





Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नालको नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev 00 Page 1 of 12

tkIS India / Vendor		tkIS India / Owner / Client	
Category Codes (Submission Purpose)	<input type="checkbox"/> 1 For Approval <input type="checkbox"/> 2 For Review / Comments <input type="checkbox"/> 3 For Information <input type="checkbox"/> 4 For Engineering <input type="checkbox"/> 5 For Enquiry <input type="checkbox"/> 6 For Order Placement <input type="checkbox"/> 7 Final & Approved <input type="checkbox"/> 8 Released for Construction	Category Codes (Submission Purpose)	<input type="checkbox"/> 1 For Approval <input type="checkbox"/> 2 For Review / Comments <input type="checkbox"/> 3 For Information <input type="checkbox"/> 4 For Engineering <input type="checkbox"/> 5 For Enquiry <input type="checkbox"/> 6 For Order Placement <input type="checkbox"/> 7 Final & Approved <input type="checkbox"/> 8 Released for Construction
Acceptance Codes (Approval Codes)	<input type="checkbox"/> 1 Approved <input type="checkbox"/> 2 Approved for Manufacturing / Fabrication with Comments as marked <input type="checkbox"/> 3 Not Approved / Resubmit <input type="checkbox"/> 4 Retained for Information / Records <input type="checkbox"/> 5 Reviewed <input type="checkbox"/> 6 Reviewed as Noted / Resubmit	Acceptance Codes (Approval Codes)	<input type="checkbox"/> 1 Approved <input type="checkbox"/> 2 Approved for Manufacturing / Fabrication with Comments as marked <input type="checkbox"/> 3 Not Approved / Resubmit <input type="checkbox"/> 4 Retained for Information / Records <input type="checkbox"/> 5 Reviewed <input type="checkbox"/> 6 Reviewed as Noted / Resubmit
Remarks for AC2 : This marked-up drawings is hereby approved for fabrication / manufacturing and shall be re-submitted after revision. This drawing should be revised only to the extent of tkIS India / Owner / Client comments. Any other changes made by you will not be considered unless clearly highlighted in covering letter asking for approval.			
This approval / review does not absolve the supplier from the full responsibility for design and fabrication.			
Date : __/__/____ Name : _____		Date : __/__/____ Name : _____	



THIS DOCUMENT WAS EARLIER ISSUED WITH DOC ID: 6695-PIP-G00-CA-0001

00		Issued for tender	03-04-18	RNJ	03-04-18	PRM	03-04-18	LNN/SJP	-
Rev.	Status	Description	Date	Prepared	Date	Checked	Date	Approved	AC
			Barcode						Category Code: -
© thyssenkrupp Industrial Solutions (India) Private Limited 2016									

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695
	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev 00 Page 2 of 12

Contents

	Page
1. INTENT	3
2. GENERAL REQUIREMENT	3
3. SCOPE OF WORK	5
4. BATTERY LIMITS & INTERFACES	10
5. PERFORMANCE GUARANTEE	10
6. PROCUREMENT ENGINEERING & VENDOR LIST	10
7. FACTORY ACCEPTANCE TEST (FAT) REQUIREMENTS	10
8. PROJECT CO-ORDINATION.....	10
9. CO-ORDINATION WITH STATUTORY BODIES AND OUTSIDE AGENCIES	11
10. CONSTRUCTION & CONSTRUCTION MANAGEMENT	11
11. PRE-COMMISSIONING, TESTING & COMMISSIONING.....	11
12. SPARES	11
13. TOOLS & TACKLES.....	11
14. 'AS-BUILT', FINAL & OTHER DOCUMENTATION.....	12
15. SPECIFIC INSTRUCTIONS	12
16. TRAINING.....	12

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	00	Page

1. INTENT

This document describes the various technical requirements of Piping Engineering and Material Handling System for the implementation and execution of tender.

