


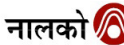




Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev   <b>01</b>   Page   <b>2</b>   of   <b>20</b>

## CONTENTS

SECTION	DESCRIPTION	PAGE
<b>1</b>	<b>Preamble</b>	<b>3</b>
<b>2</b>	<b>Scope of work</b>	<b>3</b>
<b>3</b>	<b>Scope of supply</b>	<b>12</b>
<b>4</b>	<b>Additional requirements</b>	<b>13</b>
<b>5</b>	<b>Reference Specifications and Documents</b>	<b>20</b>

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>NALCO</b> नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev <b>01</b> Page <b>3</b> of <b>20</b>

## 1 PREAMBLE

M/S NALCO (National Aluminium Company Limited) intends to set up the fifth stream Alumina Refinery at their Damanjodi Site in the state of Odisha, India.

ThyssenKrupp Industrial Solutions (India) Private Limited (tkIS - India) has been selected as EPCM Consultant for the same.

As part of this 5<sup>th</sup> stream Refinery Project, it is required to install the Bauxite Storage / handling and Bauxite Crushing Plant and related facilities like Conveyors, Junction Houses, etc. It is intended that these facilities be executed on an LSTK basis.

This document covers the Civil, Structural and Architectural scope of work related to the above-mentioned Bauxite Storage / Handling and Bauxite Crushing Package.

The detailed scope of work is described in the section 'Scope of Work'.

The Bidders shall be deemed to have familiarized with the site condition and the entire scope of work before submitting their tender.



This document shall be read in conjunction with the technical specifications given in this tender package.

Specifications, conceptual layout drawings etc., are included in the tender. The dimensions and elevations shown in the conceptual drawings are the minimum requirement. Details furnished in the documents are for information / guidance only; the LSTK CONTRACTOR shall check and confirm its adequacy and suitability for this Project. All dimensions and elevations shall be finalized by LSTK CONTRACTOR during detail engineering phase and shall be subject to Owner / Consultant approval, without entailing any extra cost and time implication to Owner / Consultant.

Broadly, this document enlists various activities to be carried out by LSTK CONTRACTOR, list of deliverables corresponding to the activities, approval of documents and submission patterns.

## 2 SCOPE OF WORK

The scope of Civil and Structural works under this contract shall include (but not limited to) complete design, detailing, supply, erection, construction, testing and putting into service all relevant civil, structural and architectural works for all units and buildings for Bauxite Storage / Handling and Bauxite Secondary Crushing Package as per specifications enclosed with the bid document. Any other work which is needed for the successful completion of the Facilities shall also be treated as part of LSTK Contractor's scope without any cost implication to Owner / Consultant. Major civil and structural works involved shall include (but not limited to) the following:

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>4</b> of <b>20</b>

## 2.1 Pre-Engineering Activities

Carrying out various field and laboratory investigations (stated below), including report preparation, recommendations, measures proposed and implementation at site; furnishing engineering reports to Owner / Consultant for review / approval / Records as mentioned elsewhere in the tender.

### 2.1.1 Geotechnical Investigation:

Rely-upon Soil investigation Report is provided by Owner / Consultant. Refer 6695-CVC-G00-DD-0001. CONTRACTOR shall carry out his own investigations independently, in case additional data is required, through reputed vendors & report the findings. The reports shall be sent to Owner / Consultant for approval before proceeding with further engineering. CONTRACTOR shall base his foundation design and geotechnical improvement method, if required, on the most conservative values out of reports provided by Owner & CONTRACTOR's own reports, without any extra cost and time implications to Owner / Consultant.

### 2.1.2 Topographical Survey Report:

Topographic survey report is provided by Owner / Consultant. Refer 6695-CVC-G00-DD-0002. CONTRACTOR shall carry out his own survey independently, in case data provided is insufficient, through reputed vendors & report the findings. The reports shall be sent to Owner / Consultant for approval before proceeding with further engineering. CONTRACTOR shall use the most conservative data out of reports provided by Owner & CONTRACTOR's own reports, without any extra cost and time implications to Owner / Consultant.

### 2.1.3 Site Clearance, Preparation and Grading




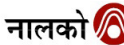
Contractor shall clear the site and fill up the land to required levels. Cutting and disposal of trees and any other obstructive elements that exist at Site are part of Contractor's scope of works. Topographical Survey Drawing for the area is attached, for reference, as mentioned in 2.1.2. Additionally, Contractor shall have deemed to have visited site prior to Bid submission in order to ascertain the actual amount of work involved. Contractor shall ensure proper compaction as specified in the Technical Specifications for Construction (Document # 6695-CVC-G00-EC-0002).

## 2.2 Engineering

The CONTRACTOR shall carry out Civil, Structural, Architectural engineering design commensurate with tender provisions. Contractor shall carry out the following (but not limited to) activities as part of Civil, Structural and Architectural Scope of Works.

