5°		
ITEM	DESCRIPTION	QTY
i	Bolt, Carriage, 10 x 114 (3/8" x 4-1/2"), thread 3" from tip	2
c	Bolt, Machine, 13 x 254 (1/2" x 10"), thread 5" from tip	1
c	Bolt, Machine, 16 x 254 (5/8" x 10"), thread 5" from tip	2
c	Bolt, Machine, 16 x 356 (5/8" x 14"), thread 6" from tip	1
bs	Bolt, Single Upset, 16 x 254 (5/8" x 10"), thread 5" from tip	1
cu	Brace, Steel Crossarm, Standard 711 (28")	2
g	Crossarm, 89 x 114 x 2440 (3-1/2" x 4-1/2" x 8'-0")	1
a	Insulator, Pin Type, ANSI Class 56-2	3
cm	Insulator, Spool, 44 (1-3/4") dia. Groove, ANSI Class 53 - 2	1
ek	Locknut, 10 (3/8")	2
ek	Locknut, 16 (5/8")	3
ek	Locknut, 13 (1/2")	1
f	Pin, Crossarm, Steel, 16 x 273 (5/8" x 10-3/4")	2
ba	Pin, Pole Top, 508 (20")	1
bv-1	Rod, Armor (Single Support), primary	3
bv-1	Rod, Armor (Single Support), neutral	1
d	Washer, 57 x 57 x 5 (2¼" x 2¼" x 3/16"), 21 (13/16") HD	6
tw	Wire, Tire, Al. Alloy, Soft, #4 AWG	32'
d	Washer, 51 x 51 x 3 (2" x 2" x 1/8"), 14 (9/16") HD	1
d	Washer, Round, 32 (1-1/4") OD, 11 (7/16") HD	2



TYPE NC1 (C1)

SCALE NTS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. REFER TO BILL OF QUANTITIES FOR THE ACTUAL TYPE OF POLE STRUCTURE TO BE USED.
3. THIS DRAWING SHALL BE WORKED WITH CIVIL WORKS BID DRAWINGS.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte

TITLE: DISTRIBUTION LINE
"STEEL POLE" THREE PHASE
(C1)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

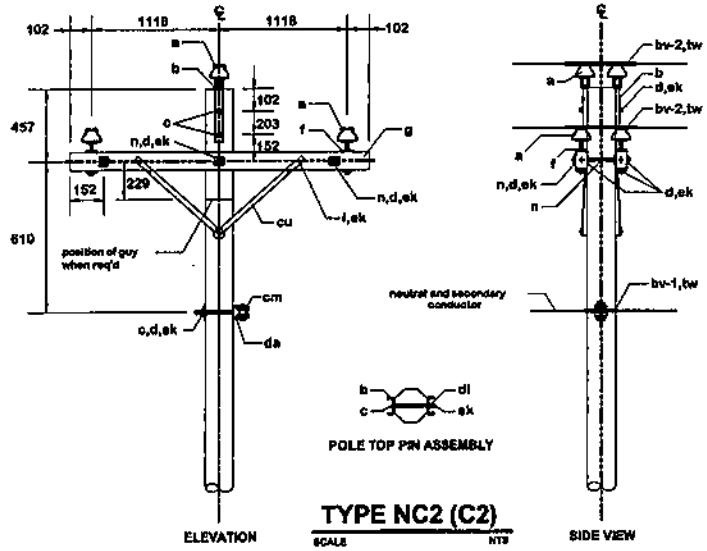
SUBMITTED: R. P. VERAR, Principal Engineer A

RECOMMENDED: C. Z. C. LUGOD, JR., Manager, EECD

APPROVED: N. G. SOMOSIERRA, Manager, DDD

DWG. NO. A4GC-BDE-03.009 | PR NO. MG-A5M22-042

SCALE: NTS | BID DRAWING | REV. 0



TYPE NC2 (C2)