This document is intended to cover the complete design, manufacture, assembly, testing at manufacturer's works, packing and forwarding, supply and delivery duly packed for transportation to site of all equipment and accessories, insurance, unloading, storage & handling at site are in the scope of the contractor.

Specifications, conceptual plot plans are included in the TENDER. The dimensions and elevations shown in the conceptual drawings are preliminary. Details furnished in the TENDER documents are for information/guidance only; the CONTRACTOR shall check and confirm its adequacy and suitability for this Project. All dimensions and elevations shall be finalized by CONTRACTOR during detail engineering phase and shall be subject to Owner/CONSULTANT approval, without entailing any extra cost or schedule implications to OWNER/CONSULTANT.

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 CONTRACTOR shall bring out such conflicting requirements clearly prior to execution of work. The conflicting requirements shall be discussed with the OWNER/CONSULTANT and same shall be resolved by OWNER/CONSULTANT. Any deviation/ extra claim on account of such contradictions shall not be accepted.

Complete and efficient erection, testing, commissioning & putting into successful commercial operation inclusive of supply of all labor, supervision, tools, implements and supplies as required.

This document shall be read in conjunction with the complete tender documents along with all attachments /Annexures. All parts of the Tender document, forms the complete requirement of the tender.

Effort is made to define the scope of work explicitly without any ambiguity. Any work that is not covered under this tender document, but which is required for successful completion of the Piping and Material Handling System shall be in scope of work of Contractor. Any piping and material handling system related item or work not explicitly mentioned in this document, but necessary to achieve successful and safe implementation of this project, shall be included by the Contractor in his scope of supply and work without any additional cost and time implication to OWNER. Omission of any piping and material handling system related item or work necessary to achieve successful implementation of this project (in line with the Statutory requirements / Standards / Specifications and internationally recognized good engineering practices) from this document, does not absolve the Contractor of contractual obligations and it is his responsibility to include such items / activities in his scope of supply and work without any additional cost and time implication to OWNER.

2. GENERAL REQUIREMENT



2.1 Codes And Standards

All piping and associated equipment (valve, gasket, flanges etc.), and material handling equipment shall conform to latest applicable standard publications and other standards mentioned in "Design Basis" (doc. no. 6695-PRC-G00-EC-0001) and the various technical specifications in Volume-4, Section -4 in the tender. In case of a conflict the requirement of stringent standards shall govern. The provisions of tender specifications (except the clause of codes and standards of individual specification) shall however have precedence over all other standards.

2.2 Completeness of Supply & Installation

It is not the intent to specify completely herein all details of the equipment & installation. Nevertheless, the equipment & installation shall be complete & operative in all aspects & shall conform to highest standard of engineering, design & workmanship.

Any material or accessory which may not have been specifically mentioned but which is necessary or usual for satisfactory & trouble free operation & maintenance of the equipment shall be furnished without any additional charge.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695
	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev 00 Page 4 of 12

The Contractor shall supply all brand new equipment & accessories as specified herein with such modification and alteration as agreed upon in writing & after mutual discussion.

All piping material and material handling equipment installation work shall comply with the provisions of the local rules and guidelines as amended up to date, relevant Codes of Practice and recommendations. In addition, other rules or regulations applicable to the work shall be followed. In case of any discrepancy, the more restrictive rules shall be binding.

Nothing in this specification or in the equipment specification shall be construed to relieve the Contractor of his responsibility.

2.3 Guaranteed Performance

The performance figures quoted in technical specification and data sheets shall be guaranteed within the tolerance permitted by relevant standards. In case of failure of the equipment to meet the guarantee, the equipment may be liable for rejection.

2.4 Deviation

All deviations shall be listed only in the format enclosed elsewhere in the tender. Deviations mentioned elsewhere shall not be taken into account while evaluating the offers. It shall be considered that the Contractor complies fully with the document except for the deviations listed in the above format.

2.5 Drawing Approval

Before starting manufacture of any equipment, the Contractor shall have to take approval of relevant drawings and data from OWNER/CONSULTANT in writing.

