





Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-ELT-556-CA-0001	Contract No. 66-6695	
	SCOPE OF WORK FOR CONTRACTOR - ELECTRICAL			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.	
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1 **INTRODUCTION**

This document describes the various technical requirements (ELECTRICAL) for the implementation and execution of LSTK tender.

2 **GENERAL**

The intent of this document is to define and describe the detail Scope of Work – Electrical for the LSTK Contractor. This shall include, but not be limited to the following -

- Scope & Responsibility
- Supply
- Engineering
- Procurement
- Inspection
- Project Management
- Construction Management
- Spares
- Tools & Tackles
- Training
- Statutory Approvals
- Documentation

and other associated activities of the LSTK tender.



2.1 **SCOPE & RESPONSIBILITY**

LSTK Contractor shall read this document in conjunction with other documents of Tender Package along with all attachments /Annexures in order to understand the complete scope of work. All parts of the Tender document, forms the complete requirement of the LSTK tender.

Effort is made to define the Scope of Work explicitly without any ambiguity. Any electrical related item / work / activity which is explicitly not mentioned in this tender document but is necessary to achieve successful completion and safe operation of the Electrical system of the units / facilities of this project (in line with the Statutory requirements / Standards / Specifications and internationally recognized good engineering practices) shall be included by the LSTK Contractor in his scope of work without any cost and time implication to the OWNER.

It will be the LSTK Contractor's responsibility to bring to the notice of OWNER / CONSULTANT any irreconcilable conflict in the tender documents as a part of his bid /offer. LSTK Contractor shall bring out such discrepancies very clearly in the offer and clarification shall be sought from OWNER / CONSULTANT. Resolution of such conflicts shall be provided by OWNER / CONSULTANT.

In case LSTK Contractor brings to the notice of OWNER / CONSULTANT any conflicting requirements during Project execution stage, then the OWNER / CONSULTANT shall provide resolution to such conflicts and the final decision of the OWNER / CONSULTANT shall be binding on the LSTK Contractor without any time and cost implication to the OWNER.

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In case of any conflict between the statutory requirements, codes and standards to be followed and various specifications, data sheets etc. of this tender document, the LSTK contractor shall bring out such conflicting requirements clearly prior to execution of work. These conflicting requirements shall be discussed and resolved with the OWNER / CONSULTANT. Any deviation / extra claim on account of such contradictions shall not be accepted.

The assumptions made by LSTK Contractor for preparing the offer shall be brought out clearly to the attention of OWNER / CONSULTANT. These assumptions shall be subject to approval by OWNER / CONSULTANT.

All deviations shall be listed only in the format enclosed as Waiver / Deviation form available in Volume 1. Deviations mentioned elsewhere shall not be taken into account while evaluating the offers. It shall be considered that the LSTK Contractor complies fully with the document except for the deviations listed in the above format.

Acquiring all necessary information related to existing facilities of plant, new facilities being installed by Owner (either directly or through other LSTK contractors) remains the responsibility of LSTK Contractor.



All co-ordination work with the OWNER / CONSULTANT & with the other agencies / other LSTK Contractors during the entire phase (upto handover) of the Project remains the responsibility of LSTK Contractor.

2.2 SUPPLY

Supply of all major electrical equipment and material within battery limits as listed below but not limited to the following –

- 415V Switchgears (PCC, MCC)
- 415V Variable speed drives
- 415V capacitor banks along with power factor improvement capacitor control panels
- 0.415kV Electrical induction motors (Motors shall be sourced alongwith the respective driven equipment)
- Auxiliary Distribution Boards (MLDB, EMLDB, SLDB, Aux.DBs etc.)
- Low Voltage Power & Control Cables, Fibre Optic Cables, communication cables
- Elevators/lifts
- Electric heaters
- Soft starters (if applicable)
- Light Fixtures - Normal, Emergency, Critical
- Aviation Lighting, windsock lighting, Area Flood Light Masts (FLMs)
- Local Control Stations & load break switches
- Three phase and Single phase Socket outlets, hand lamps, Junction Boxes, Switches
- Hydroblast cleaning Power Sockets (if applicable)
- Earthing and Lightning protection Material
- Cable Trays (Ladder and perforated)
- Conduits & accessories
- Cable Glands & cable entry blanking plugs
- Cable gland reducers / expanders
- Trefoil cable clamps (if applicable)
- Cable lugs, cable route markers
- Canopies for equipment / motors