SCALE NTS

BILL OF MATERIALS		
Three Phase Crossarm Cons't Double Support Type NC2 (C2) - 5°-30°		
ITEM	DESCRIPTION	QTY
i	Bolt, Carriage, 10 x 114 (3/8" x 4-1/2"), thread 3" from tip	4
n	Bolt, Double Arming, 16 x 559 (5/8" x 22")	3
c	Bolt, Machine, 16 x 305 (5/8" x 12"), thread 5" from tip	1
c	Bolt, Machine, 16 x 254 (5/8" x 10"), thread 5" from tip	2
c	Bolt, Machine, 13 x 254 (1/2" x 10"), thread 5" from tip	1
cu	Brace, Steel Crossarm, Standard 711 (28")	4
da	Bracket, Rigid clevis	1
g	Crossarm, 89 x 114 x 2440 (3-1/2" x 4-1/2" x 8'-0")	2
cm	Spool, Insulator, 76 (3") dia. Groove, Class 53 - 4	1
a	Insulator, Pin Type, ANSI Class 56-2	6
ek	Locknut, 16 (5/8")	13
ek	Locknut, 10 (3/8")	4
ek	Locknut, 13 (1/2")	1
dl	Pipe, Spacer, 19 (3/4") dia. x 38 (1-1/2")	2
b	Pin, Pole Top, 508 (20")	2
f	Pin, Crossarm, Steel, 16 x 273 (5/8" x 10-3/4")	4
bv-1	Rod, Armor (Single Support), neutral	1
bv-2	Rod, Armor (Double Support), primary	3
tw	Wire, Tire, Al. Alloy, Soft, #4 AWG	56'
d	Washer, 57 x 57 x 5 (2¼" x 2¼" x 3/16"), 21 (13/16") HD	13
d	Washer, 51 x 51 x 3 (2" x 2" x 1/8"), 14 (9/16") HD	1
d	Washer, Round, 32 (1-1/4") OD, 11 (7/16") HD	4

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. REFER TO BILL OF QUANTITIES FOR THE ACTUAL TYPE OF POLE STRUCTURE TO BE USED.
3. THIS DRAWING SHALL BE WORKED WITH CIVIL WORKS BID DRAWINGS.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Dilmalan, Lanao Del Norte.

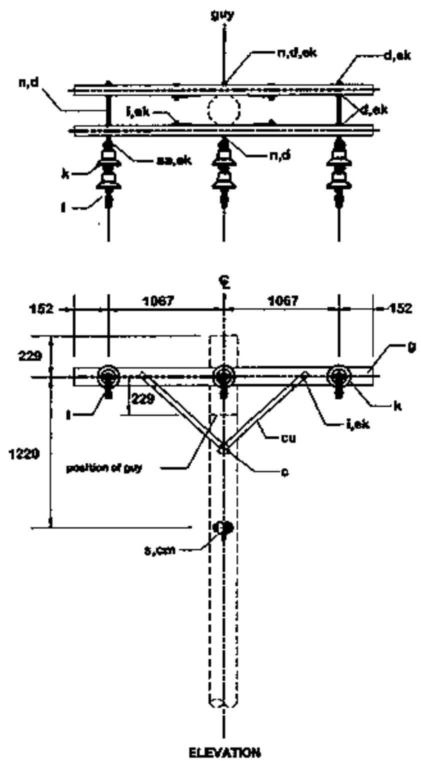
TITLE: DISTRIBUTION LINE "STEEL POLE" THREE PHASE (C2)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR, Project Engineer
RECOMMENDED: C. Z. C. LUEGO, JR., Manager, DDD
APPROVED: N. C. [illegible], Manager, DDD

DWG. NO. A4GC-BDE-03.010 PR NO. MG-A5M22-042
SCALE: NTS BID DRAWING REV. 0

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



TYPE NC7 (C7)

SCALE NTS

BILL OF MATERIALS		
Three Phase Crossarm Cons't Single Dead-End Type NC7 (C7)		
ITEM	DESCRIPTION	QTY
cu	Brace, Steel Crossarm, Standard 711 (28")	4
i	Bolt, Carriage, 10 x 114 (3/8" x 4-1/2"), thread 3" from tip	4
n	Bolt, Double Arming, 16 x 559 (5/8" x 22")	3
o	Bolt, Eye, 16 x 305 (5/8" x 12"), thread 5" from tip	1
cu	Bolt, Machine, 16 x 254 (5/8" x 10"), thread 5" from tip	7
l	Clamp, Deadend Strain	3
bn	Clamp, Loop Deadend	2
s	Clevis, Secondary, Swinging	1
g	Crossarm, 89 x 114 x 2440 (3-1/2" x 4-1/2" x 8'-0")	2
cm	Spool, Insulator, 76 (3") dia. Groove, Class 53 - 4	1
k	Insulator, Suspension, 152 (6") Clevis type, ANSI Class 52 - 1	6
ek	Locknut, 10 (3/8")	4
ek	Locknut, 16 (5/8")	11
ek	Locknut, 13 (1/2")	1
aa	Nut, Eye, 16 (5/8") Conventional	3
t	Wire, Tape, Armor, Al. Alloy, 13 x 8 (0.5" x 0.3")	1'
d	Washer, 57 x 57 x 5 (2¼" x 2¼" x 3/16"), 21 (13/16") HD	11
d	Washer, 51 x 51 x 3 (2" x 2" x 1/8"), 14 (9/16") HD	1
d	Washer, Round, 32 (1-1/4") OD, 11 (7/16") HD	4