Any manufacturing done prior to the approval of drawings/data shall be rectified in accordance with the approved drawings/data by the Contractor at his own cost and the equipment shall be supplied within the stipulated period mentioned in the commercial.

2.6 Drawings & Annexure

All drawings and annexure appended to the specification shall form part of this specification and supplement the requirements specified herein. All the specification shall be read and construed in conjunction with the drawings and annexure to determine the scope of work and terminal points.

The quantities shown on drawings and annexure are tentative for bidding purpose only. Any variation arising during detailed engineering stage shall be taken into account by supplier without any price adjustment.

2.7 Quality Assurance

Contractor shall follow his standard procedures for quality assurance and control. However, said standard procedures shall be submitted to OWNER/CONSULTANT for review and approval.



The procedures shall be in such a form as to clearly delineate the manufacturing sequence and major inspection points, tests and test procedures, acceptable ranges/values, reference drawings etc.

Manufacturing and quality control procedures shall be available for audit to OWNER and/or CONSULTANT at the place of manufacture.

OWNER and/or CONSULTANT reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.

OWNER and/or CONSULTANT may inspect the Contractor's facilities prior to award of contract.

OWNER and/or CONSULTANT may witness any or all of the tests stipulated in the relevant standards and this specification. OWNER and/or CONSULTANT may conduct surveillance of the Contractor's facilities for compliance to his standard procedures of quality assurance and quality control while work on the specified equipment is in progress.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
Rev 00 Page 5 of 12						

2.8 Packing for Shipment

The equipment complete with its accessories, spares, special tools and tackles shall be suitably protected by respective packing for shipment considering handling during transit, distance and weather conditions involved. The Contractor shall submit the packaging method for shipment to be adopted by him, if so desired by OWNER and/or CONSULTANT.

Each consignment shall be marked with Equipment name, OWNER's name & address, Project details, handling instruction etc. It shall be complete with part list and identification details. The copies of the part list of each consignment shall also be furnished to OWNER and/or CONSULTANT.

Equipment shall be packaged for transportation so as to meet the space and weight limitation of transport facilities. The contractor shall obtain approval from concerned authorities for transportation of over dimensioned consignment/ package, if any, before starting manufacture of such equipment.

3. SCOPE OF WORK

3.1 General

The Contract will be a fixed price, turnkey, lump sum Contract and the scope of work shall include, but not be limited to the complete engineering and design, procurement, supply, inspection and testing, packing for transport, shipment, insurance, delivery to site, unloading, storing at site of all equipment, material and accessories related to above Piping and Material Handling System related work along with mandatory spares, 1year O & M Spares as detailed in subsequent sections of this contract and as required for operation, handling, erecting, installing, testing and putting into efficient and trouble-free commercial operation of the equipment and materials within the contract boundary.

Scope of work shall also cover residual civil, structural and architectural works, including design, engineering, associated with the entire Piping and Material Handling System.

Contractor may note that the scope is indicative only of general requirements of the system. The exact quantities (numbers, lengths, weights, etc.) shall be determined by the successful Contractor at the time of detailed engineering, which will be required for smooth and trouble-free operation of the plant.

The Contractor is to note that the information furnished in the specification and drawings regarding the site represent the best available data and are solely for the purpose of information/guidance. OWNER does not assume any responsibility for the correctness of the same. The Contractor, prior to bidding, must visit site and collect all information necessary for correctly estimating the extent of work and the conditions under which the Contract will be carried out. Any variations of OWNER furnished data with the actual data obtained during the execution will not be the cause for any price change.

3.2 Design Work



For the list of various Piping and Material Handling System detail engineering activities which Contractor has to perform during project execution at design office, refer the following document in Volume 2.

Document Matrix for Licensor's/Owner's/CONSULTANT's Review/Approval / information etc.