### 2.2.1 Index of Deliverables:

CONTRACTOR shall develop an Index of various deliverables for each and every structure and building with title of deliverable, document no, scheduled and actual date of submission and other information; and submit the same to Owner / Consultant for information on a monthly basis.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>NALCO</b> नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev   <b>01</b>   Page   <b>5</b>   of   <b>20</b>

### 2.2.2 Concept Notes:

Preparation of Concept Notes for design, engineering and construction specific to each type of building and structure.

The Concept Note shall, as a minimum, include the following:

- Building Description
- Information regarding the foundation system to be followed.
- Loads and Load Combinations as applicable.
- Material of Construction.
- Analysis and Design philosophy to be followed.
- Any specific requirement for Construction / Erection

2.2.3 Design & Construction of all equipment foundations/ super structures for Bauxite Storage/Handling and Bauxite Crushing, Conveyor supporting structures, stockpile areas with reclaimer conveyors, Transfer towers etc.

2.2.4 Design & Construction of foundations and superstructures for stockpile areas, conveyor supporting structures, transfer towers, Substation, transformer foundations, fire walls, etc. all complete.

2.2.5 Design & construction of all operating and maintenance platforms, stairs, walkways, pipe racks, pipe supports, cable trays etc.

2.2.6 Design and Construction of all main and secondary roads required, within the Package Area Boundary, for erection, maintenance and hassle-free operation of the Unit. Design and construction of Box Culverts / Retention Walls as shown in Information Sketches shall be a part of Contractor's scope of works.



2.2.7 Developing architectural design & drawings of Plant and Non-Plant buildings: Architectural drawing for Plant and Non-Plant buildings shall be developed by LSTK contractor in line with statutory and specific requirements stated in the tender and good engineering practice.

2.2.8 Details on Ground improvement measures in terms of technical specifications, drawings etc., shall be by LSTK contractor


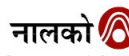
2.2.9 Developing general arrangement drawings for grade level showing foundations, rafts, base-plates including anchor-bolts and grouting, extent of pavings (light / heavy duty paving), hard-stands (if any), drainage trenches, cable trenches, drain pits, manholes, underground pits, pedestals, security fence, gates, etc.

2.2.10 Structural analysis and design of superstructure (RCC or structural steel as applicable) at all levels.

2.2.11 Detailing of fire proofing of structural steel works, as applicable.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-CVC-552-CA-0001	Contract No. 66-6695		
 thyssenkrupp	Scope Of Work For Contractor - Civil, Structural & Architectural			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	01	Page

- 1
- 2.2.12 Pile integrity tests shall be carried out for all the installed working piles.
- 2.2.13 Detailing for chemical resistant lining on various surfaces, as applicable.
- 2.2.14 Reinforcement detailing for foundations and RCC structures including bar bending schedules.
- 2.2.15 Design of roads, storm water drains, effluent drains, cable / pipe trenches, manholes, pits, sumps, fencing & gate with all necessary details.
- 2.2.16 Developing underground coordination plans (including but not limited to clearing clashes amongst underground entities such as pipes, cables, conduits, foundations including piling, or any other obstructions).
- 2.2.17 Coordination with Owner / Consultant for various activities including approvals of concept note, design calculations, drawings, selection of material samples, etc.
- 2.2.18 Design of end-connections and Fabrication drawings with details of structural steel work, including column base connections.
- 2.2.19 Detailing of Grating platforms, ladders, hand-rails. Floor plans showing cut-outs / openings.
- 2.2.20 Specifying painting, galvanizing, protective lining for structures and buildings.
- 2.2.21 Plumbing design for rainwater downtake.
- 2.2.22 Micro grading of land shall be in the scope of LSTK Contractor.
- 2.2.23 Antitermite treatment for buildings as per specifications.
- 2.2.24 Obtaining statutory approval from local authorities such as Municipal Corporation, Development authorities, Inspector of Factories and any other concerned authorities before starting the works at site.
- 2.2.25 Structures for Monorails/Overhead travelling cranes of required capacity for operation / maintenance of equipment/pumps.
- 1
- 2.2.26 Storm Water Drainage: Storm water drains within the Bauxite Storage / Handling and Bauxite Crushing Package Area shall be part of Contractor's scope. The tie-in point with Overall Plant Storm Water System shall be at a point along the boundary of the the Bauxite Storage / Handling and Bauxite Crushing Package. The exact location shall be finalized at the time of Contract execution. Roof drainage from buildings and shelters shall be connected to the nearest storm water drains.
- The New Bauxite stock piles are located adjacent to existing stock piles 5 & 6. Design and installation of interconnecting drainage and main drainage shall be adequate to ensure that there is no stagnation of water during heavy rain, inside the existing as well as proposed new stock piles.
- Contaminated rain water shall not be connected to storm water drain network. Contaminated water / effluents shall be routed into a separate drain network. The tie-in point shall be at a point along the boundary of the Package. The exact location shall be finalized at the time of Contract execution.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>7</b> of <b>20</b>

Storm water drains shall be provided on both sides of new roads as per specification.