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. REFER TO BILL OF QUANTITIES FOR THE ACTUAL TYPE OF POLE STRUCTURE TO BE USED.
3. ALL END OF WIRES MUST BE PROPERLY WRAP 5 (2") MINIMUM LENGTH.
4. THIS DRAWING SHALL BE WORKED WITH CIVIL WORKS BID DRAWINGS.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte

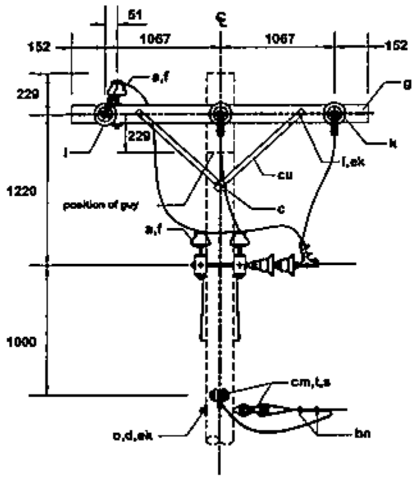
TITLE: DISTRIBUTION LINE "STEEL POLE" THREE PHASE (C7)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

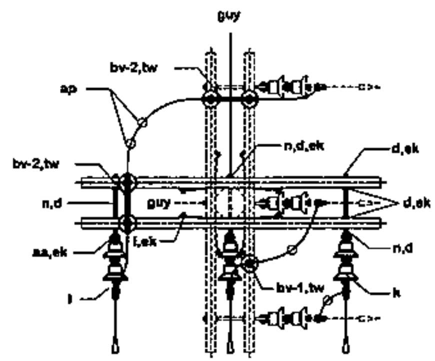
SUBMITTED: R. P. VERAR, Principal Engineer A
RECOMMENDED: C. Z. C. LUGOD, JR., Manager,
APPROVED: N. G. SOMBRERRA, Manager, DOD

DWG. NO. A4GC-BDE-03.011 | PR NO. MG-A5M22-042

SCALE: NTS | BID DRAWING | REV. 0



ELEVATION



TOP VIEW

TYPE NC7-2 (C7-2)

SCALE NTS

BILL OF MATERIALS		
Three Phase Crossarm Cons't Double Dead-End Type NC7-2 (C7-2)		
ITEM	DESCRIPTION	QTY
cu	Brace, Steel Crossarm, Standard 711 (28")	8
i	Bolt, Carriage, 10 x 114 (3/8" x 4-1/2"), thread 3" from tip	8
n	Bolt, Double Arming, 16 x 559 (5/8" x 22")	6
o	Bolt, Eye, 16 x 305 (5/8" x 12"), thread 5" from tip	2
cu	Bolt, Machine, 16 x 254 (5/8" x 10"), thread 5" from tip	14
l	Clamp, Deadend Strain	6
bn	Clamp, Loop Deadend	4
s	Clevis, Secondary, Swinging	2
g	Crossarm, 89 x 114 x 2440 (3-1/2" x 4-1/2" x 8'-0")	4
cm	Spool, Insulator, 76 (3") dia. Groove, Class 53 - 4	2
k	Insulator, Suspension, 152 (6") Clevis type, ANSI Class 52 - 1	12
ek	Locknut, 10 (3/8")	8
ek	Locknut, 16 (5/8")	22
ek	Locknut, 13 (1/2")	2
aa	Nut, Eye, 16 (5/8") Conventional	6
t	Wire, Tape, Armor, Al. Alloy, 13 x 8 (0.5" x 0.3")	2'
tw	Wire, Tire, Al. Alloy, Soft, #4 AWG	5'
d	Washer, 57 x 57 x 5 (2¼" x 2¼" x 3/16"), 21 (13/16") HD	22
d	Washer, 51 x 51 x 3 (2" x 2" x 1/8"), 14 (9/16") HD	2
d	Washer, Round, 32 (1-1/4") OD, 11 (7/16") HD	8
a	Insulator, Pin Type, ANSI Class 55-4	5
f	Pin, Crossarm, Steel, 16 x 273 (5/8" x 10-3/4")	5
bv-1	Rod, Armor (Single Support), primary	1
bv-2	Rod, Armor (Double Support), primary	2
p	Connector, Compression, Neutral	1
ap	Connector, Compression, Primary	4

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte

TITLE: DISTRIBUTION LINE
"STEEL POLE" THREE PHASE
(C7-2)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR./ARCHT.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

SUBMITTED: B.P. VERAR, Principal Engineer A

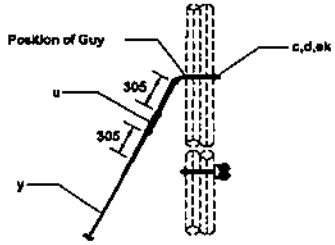
RECOMMENDED: C. Z. C. LUGOD, JR., Manager, EESCO