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- Structural Steel
- Fire sealants, weather sealants for openings
- Exhaust Fans, Ceiling Fans, pedestal fans, air blowers
- Window / split A/C
- Special Sand for Cable Trenches, Bricks, Tape
- Electrical Installation Hardware
- Consumables
- Safety equipment including all Safety PPE required in the sub-station and units, Insulation coat paint (Both sides of all electrical panels installed in indoor & outdoor), illuminated type Electrical Single line diagram for unit (including frame, power supply hardware, LED light fittings, sockets, glass etc.)
- Any other electrical equipment, materials, accessories not explicitly mentioned but required for successful completion & safe operation of the electrical work.

2.3 ENGINEERING

2.3.1 DESIGN & DETAIL ENGINEERING

The complete Electrical system shall be designed and engineered in the best technical manner on the basis of this Tender document. All equipment shall be new with state of the art technology and proven track record. Prototype equipment shall not be offered.

The materials, design and workmanship shall satisfy the applicable standards, the specifications enclosed & codes referred to. Where the specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied. In the absence of any standard / specifications / codes of practice covering any part of the work covered in the scope of work, LSTK Contractor shall develop the required specifications and implement the same with the approval of OWNER / CONSULTANT.




LSTK Contractor shall apply sound engineering and manufacturing practice and shall include all equipment and services not specifically mentioned but necessary to complete the work for the required functionality, matching the present industry standard.

The drawings/ documents and other attachments with Tender define the basic system design for the entire package. This is based on preliminary data, layouts and other data and same are for guidance/information only. LSTK contractor shall develop the final load schedule, finalise all equipment ratings, SLD, Substation layout, Cable list and other detail engineering documents / drawings.

Equipment ratings, wherever specified are indicative only. LSTK Contractor shall be responsible to verify these ratings and submit the offer accordingly.

LSTK Contractor shall finalise all equipment ratings and other data during detail engineering. Same shall be implemented without any extra cost and time implication to OWNER.

Design, engineering & erection must be done in the best engineering practice and workmanship. Established standard practices and latest statutory regulations applicable in the country shall be followed.

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LSTK Contractor shall use various softwares for performing the design & detail engineering as per the list of softwares included elsewhere in the tender. Electrical System Studies shall be performed in the latest version of ETAP software.

LSTK Contractor shall develop the complete Basic and Detail engineering drawings / documents as specified in Document Matrix (engineering deliverables and vendor documents) for OWNER / CONSULTANT Approval / Review / Information attached elsewhere in the tender.

LSTK Contractor shall develop the documents attached in this tender into Approved For Construction (AFC) status, taking into account the detailed requirements of the Project and documents contained in this tender package.

Specific attention is brought to the following for the LSTK Contractor while performing his design & detail engineering –

- GES available in Volume 4 Section 06 Part 01
- Key SLD & Detail SLD available in Volume 4 Section 06 Part 01
- Substation layout available in Volume 4 Section 06 Part 01
- Standard formats for lists (consumer, cable, feeder, LCS) available in Volume 4 Section 06 Part 01
- Typical Installation details available in Volume 4 Section 06 Part 02

2.3.2 EQUIPMENT SPECIFICATION

LSTK Contractor shall design all the electrical equipments as per the Technical specifications (all major electrical equipments) that are available in Volume 4 Section 06 Part 02 of this tender.

Additional technical requirements are indicated in the various documents available in Volume 4 Section 06 Part 01 of this tender.

2.3.3 LAYOUT ENGINEERING & BILL OF QUANTITIES (BOQ)



LSTK Contractor shall be responsible for preparation of all the electrical installation layouts and estimating the various bill of quantities as required for design, detail & procurement engineering as per the List of drawings / documents defined elsewhere in the tender.

LSTK Contractor shall be responsible for modelling of the Electrical equipments in 3D PDMS model as per the scope defined in the document List of drawings / documents included elsewhere in the tender.