The Contractor's scope of work shall include complete design, detail engineering, generation of 3D model, preparation of drawings and documents, flexibility analysis, complete in all respects, of all piping in accordance with the final Process Package, required for successful erection, commissioning, operation and maintenance of the plant.

Following is the brief description of major (but not limited to) piping and material handling system detail engineering scope of work for contractor:



- 1) Review of Tender.
- 2) Further updating the documents received in the tender as per the changes in P&IDS, supplier data etc. and further detailing.
- 3) Preparation of drawing index for the list of all drawings/documents to be released with latest revision, date of release etc. It shall also contain the scheduled date of submission and the actual date of submission. This document shall be updated on a regular basis and shall be submitted to OWNER/CONSULTANT from time to time. In the event of delay in submission of documents, variance analysis shall also be carried out with a make-up plan.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	00	Page

- 4) Preparation of list of lines with all design and operating parameters as per process scope of work, utility distribution and data from supplier's P&IDs.
- 5) Preparation of stress critical line list as per the specification on category of stress analysis specified in GES for Flexibility Analysis.
- 6) Piping Specification is attached in the tender. It is Contractor's responsibility to update and release of final piping specification based on existing plant's material specification and piping specification received in the tender. This shall include the special parts developed calculations for pipe wall thickness, branch reinforcement, etc. For generation of new pipe class/component codes the coding logic for the same is attached elsewhere with the tender.
- 7) Contractor shall prepare consolidated Line List for entire plant within battery limit during detail engineering.
- 8) Preparation of piping support specification which shall include support classes, standard assemblies for all the pipe classes listed in piping specification and fabrication drawings with list of material /weight for each function code.
- 9) Special support drawings which details geometry with dimensions, function and bill of material with weights for those supports which are not covered under standard support specification.
- 10) Piping bill of material and material summary at intermediate stages of the project and final material summary at the end of detail engineering as agreed with OWNER/CONSULTANT. This report should also include status of procurement.
- 11) Material requisitions for all special items like expansion bellows, special valves and for general piping items like pipes, fittings, strainers etc. including all Material Handling Equipment. Preparation of technical specification, bid evaluation, technical recommendations for all piping items including all Material Handling Equipments as listed in the TENDER.
- 12) Develop Overall plot plan based on overall plot plan enclosed in the tender and update as per final unit plot plans.
- 13) Final unit plot plans with adequate elevation and sectional views incorporating final data/requirements from vendors of package units, rotary equipment etc. feasibility for erection and maintenance for equipment, statutory requirements, approach roads around the unit, drop out areas, maintenance areas etc. Operator's cabin shall be provided and shown in the unit plot plans.
- 14) Piping plans and sections showing detail piping arrangement, support locations, instruments, cable trays and platform arrangement for access for all process units and pipe rack.
- 15) General arrangement drawing for utility stations and safety shower. This drawing shall indicate location, type and extent of utility stations and locations of safety showers over entire process unit.
- 16) Generation of Layouts showing access ways and escape routes based on the frozen unit plot plans during the various stages of engineering.
- 17) Perform Flexibility analysis/Flange leakage calculations of all stress critical lines, preparation of isometrics with node numbers and location of supports, springs expansion bellows etc. preparation of specification for springs and expansion bellows. Overall review and flexibility analysis of existing steam line up to consumption points due to the change in flow and pressure, if any, for new proposed plant.
- 18) Analogue reports for pulsating lines related to reciprocating rotary machines. Static and dynamic analysis, wind and seismic analysis reports wherever applicable.
- 19) Documents and drawings for local statutory approval like, IBR, PESO, and Factory Inspectorate etc.
- 20) All drawings and documents, before forwarding to OWNER/CONSULTANT will have to be vetted/approved by contractor. Drawings and documents received without vetting will be returned. Review by OWNER/CONSULTANT shall not be construed by the contractor to absolve any of his responsibilities/liabilities for mistakes/deviations from the requirements specified in the specifications and drawings.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	00	Page