APPROVED: N. S. SOMBRERISA, Manager, DOD

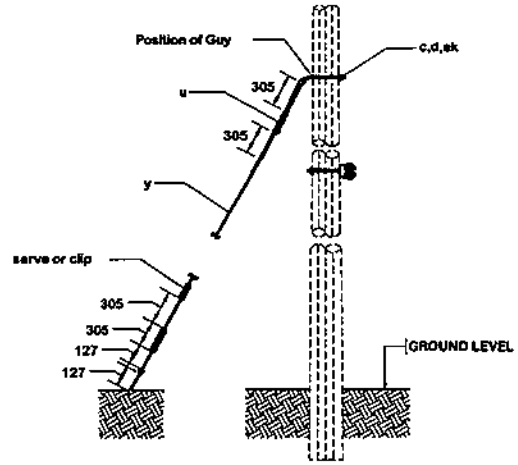
DWG. NO. A4GC-BDE-03.012 | PR NO. MG-A5M22-042

SCALE: NTS | **BID DRAWING** | REV. 0

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



POLE PIN ASSEMBLY

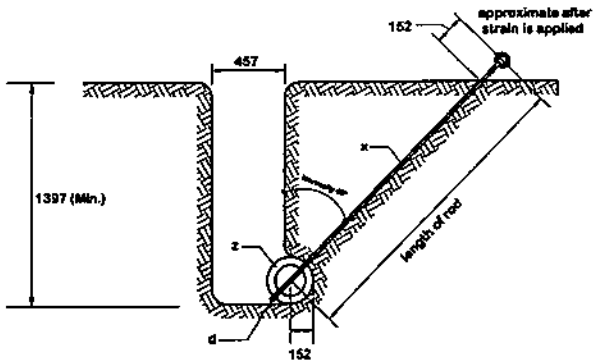


E1-2
SCALE NTS

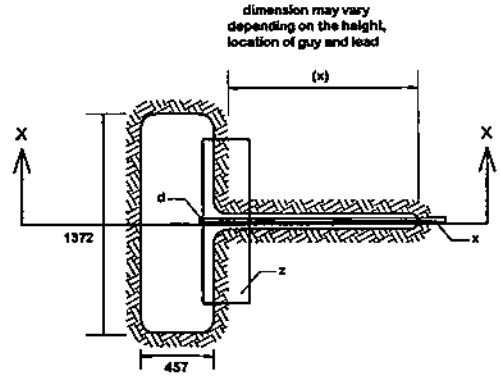
BILL OF MATERIALS		
ITEM	DESCRIPTION	QTY.
	E1-2 (Single Down Guy, Through Bolt Type)	
c	Guide eye, bolt	1
y	3/8" guy wire, 7 strands	50'
u	3-bolt, 6" long guy clamp	2
ek	Locknut, 5/8"	1
d	Washer 2½" X 2½" X 3/16", 13/16" hole	1
	F2-2 (Anchor Log Assembly)	
z	Anchor Log, 9" dia. x 4'-5"	1
x	Rod, Anchor, Threaded, Thimble Eye, 3/4" x 6' with locknut	1
d	Washer, 13/16 hole, Type 4" x 4" x 1/2"	1

NOTES:

1. ALL DIMENSIONS AS SHOWN ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. (x) DIMENSIONS MAY VARY DEPENDING ON THE HEIGHT, LOCATION OF GUY, AND LENGTH OF GUY LEAD.
3. WORK THIS DRAWING WITH CIVIL WORKS BID DRAWINGS.



SECTION "X-X"



F2-2
SCALE NTS

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP
LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte.

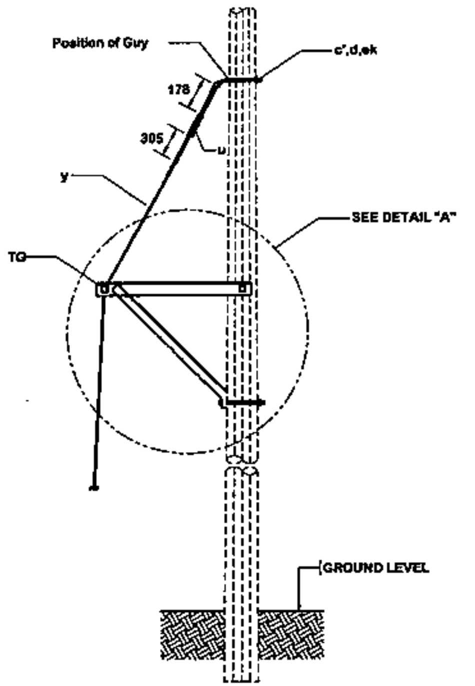
TITLE: DISTRIBUTION LINE
SINGLE DOWN GUY, THROUGH BOLT TYPE & ANCHOR LOG DETAIL
(E1-2 & F2-2)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R.P. VERAR
RECOMMEND: R. Z. C. LUGOD, JR.
APPROVED: N. G. SOMBONGKRA

