





Plant <b>1.0 MTPA ALUMINA REFINERY STREAM-5</b>	Client <b>NALCO</b>	Contract Code <b>NAL</b>	Document ID <b>6695-ELT-G00-EC-0031</b>	Contract No. <b>66-6695</b>	
	<b>TECHNICAL SPECIFICATIONS – HIGH MAST FOR LIGHTING</b>			 <b>नेशनल एल्युमिनियम कम्पनी लिमिटेड</b> <b>National Aluminium Company Ltd.</b>	
				Rev	<b>0</b>

<b>TKIS - India / Vendor</b>		<b>TKIS - India / Owner / Client</b>	
<b>Category Codes</b> (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	<b>Category Codes</b> (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 checked="" 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
<b>Acceptance Codes</b> (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	<b>Acceptance Codes</b> (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
<b>Remarks for AC2 :</b> 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.			
<b>This approval / review does not absolve the supplier from the full responsibility for design and fabrication.</b>			
Date : ____/____/____ Name : _____		Date : ____/____/____ Name : _____	

00		Issued For Engineering	28.10.17	PDW	28.10.17	MSD	28.10.17	MSD	-
Rev.	Status	Description	Date	Prepared	Date	Checked	Date	Approved	AC
© Copyright 2016 : All rights reserved ThyssenKrupp Industrial Solutions (India) Private Limited			<b>Barcode</b>						Category Code: -04



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### INDEX SHEET

The document Cover Sheet indicates revisions made in this document along with the purpose of issue of the revised document. The details of revisions made in the enclosures of this document are listed in the table of *Contents* below and the enclosures listed therein are an integral part of this document.

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	A4	Index Sheet And Status Of Revision	2	0	-
Part-I	A4	General Specifications	7	0	
Part-IIA	A4	Design Data Sheet (Requirements)	1	0	
Part-IIB	A4	Design Data Sheet (Vendor Data)	2	0	
Part-III	A4	Inspection and Test Plan	2	0	

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## 1.0 INTRODUCTION

This specification covers the general requirements for design, manufacture, assembly, inspection and testing at the vendor's works of High Mast for Lighting.

Design, manufacturing, testing and performance of High Mast for Lighting shall comply with all currently applicable Indian & IEC Standards and specific Standards & Codes specified under clause 'Codes' of Part-IIA of this specification.

Standard and descriptive requirements are covered in Part-I while specific requirement is covered in Part-IIA and data required from vendor is specified in Part-IIB. Testing requirements for factory testing are covered in Part-III.

## 2.0 CODES & STANDARDS

The design, manufacture and performance of lighting high mast shall comply with all current statutes, regulations and safety codes in the locality where the equipment will be installed.

Unless otherwise specified, the lighting mast shall conform to the relevant Indian, IEC or British Standards. In case of imported equipment standards of country of origin shall be applicable only if these standards are equivalent or stringent than applicable IS /IEC standards. The relevant Codes/Standards are specified under clause 'Codes' of Part-IIA of this specification.

The international or foreign national standards shall be applicable, if equivalent applicable Indian standards are not available.



The equipment and the installation shall also conform to the provisions of CEA rules and other statutory regulations (including local if any) currently in force in the country & state in which site is located.

In case Indian standards are not available for any equipment, standards issued by IEC/BS/ VDE/ IEEE /NEMA or equivalent agency shall be applicable.

## 3.0 TECHNICAL REQUIREMENTS




### 3.1 General technical requirements

- 3.1.1 The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
- 3.1.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply.
- 3.1.3 Vendor shall give a notice for at least one year to the end user of equipment before phasing out the product/spares to enable the end user for placement of order for spares and services.
- 3.1.4 The high mast lighting system shall have a minimum design life of 25 years unless otherwise specified.