2.4 PROCUREMENT

2.4.1 PROCUREMENT ENGINEERING

LSTK Contractor shall perform Procurement engineering consisting of preparation of Material Requisitions (Inquiry specifications), Technical Bid Analysis, Purchase Requisitions / Order specifications, checking and approval of vendor drawings, etc. for all electrical equipment/ items defined in the Tender package.

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2.4.2 VENDOR LIST

LSTK Contractor shall refer to document Vendor List available in Volume 2 of this tender. All the electrical equipments shall be procured from the vendors as indicated in the Approved Vendor list only.

2.4.3 VENDOR DOCUMENTATION

LSTK Contractor shall refer to the various technical specifications of electrical equipments available in Volume 4 Section 06 Part 02 for the requirement of drawings / documents to be prepared by the respective equipment vendor during engineering.

LSTK Contractor shall refer to the requirements of Vendor documentation procedure included elsewhere in the tender.

LSTK Contractor to refer requirement indicated elsewhere in the tender for No. of copies of vendor drawings / documents to be issued by LSTK Contractor for Approval / Review / Information during Detail Engineering stage and as a part of Final, As built documentation.

2.5 INSPECTION

2.5.1 FACTORY ACCEPTANCE TEST (FAT) REQUIREMENTS

LSTK Contractor shall refer to the Inspection test plans (ITP) available in Volume 4 Section 06 Part 02 as a part of the technical specifications of individual electrical equipments.

LSTK Contractor shall be responsible for review of Test Certificates of all electrical equipments.

In general routine tests, type tests, acceptance tests and special tests shall be performed on all electrical equipments as per the relevant applicable codes and standards at the Vendor's works.

In the absence of ITP for any electrical equipment, LSTK Contractor shall develop the same based on the applicable codes & standards and implement the same with the approval of OWNER / CONSULTANT.

Detail requirements of Inspection at Vendor's works are defined elsewhere in the tender.



2.6 PROJECT MANAGEMENT

2.6.1 PROJECT IMPLEMENTATION

LSTK Contractor shall be responsible for carrying out all Project management related activities including planning & scheduling, progress monitoring for successful implementation of the project as per stipulated time schedule.

2.6.2 PROJECT CO-ORDINATION

LSTK Contractor shall be responsible for co-ordination with OWNER / CONSULTANT and with various external agencies like statutory authorities, suppliers of all electrical equipments / items,

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package vendors, any third party agencies (if applicable), other LSTK Contractor, sub-contractors for this project as well as co-ordination among LSTK Contractors own departments / offices involved in implementation of this project for smooth & trouble-free completion of the project.

LSTK Contractor shall attend meetings at OWNER / CONSULTANT / Vendor / Sub-Contractors office as per the requirements during the entire phase of the project.

Detail requirements of Project implementation & Co-ordination are defined elsewhere in the tender.

2.7 **CONSTRUCTION MANAGEMENT**

2.7.1 **CONSTRUCTION**

LSTK Contractor shall be responsible for the complete construction activities for all the electrical equipments / items supplied for this project. LSTK Contractor shall ensure the use of appropriate machinery, tools & tackles for the construction activities.

LSTK Contractor shall ensure that services of the Vendor / OEM personnel are considered at site for supervision of installation of switchgears (for providing guidance to installation contractor and ensuring that necessary precautions are taken for proper alignment and assembly of the panels), elevator / lifts.

LSTK Contractor shall be responsible for providing sufficient man-power for execution as well as supervising construction, pre-commissioning, commissioning and closure of works activities.

Detail requirements of construction & construction management are defined elsewhere in the tender.

2.7.2 **SITE EXECUTION & CO-ORDINATION**



LSTK Contractor shall be responsible for carrying out all the site related activities for successful implementation of the project within stipulated time schedule.

LSTK Contractor shall be responsible for safe and efficient management of site stores, materials and equipments and timely mobilisation of all the required resources. LSTK Contractor shall follow good house-keeping practices. LSTK Contractor shall prepare and maintain all documentation for site work as per approved site procedures.

Detail requirements of site execution & co-ordination are defined elsewhere in the tender.