Design, supply, construction of pipe culverts/ box culverts for drainage networks crossing the roads within the Package shall be a part of Contractor's scope of works.

Drainage arrangement shall take care of water drainage around new stock-pile area.

2.2.27 All other civil structural works forming part of scope of works of General Civil, Architectural, Mechanical, Rotating equipment, Electrical disciplines etc. and including construction of Roads, Drainage, Sewage and other earthfill protections and as laid out elsewhere in this bid package.

2.2.28 A 3D model shall be generated showing all the structures and buildings at their respective correct physical location. All details like the connection plates, connecting members etc. shall be modeled as obstruction blocks to ensure a clash-free model. The model shall also include all underground facilities like the foundations, pits, trenches, anchor bolts etc.

2.2.29 A review file generated out of the 3D model using appropriate application software as listed elsewhere in this tender, shall be submitted to Owner / Consultant for review on a regular basis. The comments out of such review process shall be taken aboard by the CONTRACTOR without any cost or time implication to Owner / Consultant.

2.2.30 All Plant & Non-Plant rooms shall be designed for necessary equipment as well as necessary furniture to make respective room functional.

2.2.31 In case of any structural connection to existing structure/s is required, Contractor shall be responsible for carrying out adequacy check and resulting necessary modifications for the same. Drawings for the existing structure, if available, shall be provided by Owner. If not available, Contractor shall find out the details by carrying out appropriate site survey.



2.2.32 Contractor shall analyse & design the civil foundations & structures based on latest codes using latest version of STAADPro (V8i SELECT Series 5). Contractor shall follow appropriate method of analysis (3-D or 2-D) and describe the same in the Concept Note.

## **2.3 Construction**

2.3.1 Construction shall be carried out as per various documents attached with the tender, national codes and standards.



2.3.2 LSTK contractor shall adopt mechanisation of construction activities.

2.3.3 Site-preparation: CONTRACTOR shall be responsible for planning, designing, reshaping and contouring the site to final grade elevations after study and verification of the existing site conditions.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>8</b> of <b>20</b>

- 2.3.4 For any foundation / underground facility / above-ground facility / roads etc. if founding soil/ medium is not meeting the requirement as specified in the engineering standards, the required levels specified in engineering standards (e.g. compaction etc in line with specifications) shall be achieved by LSTK contractor without any extra cost and time implications to Owner / Consultant.
- 2.3.5 LSTK contractor shall take precautionary measures to protect construction work and material against damage due to construction activities, pilferage and theft etc.
- 2.3.6 Anti termite treatment shall be provided at foundation excavations, trenches, pits, plinth filling etc. in the entire plot area.
- 2.3.7 Clearing of Site: Prior to, during & after completion of construction, CONTRACTOR shall clear the site of all left out construction materials, construction equipment, debris, excess earth, etc. All servicable material shall be deposited in the Owner's store & unservicable material to be taken outside the premisis and deposited in municipal corporation dumping ground or any other place, without any extra cost and time implications to Owner. Contractor shall submit permission / approval taken from the municipal corporation or local authority / private land owner, where contractor is deemed to deposit the unservicable material.
- 2.3.8 Security Fence during Construction: CONTRACTOR shall provide any required temporary security fence and gate separating existing plant / construction area and proposed construction site. LSTK contractor shall implement these requirements, without any claim for extra cost and time implication to Owner.
- 2.3.9 The CONTRACTOR shall consider all necessary safety barricading of the LSTK package so as to isolate the same from the existing plant in the vicinity, for the safe execution of work. The height of the barricade shall be defined by the height of the adjacent equipments / structures. Barricading shall be of structural steel & GI corrugated sheets, to ensure safety against transfer of heat / sparks during welding or any other site activities. Barricading should have arrangement of sprinkler / water curtain system with provisions of drainage/ collection of water / reuse of water for sprinkler/ water curtain system. The barricading should be structurally designed to withstand all the loads acting on it including wind & earthquake. CONTRACTOR should carry out all necessary piling if required for stability of barricading & its foundation. CONTRACTOR to ensure availability of gas detection instrument during issue of work permit for construction work. Necessary fire extinguishers shall be made available near the barricading area. CONTRACTOR shall design the extent and height of barricading in consultation with Owner / Consultant and the scheme for barricading shall be approved by Owner / Consultant. The comments of Owner / Consultant shall be incorporated by CONTRACTOR without time & cost impact to Owner / Consultant.



Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नालको</b> <b>NALCO</b> नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev <b>01</b> Page <b>9</b> of <b>20</b>



Some part of the work may have to be executed within existing plant and in the plant running condition. All necessary permits & safety measures for working personnel, material etc., shall be adhered to. Adequate safety precautions like barricading, water sprinklers, fire extinguisher, etc. shall be taken.

Contractor shall ensure the safety of nearby structures / foundations while carrying out excavation / blasting of hard rock / soft rock.

- 2.3.10 The construction material (structural steel, cement, reinforcement steel, paint, roof sheeting etc.) shall be procured / supplied ONLY from the approved brands / suppliers. Contractor shall submit Request for Approval of Material (RAM). Contractor shall procure the material only after approval by Owner / Consultant.
- 2.3.11 The prevailing water table at plant-site is expected to be in the range of 10 m to 12 m below existing ground level. Wherever deeper excavation is necessary & the ground water is expected to cause hinderance, dewatering at the site shall be in scope of LSTK contractor.
- 2.3.12 Scope of Civil, structural, architectural work including demolition, reconstruction as envisaged in other sections / clauses / documents / drawings etc. of this Tender package shall also be in the scope of Work and supply by the LSTK contractor. The CONTRACTOR shall carry out these activities without any claim for extra time & cost implication to Owner / Consultant.

## **2.4 Statutory / Regulatory Approvals & clearances**



- 2.4.1 The CONTRACTOR shall be responsible to comply with all regulatory / statutory requirement at the time of project execution & handover, which, at the time of tendering & issuance of LOA / work order may not be applicable / in force.
- 2.4.2 All necessary Statutory Approvals shall be obtained by the CONTRACTOR including but not limited to obtaining Stability certificate for all buildings, Technological structures, etc. as per the regulation of Government of Orissa state, local regulatory bodies / municipality, National Building Code of India, Factory Inspectorate etc as applicable. LSTK contractor shall carry out the following.
- 2.4.3 Preparation of all the drawings/ documents meeting all the statutory requirements.
- 2.4.4 Preparation of all the drawings/ documents in required format & nos. of sets, for submission to various statutory bodies.
- 2.4.5 Obtaining approval from all the statutory bodies.
- 2.4.6 All necessary charges / expenditures etc. whatever required to obtain the approval from statutory bodies is to be borne by CONTRACTOR.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>10</b> of <b>20</b>

- 2.4.7 Submission of all the copies of drawing/ documents in multiple copies including original duly approved by the statutory bodies to Owner.
- 2.4.8 Any extra requirement / modification necessitated by statutory authorities shall be incorporated by the LSTK CONTRACTOR without extra cost and time implications to Owner / Consultant.
- 2.4.9 The CONTRACTOR shall assist the Owner / Consultant in obtaining necessary statutory approvals, clearances from the statutory bodies like Factory inspector, Industrial Licensor, etc. in connection with the PROJECT. Assistance of CONTRACTOR includes (a) Preparation of necessary documents required for obtaining various approvals, (b) CONTRACTOR shall accompany with Owner / Consultant to submit all the necessary documents to statutory authority and also prepare & make presentation, if required, to be given to statutory authorities etc.
- 2.4.10 The CONTRACTOR shall obtain all statutory approvals before start of construction and commissioning activities.
- 2.4.11 The CONTRACTOR shall ensure that all original approved copy of all statutory requirements is submitted to Owner.

## **2.5 As built & Final Documentation**

- 2.5.1 CONTRACTOR shall develop as-built drawings / documents as a part of final documentation for archiving purpose. Detail requirement for the same shall be as specified in the Vendor Documentation Procedure.
- 2.5.2 CONTRACTOR shall ensure preparation & submission of as-built drawings etc. incorporating all pre-commissioning & Statutory bodies' audit punch list changes, if any.
- 2.5.3 CONTRACTOR is to ensure that all documents for "APPROVAL / REVIEW / COMMENTS" are submitted in soft copies (in MS Word / Excel / AutoCAD / PowerPoint etc.) in editable format as well as hard copies as per requirement of Owner.
- 2.5.4 CONTRACTOR is to ensure that all documents for "INFORMATION" are submitted in soft copies (in MS Word / Excel / AutoCAD / PowerPoint etc.) in editable format as well as hard copies as per requirement of Owner.
- 2.5.5 CONTRACTOR shall furnish a data file of all the drawings prepared in electronic format in CD and AutoCAD version 14.
- 2.5.6 Final & as built document is to be submitted in MS Office or AutoCAD as applicable including PDF format for various documents / drawings both in soft copy and hard copies.
- 2.5.7 In general, documents shall be generated in MS office and AutoCAD, if & otherwise not essential.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>11</b> of <b>20</b>

2.5.8 CONTRACTOR shall note that documentation means all types of documents including vendor's & sub-vendor's documentation which primarily includes manuals, equipment drawings, fabrication drawings, piping drawings, all types of electrical drawings, cross sectional drawings, drawings for internal etc.