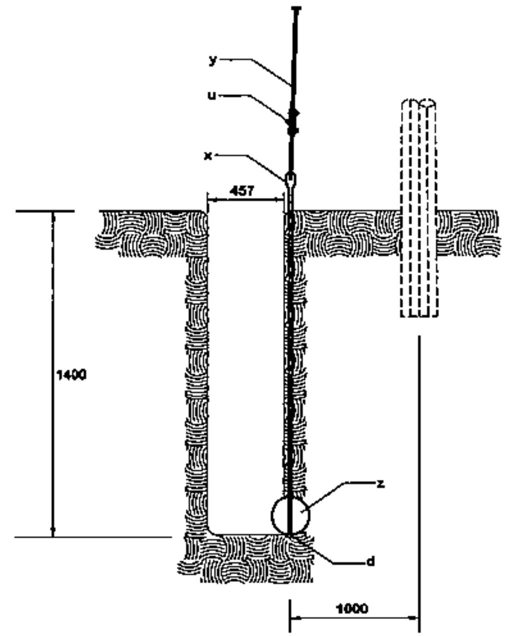
DWG. NO. A4GC-BDE-03.013 PR NO. MG-A5M22-042
SCALE: NTS BID DRAWING REV. 0

BILL OF MATERIALS		
ITEM	DESCRIPTION	QTY
	E1-2A (TRUSS GUY DETAILS)	
c'	Bolt, Thimble Eye, Angle Type, 16 x 254 (5/8" x 10"), thread 5" from tip	1
u	Clamp, Guy Straight, 3 Bolt Heavy Duty, Steel	2
ek	Locknut, 16 (5/8")	1
ek	Locknut, 19 (3/4")	1
ek	Locknut, 13 (1/2")	1
d	Washer, 57 x 57 x 5 (2¼" x 2¼" x 3/16"), 21 (13/16") HD	3
y	Guy Wire, Steel Galvanized, 3/8" dia., 7-strands	50'
TG	Truss guy	1
c	Bolt, Machine, 19 x 305 (3/4" x 12"), thread 5" from tip	1
c	Bolt, Machine, 13 x 305 (1/2" x 12"), thread 5" from tip	1
	F2-2A (ANCHOR LOG DETAILS)	
z	Anchor Log, 9" dia. x 4'-6"	1
x	Rod, Anchor, Threaded, Thimble Eye, 19 x 2440 (3/4" x 8') with locknut	1
d	Washer, 102 x 102 x 13 (4" x 4" x 1/2"), 21 (13/16") HD	1



E1-2A

SCALE NTS

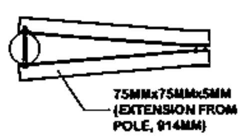


F2-2A

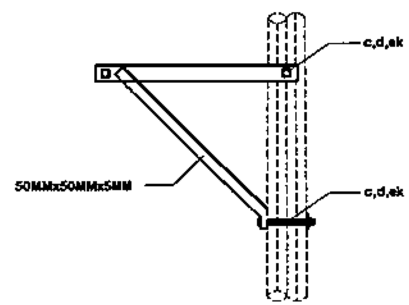
SCALE NTS

NOTES:

1. ALL DIMENSIONS/CLEARANCES AS SHOWN ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. FOR BIDDING PURPOSES ONLY. NECESSARY ADJUSTMENT INCLUDING ALL NECESSARY MATERIALS TO FUNCTION AS INTENDED SHALL BE DETERMINED BY THE CONTRACTOR BASED ON THE ACTUAL REQUIREMENTS.
3. WORK THIS DRAWING CIVIL WORKS BID DRAWINGS.



PLAN



DETAIL "A"

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Ditucalan, Lanao Del Norte.

TITLE: DISTRIBUTION LINE
TRUSS GUY & ANCHOR LOG DETAIL
(E1-2A & F2-2A)