- 21) Interface engineering requirements with other Contractors/Package Suppliers/existing plant facilities.
- 22) Piping isometrics for all pipelines including small bore and vessel trims indicating locations of supports, instruments and complete bill of material. System isometrics to be prepared for steam, boiler feed water and condensate network for statutory approval of IBR etc. as applicable.
- 23) Purchase orders for all piping items on approved suppliers by OWNER/CONSULTANT, submission of final approved vendor drawings for items like strainers, expansion bellows, springs, steam traps, valves and other special parts including all Material Handling Equipment.
- 24) Nozzle orientation, locations and orientation of platform clips, ladder clips and pipe support clips for all static equipment like columns, reactors, vessels, tanks etc.
- 25) Design guide for welding examination, post weld heat treatment and non-destructive testing specification as per applicable code, fluid category and material specification.
- 26) Specification for 3D modelling of all design databases for piping, mechanical, civil, and electrical and instrumentation.
- 27) Contractor shall prepare 3D model of the plant within their battery limit..
- 28) Final documentation for erection purpose and As Built documentation with the incorporation of all design changes carried out at site.
- 29) Final and As built 3D model for the plant.
- 30) All underground piping drawings shall be prepared on OWNER/CONSULTANT approved formats using the same area division as of A/G piping and shall be showing sufficient details to clearly indicates all types of underground piping routes, clearances, foundations for pipe rack columns, equipment, technological structures, manholes/catch basins, and all other foundations, all electrical/instrumentation cable trenches if laid below ground, main headers with locations, pipe sizes and invert levels, all types of equipment drain points with locations and invert levels, branch pipe locations and their connections to main headers, all levels of inlet and outlet pipes at each manhole and catch basin, co-ordinates etc.
- 31) Blow up details wherever required for clarity shall be made. All dimensions shall be in millimetres whereas all levels and co- ordinates shall be in meters. Vital installation and Battery limits shall be marked with co- ordinates.
- 32) All information such as locations, number, levels, types, direction of flow etc. for all pipes, manholes, catch basin, cleanouts, valve pits etc. shall be clearly marked on piping Gad's.
- 33) This is brown field project. Contractor has to estimate and determine clash with underground facilities (like, sewage lines, water lines, firefighting lines, any cables) during detail engineering. For this reason, additional cost or schedule extension shall not be entertained during execution.
- 34) Contractor to co-ordinate with OWNER for shut-down and related work permits for the provision of tie-in points. Subsequently the Contractor to do the feasibility study and freeze the routing of lines through existing facilities in the plant up to the required battery limit and submit to OWNER for approval prior to further engineering. It is the scope of the Contractor to carry out all the related engineering, erection, testing, pre-commissioning, commissioning activities related to above in-line with the requirements.
- 35) Contractor shall design, engineer, supply of all material and install the fire protection system as per the GES for Fire Fighting System attached with this tender in Volume-4 Section-4.3 and Fire protection scheme/ specifications of Contractor approved by OWNER/CONSULTANT.
- 36) It will be the 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. Contractor shall bring out such discrepancies very clearly in the offer. OWNER/CONSULTANT shall provide the resolution to such conflicts. Resolution to conflicting requirement during Project execution shall be provided by OWNER/CONSULTANT and same shall be binding on the Contractor.
- 37) 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 contractor shall bring

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	00	Page

out such conflicting requirements clearly prior to execution of work. These conflicting requirements shall be discussed with "OWNER/CONSULTANT" and same shall be resolved by OWNER/CONSULTANT. Any deviation/extra claim on account of such contradictions shall not be accepted.

- 38) The assumptions made by 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.
- 39) Acquiring all necessary information related to the existing piping and material handling system facilities of plant which is required for successful completion of work of the Piping and Material Handling System, remains the responsibility of Contractor.