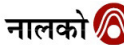
2.5.9 CONTRACTOR shall note that in order to ensure receipt of complete documents i.e. manuals and as-built drawings, CONTRACTOR is to develop a Master Document list (MDL) in advance so that when these documents are handed over, the reference of the MDL is mentioned, which will facilitate reconciliation of the submitted documents to check whether complete documents have been received or not. A document handing over system is to be developed on award of the contract.

## **2.6 Compliance with Codes and Standards:**

2.6.1 CONTRACTOR agrees that the Work and all systems, components and parts of the Work shall comply with:

- (i) those design criteria, codes and standards which are specified in this tender, Scope of Work and as agreed between CONTRACTOR and Owner / Consultant; and
- (ii) List of Engineering Standards and Specifications developed for the Project. (Engineering Standards and Specification enclosed as Annexure); and
- (iii) the requirements of all relevant Indian authorities, including without limitation:
  - a) Orissa State Pollution Control Board
  - b) Factories Act;
  - c) Indian Petroleum Rules;
  - d) Tariff Advisory Committee Guidelines;
  - e) Liquid effluent discharge, as per Minimal National Standards for liquid effluents and air emissions conforming to Pollution Control Board Standards;
  - f) Civil Aviation Rules;
  - g) Indian Boiler Regulation Act;
  - h) India Electricity Rules; and
  - i) Requirements of other authorities concerned with the Project or out of any licence, permission, sanction, approval or no objection relative thereto.
  - j) Weights & Measures

2.6.2 CONTRACTOR also agrees that all design criteria, codes and standards included in this Contract are and at all times prior to the Acceptance of the Work will be in compliance with the requirements of such authorities.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>NALCO</b> नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev <b>01</b> Page <b>12</b> of <b>20</b>

## 2.7 Any extra claim / work:

- 2.7.1 In case of any extra claim, contractor has to take approval from Engineer-in-Charge before starting the work in accordance with the General Conditions of Contract.

## 2.8 Order of Precedence


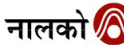
- 2.8.1 In case of conflicting requirements in tender documents, specifications, drawings or relevant applicable standards, the same shall be brought to notice of Owner / Consultant. In general most stringent of them shall be used with approval of Owner / Consultant.

The CONTRACTOR shall perform all design and engineering in accordance with the Engineering Standards and Specifications, International Codes and Standards and latest IS Codes and Standards as detailed elsewhere in this tender, Licensor Specifications and Standards, National and Local Rules and Regulations. Revisions of the above as on the Effective Date of the Contract shall be utilised by the CONTRACTOR. The above requirements shall be considered as the minimum requirements.

- 2.8.2 The information given in each of the above-mentioned document shall be used in conjunction with all other above-listed documents. In cases of conflict between documents in any level of the hierarchy, the CONTRACTOR shall provide its interpretation in writing of the most stringent requirement for Owner / Consultant approval. In all such cases of conflict, Owner / Consultant decision shall be final. Any deviations to the above require prior Owner / Consultant approval. If standards or specifications are not available for specific applications, CONTRACTOR shall develop such standards and specifications, based on industry standards and practices, its own experience, and on the basis of fit for purpose. All new and revised Contract standards or specifications shall be submitted to Owner / Consultant for approval. The Plant shall be engineered and constructed to minimise the Plant's environmental impact. Any modification to agreed design criteria shall be subject to Contractor providing detailed justification and Owner's approval of the same.

## 3 SCOPE OF SUPPLY



All materials (consumables/non-consumables) required to complete the job shall be supplied by the Contractor.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>NALCO</b> नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev   <b>01</b>   Page   <b>13</b>   of   <b>20</b>