2.7.3 **PRE-COMMISSIONING, TESTING & COMMISSIONING INCLUDING SITE ACCEPTANCE TESTING (SAT)**

LSTK Contractor shall be responsible for carrying out the pre-commissioning checks, testing and commissioning of the electrical equipments installed within the battery limits and also as per the scope of work involved in the various interfaces as detailed in the document Battery

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Limits & Interfaces – Electrical.

LSTK Contractor shall ensure the services of specialists of Vendor / OEM at site during testing and commissioning phase, to check proper configuration of all relays and meters, assistance for carrying out relay testing and setting, demonstrating connectivity, boxing up etc. for switchgears.

LSTK Contractor shall also consider the Supervision of Testing and Commissioning by equipment manufacturer for major electrical equipments including UPS, VFDs, Elevators / lifts.

The requirements of Site Acceptance Testing (SAT) are covered in the doc. No. 6695-ELT-G00-QA-0001 available in Volume 3 of this tender. The requirement indicated in this document is minimum and as a general guideline. LSTK Contractor shall also carry out all the required installation checks and tests as per OEM & Site requirement.

LSTK Contractor shall ensure that all electrical equipments shall be put into service only after all safety checks, functional checks and specific instructions from OEM / OWNER / CONSULTANT are complied. LSTK Contractor shall ensure to close all punch points before the electrical equipments are put into service.

Other detail requirements of pre-commissioning, mechanical completion, testing & commissioning are defined elsewhere in the tender.

2.8 **SPARES**

LSTK Contractor shall supply following types of spares –

- Mandatory spares
- Commissioning spares
- One year operation & maintenance spares



LSTK Contractor to refer to the Document - Spares Philosophy available elsewhere in this tender.

For the equipment's which are not covered in the document of Spares Philosophy, LSTK Contractor shall supply all types of spares required as per good engineering practice, required for safe and intended operation of equipment and in line with the recommendations of the Specific Electrical Original Equipment Manufacturer (OEM) for each electrical equipment.

2.9 **TOOLS & TACKLES**

LSTK Contractor shall supply the following tools & tackles and miscellaneous accessories for maintenance and operation of all electrical equipment. These shall include following as a minimum:-

- Portable LV meggar (500/1000V) - 2 Nos.
- Digital multimeter- 2Nos.

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- Tong tester - 2 Nos.(each with range 0-2000A AC/DC)
- Tool and key cabinet-2each
- Insulated step ladder- 2 Nos.
- Earthing discharge rod for 11KV, 6.6kV -2Nos.each (if applicable)
- HV Tester (11KV, 6.6kV) – 2nos. each (if applicable)
- Motor checkers-2Nos.(with %R, %L & IR value check)
- IR Temperature Gun – 2Nos.
- Non-Sparking Tool set – 2Nos.
- Insulated step ladder with platform in substation: 1Nos.
- Hand Gloves (applicable for all voltage levels): 1set each.
- Flash suit (applicable for all voltage levels) : 1No.each

The requirement indicated above is the minimum. LSTK Contractor shall also supply all tools and tackles based on the recommendation of the OEMs of various electrical equipments.

LSTK Contractor to also refer to the requirement of supply of tools & tackles listed in the technical specification for HV & LV Switchgears available in Volume 4 Section 06 Part 02 of this tender.

2.10 TRAINING

2.10.1 AT MANUFACTURER'S WORKS

LSTK Contractor shall provide training for OWNER'S four engineers in two different batches separately for a period of at least one week at manufacturer's works for the following equipment.:-

- VFD panels/soft starters.
- Any specialised electrical equipment which is part of LLI/Package item.
- Numerical relays.

2.10.2 AT SITE



LSTK Contractor shall provide training for OWNER'S four engineers in two different batches separately for a period of at least one week at site for the following equipment.:-

- HV Switchgears (if applicable)
- UPS (if applicable)
- Battery Charger (if applicable)

Additionally LSTK Contractor shall also provide on-site training of Elevator / lifts for a period of minimum half day to Owner's operating staff (for 4 to 8 persons).