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR, Principal Engineer

RECOMMENDED: O. Z. C. LUGOD, JR., Manager, GEOD

APPROVED: N. G. [illegible]RRA, Manager, DDD

DWG. NO. A4GC-BDE-03.014 | PR NO. MG-A5M22-042

SCALE: NTS | BID DRAWING | REV. 0

GENERAL DESIGN DATA

SINGLE POLE

1. Nominal Voltage — 13.8 kV

2. Conductors and Wires

Conductors and Wires	PRIMARY CONDUCTOR		NEUTRAL CONDUCTOR		SECONDARY CONDUCTOR		GUY WIRE	
Type and Size	ACSR, 1/0 AWG		ACSR, 2 AWG		Poly AAC, 2 AWG		3/8" High Strength Grade Steel Galvanized	
Stranding	6/1		6/1		7		7-strand	
Outside Diameter	10.11 mm	0.398 in	8.03 mm	0.316 in	9.70 mm	0.382 in	9.53 mm	0.375 in
Area	62.46 mm²	0.0967 in²	39.19 mm²	0.0607 in²	73.90 mm²	0.1145 in²	51.10 mm	0.8782 in
Weight	211.5 kg/km	0.1430 lb/ft	134.0 kg/km	0.0911 lb/ft	128.4 kg/km	0.0863 lb/ft	0.408 kg/m	0.273 lb/ft
Ultimate Strength	1,980 kg	4,380 lbs	1,295 kg	2,855 lbs	550 kg	1213 lbs	4,900 kg	10,800 lbs

3. Maximum Loading:

Temperature	7.22 °C (45 °F)
Wind Velocity	160 KPH

4. Tension Limits (Percentage of Ultimate Tensile Strength):

	Unloaded Final @ 7.22 °C (45 °F)	Loaded Final @ 7.22 °C (45 °F)
Conductor	20	40
Neutral Wire	20	40
Insulator Assembly		40 M and E

5. Span Limitations (Meters):

	Structure Type	Maximum Span		Deflection Angle
Single Pole, Secondary	NJ5 (J5)	50 m		0° ~ 5°
	NJ10 (J10)	50 m		5° ~ 30°
	NJ7 (J7)	50 m		30° ~ 60°
	NJ15 (J15)	50 m		
	NJ15A (J15A)	50 m		
Single Pole, Single Phase	NA1 (A1)	50 m	100 m	0° ~ 5°
	NA2 (A2)	50 m	100 m	5° ~ 30°
	NA3 (A3)	50 m	100 m	30° ~ 60°
	NA4 (A4)	50 m	100 m	60° ~ 90°
	NA5 (A5)	50 m	100 m	
	NA5-1 (A5-1)	50 m	100 m	
	NA5-2 (A5-2)	50 m	100 m	
	NA5-3 (A5-3)	50 m	100 m	
	NA5-4 (A5-4)	50 m	100 m	
	NA6 (A6)	50 m	100 m	
	NA14 (A14)	50 m	100 m	
	NA15 (A15)	50 m	100 m	
Single Pole, Two Phase	NB1 (B1)	50 m	100 m	0° ~ 5°
	NB2 (B2)	50 m	100 m	5° ~ 30°
	NB3 (B3)	50 m	100 m	30° ~ 60°
	NB4-1 (B4-1)	50 m	100 m	60° ~ 90°
	NB5-1 (B5-1)	50 m	100 m	
	NB7 (B7)	50 m	100 m	
	NB8 (B8)	50 m	100 m	
	NB14 (B14)	50 m	100 m	
	NB15 (B15)	50 m	100 m	
Single Pole, Three Phase	NC1 (C1)	50 m	100 m	0° ~ 5°
	NC2 (C2)	50 m	100 m	5° ~ 30°
	NC3 (C3)	50 m	100 m	30° ~ 60°
	NC4-1 (C4-1)	50 m	100 m	60° ~ 90°
	NC5-1 (C5-1)	50 m	100 m	
	NC7 (C7)	50 m	100 m	
	NC8 (C8)	50 m	100 m	
	NC14 (C14)	50 m	100 m	
	NC15 (C15)	50 m	100 m	

6. Clearances, Values Strictly Minimum:

Crossing Over @ 48.8 °C (120°F), No Wind, Final Sag	Clearance	
Track Rails of Railroads	10.00 m.	32.80 ft.
Public Street and Highways	7.60 m.	24.93 ft.
Rural Road	6.70 m.	21.98 ft.
Cultivated Fields, Area Accessible only to Pedestrians	5.80 m.	19.02 ft.
Conductor Clearance to Support	Refer to Drawing	
Conductor Clearance to Guy	Refer to Drawing	

7. Guy:

Maximum Working Load on 1.5 m. (5') Log Anchor	4,550 Kgs. (10,000 lbs.)
Guy Slope (L/H)	0.8 to 1.0
Maximum Design Tension in Guy Wire	3,300 Kgs. (7,250 lbs.)

8. Crossarms and Braces

Material	Galvanized Steel
Galvanizing According to:	ASTM A123

9. Steel Pole Data — Refer to Civil Drawings

10. Pole Setting

Length of Pole		Depth of Pole Setting			
		In Earth		In Rock	
Meter	Feet	Meter	Feet	Meter	Feet
9.14	30	1.52	5.0	1.22	4.0
10.67	35	1.68	5.5	1.22	4.0
12.19	40	1.83	6.0	1.22	4.0
13.71	45	1.98	6.5	1.37	4.5
15.24	50	2.13	7.0	1.52	5.0

SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

OWNER: NATIONAL POWER CORPORATION
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Dimucalan, Lanao Del Norte.