#### 4 ADDITIONAL REQUIREMENTS

##### 4.1 General

- 4.1.1 Apart from the conditions mentioned in the Job Specification for Bauxite Storage / handling and Secondary Crushing Package, the following shall be strictly adhered to.
- 4.1.2 Standard drawings for recurring details are attached with the tender. Contractor shall follow these details in his design. Contractor shall prepare drawings for those construction details for which standard drawings are not available.
- 4.1.3 The local sand available in and around Damanjodi area is not acceptable for construction work. Approved sand shall be brought from Nowarangpur river area which is about 130km from Project Site.
- 4.1.4 Substations shall be of RCC construction
- 4.1.5 Minimum grade of R.C.C to be used for civil-structural works shall be M30.
- 4.1.6 Fly-ash concrete shall be used in concrete mixes in accordance with relevant Indian Codes.
- 4.1.7 Fly ash Cement bricks shall be used for all masonry works.
- 4.1.8 Contractor can obtain fly ash free of cost from the existing dry silos of Owner.
- 4.1.9 Only steel shuttering shall be used for civil construction.
- 4.1.10 The minimum diameter of reinforcement bar for slabs, beam stirrups and column ties shall be 8 mm and for footing slabs and vertical walls it shall be 10 mm. The maximum spacing of these bars shall be restricted to 300 mm c/c.
- 4.1.11 Contractor shall make necessary arrangement for placing the anchor bolts in position before concreting. Whenever there are more than four foundation bolts, these shall be fixed by using template. In case bolts are not available at site at the time of casting of foundation, proper pockets and sleeves shall be left as per direction of the Engineer-in-charge.
- 4.1.12 All designs, detailing & construction shall strictly conform to enclosed standards, specifications & drawings. However drawings marked "Issued for Information only" are only for guidance to the Contractor.
- 4.1.13 Sequence of construction is to be shown on the AFC drawings by indicating construction joints wherever required.
- 4.1.14 No equipment shall be directly supported on suspended floor slab. Suitable arrangement of beams shall be provided underneath to support the equipments.
- 4.1.15 Only minor equipment foundations (weighing up to 1.0 MT) may be considered as lightly loaded structures (as mentioned in geotechnical recommendation) & founded at shallow depth.
- 4.1.16 The foundation design shall be based on approved Geotechnical investigation recommendations.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-CVC-552-CA-0001	Contract No. 66-6695		
 thyssenkrupp	Scope Of Work For Contractor - Civil, Structural & Architectural			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	01	Page

4.1.17 Contractor shall depute his concerned Civil-Structural design engineer to Consultant's review office as and when required for review of his documents. During such reviews involving computer aided analysis/design/drafting of structures, the Contractor shall make his own arrangement of Personal Computer (PC) in the form of Lap-top in the premises of Consultant's review office. This is required to expeditiously resolve all the comments including those involving the use of PC by Contractor in his submission. The Contractor shall ensure that these PC's are fully operational along with necessary software already loaded including the input/output/drawing files of the structures being reviewed. The Contractor shall revise and re-submit the analysis/design and drawings as required during review.

4.1.18 The Risk Coefficient for calculation of Wind Loads on temporary structures may be considered in accordance with Table 1 of IS 875 (Part 3): 2015.

## **4.2 Architectural Requirements**

4.2.1 Architectural features shall be in accordance with the following referenced publications:

- National Building Code of India
- Orissa State Factory Act
- Local Municipality or Any other Authority's Bye-laws as applicable.
- TAC (Tariff Advisory Committee) Recommendations
- GRIHA (Green Rating for Independent Habitat Assessment) recommendations – Three star rating.





4.2.2 Site planning of building shall take into account aspects like inter-relationship of the buildings with the whole system, movement pattern, traffic and road net-work, safety regulations, service network, fire safety, climatic and environmental aspects, site conditions like site dimension, contour, drainage, noise level, view, future expansion, visual aspects etc.

Main and service/ maintenance entrances of buildings shall be provided with vehicular access. All exit points also shall be provided with footpath/ vehicular access. Truck movement space in accordance with traffic pattern shall be provided for the building as per the location of hoisting bay/ loading, unloading platform. Road network and open space around the buildings shall be designed considering movement and functioning of Fire tenders.

4.2.3 Spatial requirements shall be decided based on the activities to be performed in the building and consequent occupancy pattern, equipment layout, etc. Sizes of various types of spaces shall be decided based on occupancy / equipment / panel / furniture layout, maintenance, safety, lighting, ventilation and statutory requirements.

4.2.4 Plinth protection shall be provided with minimum 1.0 meter wide, 75 mm thick concrete. Adequate slope shall be provided to ensure run-off of rain water away from building.

4.2.5 Finished Floor levels for the buildings shall be decided on the basis of functional requirements. The Finished level for Ground Floor shall be sufficiently (minimum 150mm) raised from the highest level of approach road or pavement.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-CVC-552-CA-0001	Contract No. 66-6695
 thyssenkrupp	Scope Of Work For Contractor - Civil, Structural & Architectural			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev 01

#### 4.2.6 Walls

External masonry walls shall be minimum 230mm thick.

Internal masonry walls shall be minimum 115mm thick.

Fire walls around transformers shall be 350 thick masonry wall or 200 thick RCC wall.



Random Rubble Masonry walls shall be minimum 300mm thick.

4.2.7 Doors, steps, ramps, accessways and staircases shall be provided in accordance with relevant codes and standards and shall meet the functional requirements of the building. Rolling shutters of adequate size shall be provided where equipment entry is envisaged. Mechanically operated Rolling Shutters shall be provided for opening sizes exceeding 9.0 sqm.

4.2.8 Canopies over all entries/ exits and shades over all windows / openings shall be provided as protection against rain and sun protection. Parapets shall be provided for the roofs in accordance with Indian Standards. Shades shall have minimum projection of 600mm. Parapets shall be minimum 500mm for non-accessible roofs and 900mm for accessible roofs.