The above list of activities is not exhaustive and therefore not limited to the above. The Contractor's scope of work includes all such activities as required for successful commissioning of the plant as per the requirements of the P&IDs, line lists, Piping Design Basis and Engineering specifications etc. enclosed in the bid document so as to result in a total trouble free operable and maintainable plant. Residual engineering within the battery limit must be done by contractor without any additional cost and schedule extension.



3.3 Scope of Supply

Contractor's scope of supply includes supply & procurement of all materials and consumables complete in all respects, of all piping, valve, fittings etc. in accordance with the final Process Package, required for successful erection, commissioning, operation and maintenance of the plant including material handling system.

Following is the major list of materials/consumables in the scope:

- 1) Procurement, supply and storage of all piping components including all material handling equipment with material test certificates, local statutory inspection certificates, packing list with all required details of delivery/receipt dates, container number and supplier's details. Contractor should also furnish all formats, procedures for material control system to be adopted at site between inventory stores and erection contractor.
- 2) Supply of piping support material which includes standard support assemblies, structural steel, springs, expansion bellows, struts etc.
- 3) Supply of painting material and execution of painting for all piping items, structural steel and for other miscellaneous items as per applicable painting specification.
- 4) Supply of insulation and lining material and executing insulation for piping, equipment as per line list and equipment specification.
- 5) Supply of first fill of lubricants for all equipment in material handling system, chemicals, cooling tower dosing chemicals etc. and all other similar items required by various suppliers/ sub-suppliers.
- 6) Supply of piping material required for flushing, testing, pre -commissioning and commissioning of the plant e.g. testing mediums, pipe spools with flanged ends, blinds, vent and drain assemblies, blinds, hoses, gaskets and fasteners.
- 7) The contractor shall be responsible for providing all material, equipment and services, which are required for completion of the job meeting the specification requirement ensuring high degree of reliability, availability, operability and maintainability. The equipment and system/sub-system shall conform in all respects to high standards of Engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a reliable and efficient manner.
- 8) Supply of all primary and secondary supports for piping associated with equipment and inside buildings shall be in contractor's scope

The above list of activities is not exhaustive and therefore not limited to the above. The scope of supply of the Contractor includes all such activities like supply of all materials and components as required, for successful commissioning of the plant as per the requirements of the P&IDs, line lists, Piping Design Basis and Engineering specifications etc. enclosed in the tender document so as to result in a total trouble free operable and maintainable plant.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695
	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.
				Rev 00 Page 9 of 12

3.4 Scope of Erection

Furnishing of all labor, skilled & unskilled, supervisory personnel, erection tools & tackles, testing equipment, implements, supplies and transport for timely & efficient execution of the erection work.



Proper storing arrangement and protection of equipment and materials at site at Contractor's expense. The Contractor shall be held responsible for any loss or damage until his work is fully and finally accepted.

All testing equipment as required for testing & commissioning of equipment/system shall be arranged by the Contractor.

Following is the major list of various erection activities which Contractor shall execute to complete piping and material handling system in accordance with the final Process Package to achieve successful commissioning, operation and maintenance of the plant.