2.11 STATUTORY APPROVALS

LSTK Contractor shall be responsible for obtaining all statutory approvals as per GENERAL CONDITIONS OF LUMPSUM TURNKEY (LSTK) CONTRACT.

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2.12 DOCUMENTATION

After completion of work, and prior to start-up / energisation of electrical equipment / systems, LSTK Contractor shall mark-up the 'As Built' details / information on all 'Released for Construction (RFC)' drawings / documents and Manufacturer's drawings / documents related to the electrical works and submit the same to OWNER / CONSULTANT.

One set of up-to-date Final, As-built drawings / documents shall be suitably stored in respective Substation(s) for all equipment installed therein.

All tests results, protocols and associated checklists generated as part of the 'Mechanical Completion', pre-commissioning checks, testing and commissioning of the electrical systems shall form a part of the Final Documentation submitted by LSTK Contractor to OWNER / CONSULTANT.

All technical specifications, inspection reports and certificates of equipment / material supplied by LSTK Contractor shall become a part of this Final Documentation.

LSTK Contractor shall also be responsible for providing Vendors final documentation for all electrical equipments supplied for the project.

Detail requirements of LSTK Contractor's Final, As-built documentation & procedure are defined elsewhere in the tender.

3 BATTERY LIMITS & INTERFACES

LSTK Contractor shall refer to the document Battery Limits & Interfaces - Electrical doc.no. 6695-ELT-556-CA-0002 available in Volume 2 of this tender document.



This document details the battery limits and interfaces defined for the various power supplies i.e. 11KV main incoming power to the plant substation, Emergency power supply, interfaces with other systems such as SCADA, PA system, Telephone, Fire alarm system, earthing and interface with OWNER/ OTHER LSTK Contractors.

The interfaces listed in the document are envisaged as a minimum. Any additional interface if required during detail engineering & for completion and safe operation of the plant shall be included in the scope of LSTK Contractor with no extra time and cost implication to OWNER/ OTHER.

LSTK Contractor shall also refer to the Battery Limit & Interfaces – Electrical document for any free issue material to be given to the LSTK Contractor by the OWNER/ OTHER .

4 PERFORMANCE GUARANTEE

LSTK Contractor shall be responsible for demonstrating the performance guarantee of the equipment as per the guaranteed technical parameters within the tolerance permitted by relevant standards during the testing of the equipment at the vendor's works.

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If any equipment supplied by the LSTK Contractor fails at site during erection, testing, commissioning or service (within guarantee period), the LSTK Contractor shall repair and put back into successful operation the failed equipment within the time frame and procedure of repair agreed with the OWNER depending on nature of failure, at no extra cost to the OWNER.

In case of failure of the equipment (including bought out items) to meet the guaranteed performance, OWNER / CONSULTANT reserves the right to reject the equipment. However, OWNER also reserves the right to use the rejected equipment until the new equipment meeting the guaranteed performance requirement is supplied by the LSTK Contractor.

All the equipments and material supplied by LSTK Contractor shall be guaranteed for a period as specified elsewhere in the tender.

5 SPECIFIC INSTRUCTIONS

LSTK Contractor shall specifically take note of the following -



- While preparing the technical specifications for Material requisition, LSTK Contractor shall suitably revise / update the specifications / datasheets available in the Tender in order to adapt the same for their scope of work.
- Construction power supply shall be made available at a single point at the nearest substation as per the following –
 - 1no. 400A TPN SFU feeder for LSTK Contractor's plant area
 - 1no. 125A TPN SFU feeder for LSTK Contractor's Laydown and maintenance area
 - 1no. 63A TPN SFU feeder for LSTK Contractor's Labour colony

All other terms & conditions for Construction power supply shall be as per the relevant clauses defined elsewhere in the tender.

- Following documents shall be submitted by the LSTK Contractor to the Owner while applying for Construction power
 - List of all equipment
 - Energy Meter (the energy meter must be kept in sealed box during installation at the site)
 - Single line diagram for Office, Lighting & fabrication yard Power Supply
 - Field Test Certificate (For Earthing, etc)
 - Electrical Contractor License Copy
 - Completion Certificate
 - Calibration Test Certificate of Energy Meter from STANDARD TESTING LABORATORY, BHUBANESWAR