4.2.9 Handrailing shall be provided in stairs, open sides of elevated floors and in all unprotected openings in slabs as a safety device.

4.2.10 Water supply & distribution services shall be provided to meet the occupancy requirement and as per referenced publications.

4.2.11 Drainage & sanitary services, including toilets, shall be provided to meet the occupancy requirement and as per referenced publications. Janitor's space shall be provided within toilets.

4.2.12 Electrical services shall be provided as per Electrical Specifications.



4.2.13 Daylighting and natural ventilation shall follow the requirements of the referenced publications.

4.2.14 Daylighting shall be supplemented by artificial illumination in accordance with Electrical Specifications. Natural ventilation shall be supplemented by mechanical / electrical means of ventilation as specified in the respective specifications.

4.2.15 Acoustics & Sound Insulation shall follow the requirements of the of the referenced publications.

Noise level shall be controlled by means of

- Segregating noise sources by buffer zones.
- Dampening of noise levels by dampening devices.
- Providing acoustic treatment with acoustic material (on walls, ceilings, floors as required)

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-CVC-552-CA-0001	Contract No. 66-6695		
 thyssenkrupp	Scope Of Work For Contractor - Civil, Structural & Architectural			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	01	Page

4.2.16 Air-lock lobby shall be provided at the entrance exit of all air-conditioned spaces.

4.2.17 Emergency exits shall be provided suitably in accordance with National Building Code of India, the Orissa State Factory Act and the requirements of this Tender. Doorways, corridors, passage, accessways to staircases shall be designed suitably.

4.2.18 In addition to the functional and safety requirement, aesthetic requirement of buildings / sheds shall be taken care of in the design.

The following elements shall be subject to Owner / PMC approval



- Building / shed shape.
- Canopies, overhangs and shading devices.
- Entrance / exit steps, doors.
- Window / ventilator composition.
- External wall location with respect to columns.
- Colour scheme, grooves in plaster.
- Spatial arrangement.
- Gutters and rain water pipes.
- Finishing materials.
- Plumbing fixtures.

4.2.19 Architectural finishes (for floors, walls, ceilings) shall be provided as per functional requirements in accordance with referenced publications and relevant Indian Standards. False ceilings shall be provided for aesthetics and as required by air conditioning and ventilation requirement. False flooring / raised floor shall be provided as required. Actual requirements shall be reviewed during detailed engineering stage based on functionality and aesthetics. External painting of buildings shall be carried out with weather-proof paint of approved manufacturers over suitable coat of primer. The paint shall be suitable for the local climate and shall be with a comprehensive performance warranty of 7 (seven) years.

4.2.20 Water-proofing of terraces shall be carried out using Atactic Polypropylene (APP). Minimum slope of 1:50 shall be maintained.

4.2.21 All plumbing shall be concealed.



Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev   <b>01</b>   Page   <b>17</b>   of   <b>20</b>



### 4.3 Requirements for Roads, Drains and Culverts

#### 4.3.1 Roads:

Roads and culverts shall be designed for Class A loading as per IRC 06 – 2014, structural design period of 15 years or actual load due to heavy equipment, trailers, trucks & tank, whichever is higher. A minimum wheel load of 10 tons/axel per 250x500 square mm at the surface shall be considered for the road design.

The roadway system including kerbs, sub-base, road base and surface course shall be designed to provide a 15 year service life before major repairs are needed.


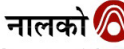
Road widths, vertical clearances and kerb radii shall be proportioned to accommodate the largest and longest vehicles (including their loads) likely to be present at any time during the life of the plant, including construction and refit periods. Turnarounds shall be designed to allow easy manoeuvring of laden trucks.

- |                         |  |
|-------------------------|--|
| a) Road width-          | Roads shall be minimum 7m wide (carriageway) with 1.0m shoulder on either side.  |
| b) Camber -             | 1 in 50  |
| c) Radius of curves -   | As per IRC :37-2001.   |
| d) Road cross-section - | Road shall be designed based on CBR (California Bearing Ratio). Value of Sub-grade shall be as per design requirements (CBR values to be obtained by the contractor during survey) as per IRC:37-2001.         |
| e) Vertical clearance   | Clearance above the road crown shall be minimum 6.0m for roads without crane duty and 8.0m for roads with crane duty. These clearances shall be verified against the requirements of vehicles planned for use. |

#### Road cross-section:

Road cross-section shall consist of the following layers (top to bottom):

- 200mm THK RCC paving
- 150 THK W.B.M in two layers (Grade III)
- 75mm THK W.B.M (Grade II)
- 230mm THK Granular sub-base
- Well-compacted earth (existing strata / fill to be compacted to 95% Proctor density)

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>18</b> of <b>20</b>

Road Shoulders shall be 75mm THK W.B.M (Grade II) over 230 THK granular sub-base and well-compacted earth to 95% Proctor density.