- 1) Taking delivery of OWNER supplied equipment and materials from the OWNER's store (if any) and safe transportation up to the place of erection and excess material back to OWNER's store
- 2) Opening of packing cases and inspecting the equipment and materials at site & reporting damages or any discrepancy thereof, if any observed immediately after opening, to OWNER.
- 3) Repair of all minor damages such as removal of paint, loosening of components of the assembly etc.
- 4) Execute piping fabrication including prefabrication, preheating, welding including radiography, site fabrication, Post weld heat treatment, laying and erection including bolt tensioning, bolt torquing, supporting, water/steam flushing, air drying, nitrogen purging, testing, cleaning, painting, insulation, chemical cleaning etc. as per specifications. Vent & drain connections used for hydro test shall be seal welded after test. Passivation of all grades of stainless steel including stabilised grades to be done by the Contractor. Necessary procedure and criteria shall be submitted by the Contractor for OWNER/CONSULTANT approval.
- 5) Fabrication and installation of supports including construction of pipe support RCC pedestals independent of floor pavement.
- 6) Erection of all Material Handling Equipments.
- 7) Incorporation of all punch items, comments issued by OWNER/CONSULTANT during review, technical audits.
- 8) Set up field engineering cell and execute field engineering, which becomes necessary to resolve problems arising during prefabrication, shop fabrication, field fabrication or erection at site & based on sub-supplier data. Necessary field design change drawings shall be prepared by Contractor and submitted for review/information and shall be reflected in the As Built Drawings/Documents/3D model.
- 9) Obtain clearance/approval from local statutory/Government agencies e.g. IBR, OISD, PESO, CCOE etc. Equipment General Arrangement drawings shall be submitted for approval to PESO before commencement of construction.
- 10) Contractor shall familiarize himself and other subcontractors with the site conditions, health and safety rules, approach roads, location of fabrication yard, warehouse, transportation etc. as per the attach document with this tender.
- 11) Pre-commissioning check up to ensure correctness of erection as per actual manufacturer instructions
- 12) Testing & commissioning in presence of OWNER's engineers
- 13) Obtaining Engineer's approval & written acceptance of satisfactory operation
- 14) Handing over of installation for commercial operations
- 15) Preparation and submission of drawings & job compliance report and obtaining drawing approval and charging permission from the inspectorate.

The above list of activities is not exhaustive and therefore not limited to the above. The scope of construction of the Contractor includes all such activities as required for successful commissioning of the

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	00	Page

plant as per the requirements of the P&IDs, line lists, Piping Design Basis and Engineering specifications etc. enclosed in the tender document so as to result in a total trouble free operable and maintainable plant.

4. BATTERY LIMITS & INTERFACES

Contractor shall refer to the document available in Volume 2 Section 5 of this tender document.

This document details the battery limits and scope of work defined for the various material handling equipment, piping, pipe racks, interfaces with existing systems, and interface with other Contractor.

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 Contractor.

5. PERFORMANCE GUARANTEE

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

6. PROCUREMENT ENGINEERING & VENDOR LIST

Procurement engineering consisting of preparation of Material Requisitions (Inquiry specifications), Technical Bid Analysis, Purchase Requisitions / Order specifications, checking and approval of supplier drawings, etc. for all piping material and material handling equipment/ items defined in the tender.

The complete piping material and material handling 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, Contractor shall develop the required specifications and implement the same with the approval of OWNER/CONSULTANT. Contractor shall apply sound engineering and manufacturing practice and shall include all equipment and services.

Contractor shall refer to Vendor List available in Volume 2 Section 3 of this tender.

Requirement of Vendor Documentation is defined in the technical specification of individual equipment.

7. FACTORY ACCEPTANCE TEST (FAT) REQUIREMENTS

Contractor shall refer to the Inspection test plans available in Volume 3 Section 1 of this tender.



In general routine tests, type tests, acceptance tests and special tests shall be performed on all piping material and material handling equipment as per the relevant applicable codes and standards.

8. PROJECT CO-ORDINATION

Contractor shall be responsible for carrying out all project implementation related activities systematically for successful implementation of the project as per stipulated time schedule.

Contractor shall be responsible for co-ordination with OWNER, CONSULTANT, and with various external agencies like statutory authorities, suppliers of all equipment / items, package suppliers, third party inspection agencies, other Contractor, sub-contractors for this project as well as co-ordination among Contractors own departments / offices involved in implementation of this project for smooth & trouble-free completion.

Detail requirements of project co-ordination are defined in Volume 2 Section 1 of this tender.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			नालको  NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev 00	Page 11	of 12

9. CO-ORDINATION WITH STATUTORY BODIES AND OUTSIDE AGENCIES

The contractor shall be fully responsible for carrying out all co-ordination and liaison works with Inspectors, Factory Inspector, and other statutory bodies for implementation of the work.