TITLE: DISTRIBUTION LINE
"STEEL POLE" GENERAL DESIGN DATA

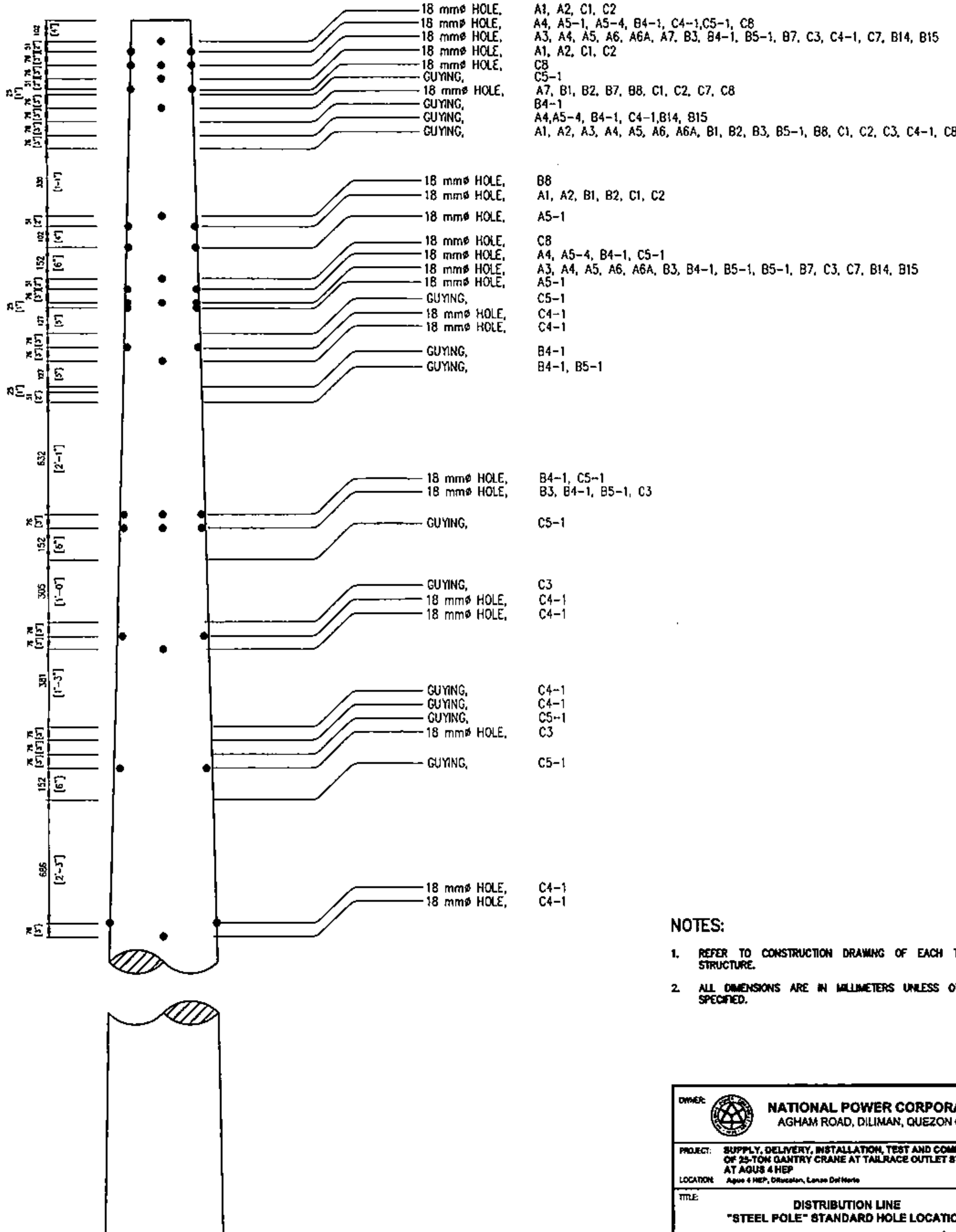
	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R.P. VERAR, Project Engineer
RECOMMENDED: C. Z. C. LUGOD, JR., Manager, SSSD
APPROVED: N. G. SOMBILLERA, Manager, DDD

DWG. NO. A4GC-BDE-03.015 SPECS. NO. MG-A5M22-042

SCALE: NTS BID DRAWING REV. 0

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.



NOTES:

1. REFER TO CONSTRUCTION DRAWING OF EACH TYPE OF STRUCTURE.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Diliucalan, Lanao Del Norte

TITLE: **DISTRIBUTION LINE "STEEL POLE" STANDARD HOLE LOCATION**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCHT.		
CIVIL/ARCHT			
ELEC.			
MECH.			