Road Crown shall be minimum 150mm above adjoining Finished Ground / Paving Level.

#### 4.3.2 Storm Water Drainage:

New storm water surface drains and underground pipework shall be constructed in the project site for efficient collection and removal of stormwater. The drainage shall be provided by grading design. These drains shall be connected to the existing storm water drains at appropriate locations. Roof drainage from buildings and shelters shall be connected to the nearest storm water drains.

RCC Storm Water drains shall be provided for all roads & around buildings. Minimum width of the drain shall be 300 mm and minimum depth shall be 150 mm. Storm Water Drain shall be designed for minimum freeboard of 100 mm.

Chemical effluents, contaminated rain water or oily-water shall not be connected to storm water drains. These effluents shall be treated as specified elsewhere in this tender.

Stormwater sewers shall be routed under footways or piperacks adjacent to roads to provide easy access and avoid damage from wheel loads. Inclusion of two sewers, one on each side of the roadway, avoids the need for crossconnections. The drains shall be covered with heavy duty G.I.gratings or precast covers as required from ease of approach to nearby area.

Pipe diameters shall be standardised to reduce the variety of sizes. A minimum main diameter of 200 mm is recommended to facilitate easy maintenance. Pipe gradients shall be established with regard to the typical ground gradients on the site, with an absolute minimum of 1:100.



Design, supply, construction of OWS, CRWS systems, sewage, drinking water systems etc is in scope of LSTK contractor.

Layout requirement may force relocation / re-routing / re-construction of existing storm-water and other drainage systems. CONTRACTOR shall carry out these activities without any claim for extra cost or time implication to OWNER / PMC.

#### 4.3.3 Culverts:

Pipe culvert / RCC Box culverts shall be provided on the drain crossing of the roads. All culverts shall be designed to suit crane movement.

For all electrical/ instrument cables crossing the main/approach roads, suitable road crossings either by PVC pipes encased in concrete or RCC duct banks/ culverts shall be provided as per Electrical/ Instrumentation requirements. Crossings shall be designed for crane loads required for erection.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>19</b> of <b>20</b>

#### 4.3.4 Paving:

Contractor shall provide RCC pavement for the unit areas. Paving extents where indicated are for guidance only and shall be considered as minimum. Any additional paving required during detail engineering is to be carried out by CONTRACTOR at no extra cost and time implications to OWNER / PMC.

Hardstands suitable for 650T crane (or any other higher capacity crane actually deployed for erection) capacity with ringer attachment and or with sky horse attachment for handling heavy equipment / machinery shall be constructed to suit erection scheme. It shall be partly or totally dismantled as per requirement.

#### 4.4 Painting of Structural Steel Works

Surface preparation, Primer and Painting shall be as per Painting specification (6695-EQS-G00-EC-0007).



#### 4.5 Review of Design and Issued for Construction (IFC) Drawings

Design basis for all structures shall be submitted to Consultant for review and comments.

The Contractor shall prepare & submit specifications of materials etc., which are not covered or attached in the Tender Documents for review by Owner / Consultant.

For all other works/buildings/structures, requisite number of prints (as mentioned elsewhere) of design calculations and IFC drawings shall be sent simultaneously to Consultant / OWNER for information and to site for construction.

Submission of Approval / review category documents shall be taken up prior to records category documents. Owner / Consultant comments on approval / review category documents shall be duly complied in information / records category documents before issuing for construction. Construction at work site shall commence only after the approval cycle by Consultant / Owner is duly completed.

Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-CVC-552-CA-0001</b>	Contract No. <b>66-6695</b>
	<b>Scope Of Work For Contractor - Civil, Structural &amp; Architectural</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>
				Rev <b>01</b> Page <b>20</b> of <b>20</b>

## 5 REFERENCE SPECIFICATIONS / DOCUMENTS

6695-LAY-G00-LD-0001	Overall Plot plan
6695-PIP-552-CA-0005	Scope Of Work For Contractor - General
6695-PIP-552-EC-0002	Specification for Bauxite Storage, Handling and Secondary Crushing Facilities
6695-CVC-G00-EC-0001	General Engineering Specification - Civil, Structural & Architectural
6695-CVC-G00-EC-0002	Technical Specifications for Construction Works - Civil, Structural & Architectural
6695-CVC-G00-EC-0003	Standard Instruction on Design Calculation Documentation
6695-CVC-G00-EB-0005	Standard Drawings - Architectural
6695-CVC-G00-EB-0006	Standard Drawings - RCC
6695-CVC-G00-EB-0007	Standard Drawings - Structural Steel
6695-CVC-G00-DD-0001	Soil Investigation Report
6695-CVC-G00-DD-0002	Traverse & Topographic Survey (Contour Plan) Report