Applications on behalf of the OWNER, for submission to the Inspector and other statutory bodies along with necessary drawings complete in all respects shall be prepared by the Contractor. Approved drawings and certificates shall be submitted to the OWNER/CONSULTANT well ahead of schedule so that the actual commissioning of equipment does not get delayed for want of inspection and approval by the Inspector and other statutory bodies.

The actual inspection work by the Inspector shall be arranged by the Contractor and necessary coordination and liaison work in this regard shall be the responsibility of the Contractor. However, any fee paid to inspector/statutory bodies etc. in this regard shall be reimbursed by OWNER on production of documentary evidence. In case any penalty is levied for delay in submission or otherwise, the same shall be in Contractor's account.

10. CONSTRUCTION & CONSTRUCTION MANAGEMENT

Contractor shall be responsible for the complete construction activities for all the piping and material handling related equipment / items supplied for this project.

Contractor shall be responsible for site stores management, material management system, security, etc. for smooth construction activities

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 in Volume 3 Section 3 of this tender.

11. PRE-COMMISSIONING, TESTING & COMMISSIONING

Contractor shall be responsible for carrying out the pre-commissioning checks, testing and commissioning of the piping and material handling related equipment installed within the battery limits and also as per the scope of work involved in the various interfaces as detailed in the document Battery Limits & Interfaces.

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

All co-ordination for commissioning of sub-systems (in scope of other Contractor) required for the overall system commissioning shall be done by Contractor.

12. SPARES

Contractor shall supply following types of spares –



- Mandatory spares (List with price)
- Commissioning spares
- List of One year operation & maintenance spares

Contractor shall refer to the document "Spare Philosophy" available in Volume 2 Section 3 of this tender.

For the equipment's which are not covered in the document of Spare Philosophy, 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 Original Equipment Manufacturer (OEM) for each piping material and material handling equipment.

13. TOOLS & TACKLES

Contractor shall supply all tools & tackles and miscellaneous accessories for maintenance and operation of all piping material, valves, gaskets etc. and material handling equipment for satisfactory completion of the project.

Plant 1.0 MTPA ALUMINA REFINERY STREAM-5	Client NALCO	Contract Code NAL	Document ID 6695-PIP-552-CA-0007	Contract No. 66-6695		
 thyssenkrupp	SCOPE OF WORK FOR CONTRACTOR (PIPING & MATERIAL HANDLING)			 नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		
				Rev	00	Page

14. 'AS-BUILT', FINAL & OTHER DOCUMENTATION

After completion of work, and prior to start-up / energisation of equipment / systems, 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 Piping and Material Handling System related works and submit the same to OWNER/CONSULTANT.

One set of up-to-date "As-built" drawings/documents shall be suitably stored in project office for all equipment installed therein.

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

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

The mode of submission of these drawings / documents, their required format(s) and number of sets shall be as defined in the Tender Document.

Contractor shall submit System study -3D model - native copy with library & associated soft files as native copy as a part of final documentation.

15. SPECIFIC INSTRUCTIONS

Contractor shall specifically take note of the following -

Several of the technical documents included in the tender were also used for this Project. There may be references to various Contractors / CONSULTANT in these documents. The Contractor is requested to read the same as Contractor in context of the current project. In case, the matter is still not clear to the supplier, supplier shall seek clarification for the same from OWNER/CONSULTANT.

In various technical specifications in the technical documents, there is a mention of "as specified in the requisition" or "if specified in the requisition", etc. it shall be noted that the responsibility of preparing the material requisition shall be in Contractor scope and all the relevant data / requirements shall be specified by Contractor while preparing the requisitions.

While preparing the technical specifications for Material requisition, Contractor shall suitably revise / update the specifications available in the technical documents to adapt the same for the current project.

16. TRAINING

Contractor shall provide training for OWNER's engineers in two different batches separately for each equipment type for a period of at least one week at manufacturer's works / site as applicable.

Contractor shall submit separate price for above in the price format mentioned elsewhere in the tender.