SUBMITTED: R. P. VERAR
RECOMMENDED: C. Z. C. LUGOD, JR., Manager
APPROVED: N. G. SORIANO, Manager

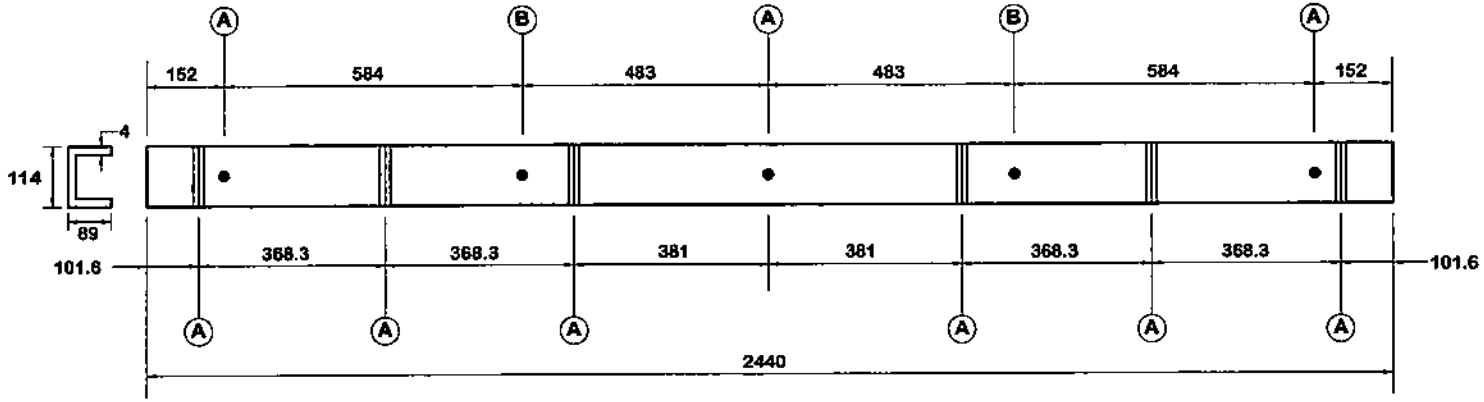
DWG. NO. A4GC-BDE-03.016 | SPECS. NO. MG-A5M22-042

SCALE: NTS | **BID DRAWING** | REV. 0

TOLERANCE SIZE OF HOLE		
CODE	NOMINAL HOLE DIAMETER	SIZE OF BOLT
Ⓐ	18 (11/16")	16 (5/8")
Ⓑ	12 (7/16")	10 (3/8")

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. DRILL HOLES ON CENTERLINES OF CROSS ARM FACES.
3. REMOVE ANY BURRS THAT REMAIN.
4. ALL THREADS MUST BE HAND–TAPPED AFTER GALVANIZING.
5. ALL STEEL MEETS OR EXCEEDS ASTM A572M GRADE 50 SPECIFICATIONS, YIELD STRENGTH (YS) => 50 ksi OR 345 MPa.
6. CROSS ARMS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A123M WITH MINIMUM COATING THICKNESS OF 85 MICRONS.
7. CROSS ARM SPECIFICATION CONSIDERATIONS INCLUDE THE CONDUCTOR, LINE HARDWARES, SPAN DISTANCES, LINE ANGLE, WIND LOAD ON CROSS ARMS AND CONDUCTORS.
8. CROSS ARM OR SIDEARM CONSTRUCTION FOR SINGLE PHASE TO THREE–PHASE CIRCUIT APPLICATION.



CROSSARM DRILLING GUIDE

SCALE NTS

REV.	DATE	NATURE OF REVISION	BY	CHKD.	RECD.	APPD.

OWNER: **NATIONAL POWER CORPORATION**
AGHAM ROAD, DILIMAN, QUEZON CITY

PROJECT: SUPPLY, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF 25-TON GANTRY CRANE AT TAILRACE OUTLET STRUCTURE AT AGUS 4 HEP

LOCATION: Agus 4 HEP, Dilucalan, Lanao Del Norte

TITLE: **DISTRIBUTION LINE CROSSARM DRILLING GUIDE**

	BY	CHKD	DATE
DESIGNED			
DRAWN			
REVIEWED	PRINCIPAL ENGR. / ARCH'T.		
CIVIL/ARCH'T			
ELEC.			
MECH.			

SUBMITTED: R/F VERAR, Project Engineer
RECOMMENDED: C. Z. C. LUBOD, JR., Manager, ESSD
APPROVED: N. G. SOMOSIERRA, Manager, DDD

DWG. NO. A4GC-BDE-03.017 PR NO. MG-A5M22-042

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