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### 3.2 Mast

- 3.2.1 The high mast shall be basically telescopic tubular pole of galvanized steel with motorized racking mechanism for lowering the lamp carriage. Mast shall be of continuously tapered, polygonal cross section construction. Minimum height of mast shall be 30 meters unless otherwise specified. The mast shall be fabricated from galvanized steel plates in suitable number of sections, telescopically joined giving a continuous tapered profile and presenting good visual appearance. The base flange shall be provided with gaskets and high tensile anchor bolts. The bottom section shall have adequate sized opening with a hinged door to accommodate electric drive for winch, cable, plug socket, etc. The opening shall be such as to permit clear access to the above components inside the mast. The opening shall be complete with a close fitting, dust and vermin proof door, weather protected with gaskets of durable material and provided with a heavy-duty double locking arrangement. Door size shall be minimum 1200 x 250 mm.
- 3.2.2 The means for natural ventilation of the mast shall be provided.
- 3.2.3 For the environmental protection of the mast, the entire fabricated mast shall be hot dipped galvanized internally and externally in single dip having a uniform average thickness of minimum 85 microns.
- 3.2.4 The whole head frame assembly shall be covered and protected by an CRCA sheet steel / SS304 canopy secured to the frame by stainless steel bolts and nuts. The canopy shall have suitable prevention arrangement against entry of birds etc.
- 3.2.5 The mast shall have integral power tool for winch drive unless otherwise specified in the data sheet.
- 3.2.6 The mast shall have two suitably sized (12 mm minimum) earthing terminals at convenient location in the base compartment and these shall be suitable for connection with 75 x 10mm GI strip to the plant- earthing network unless otherwise specified.
- 3.2.7 Lightning rod at the top of the mast for the lightning protection of the lighting mast system as per standard: IS/IEC-62305 shall be provided.
- 3.2.8 The mast structure shall be suitable to sustain an assumed maximum reaction arising from a wind speed as per IS 875 (three second gust), and shall be measured at a height of 10 metres above ground level. The force co-efficient taken for design of the polygonal structure is to be established from the wind tunnel test data.  
Refer Annexure-I for site data.
- 3.2.9 Hot dip galvanized Luminaries carriage designed to install luminaries as specified in data sheet or as per illumination design, its control gear boxes and junction box. The same is to be fabricated from ERW or steel tubes in two halves and flanges joined at site with stainless steel bolts and nuts. Holes are to be provided in the bottom side of tubes to act as conduit for wiring cable. HDPE or PVC lining is to be provided in the inner side of carriage to avoid metal contact with mast surface.
- 3.2.10 CRCA sheet steel / SS304 weather proof junction box (IP65 minimum) wherever suitable shall be provided on the carriage Assembly for terminating the trailing cable and power cable to luminaries. These junction boxes shall be suitable for specified hazardous area if specified in the data sheet and shall have CCoE approval.
- 3.2.11 The complete design of the mast and associated foundation shall be such that mast is structurally and mechanically safe.

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- 3.2.12 The light fittings provided on the light mast shall have individual switch controls in the feeder pillar box to have the flexibility to put the selected light fittings ON / OFF. Three phase supply to be equally distributed to the 10 light fittings alternatively (eg: light Fittings 1,4,7,10 to R-phase; 2,5,8 to Y-Phase; 3,6,9 to B-Phase ) to ensure equal light coverage in all directions even if one phase supply is available.

### **3.3 Lantern Carriage**

- 3.3.1 The Lantern carriage shall be of steel tubular ring type construction designed to accommodate the specified number of lighting fixtures and balance counter weights shall be provided wherever required. The carriage shall be fabricated in two halves jointed by bolted flanges to enable easy removal from the erected mast for replacement and maintenance purpose.
- 3.3.2 The complete lantern carriage assembly shall be hot dip galvanized after fabrication. It shall have perfect self-balance arrangement so as to avoid swing and to prevent damage to mast surface or other installed parts, during lowering/raising operation of carriage.
- 3.3.3 All hardware used shall have necessary corrosion protection. The carriage shall have CRCA sheet steel / SS304 junction box which shall be min. IP65, weather protected and suitable for hazardous area wherever applicable. It shall have required number of terminals (phase, neutral and earth) for connection to the designed number of flood light fittings and associated control gears fixed on the carriage.
- 3.3.4 Unless otherwise specified, Lantern carriage shall be suitable for accommodating a minimum of 10 numbers of flood light fixtures. The number, wattage and type of lighting fixture of the high mast shall be as provided as specified in job specification/data sheet.
- 3.3.5 The safe area flood light fixtures shall have CRCA sheet steel / SS304 body with frame, heat resistant clear toughened glass fixed to the frame with silicon gasket with electromechanically brightened, polished and stainless steel reflector with CRCA sheet steel / SS304 control gear-box copper ballast and LED lamps. The fixtures shall have a facility for lamp centering and focusing and shall be provided with angle indicator for aiming.
- 3.3.6 The flood light fixtures shall be suitable for hazardous area if specified in the data sheet and these shall have CCoE approval for use in hazardous area. These fixtures shall also have a facility for lamp centering and focusing and shall be provided with angle indicator for aiming.
- 3.3.7 Each high mast shall have minimum one number aviation obstruction lighting fixtures with neon lamps unless otherwise specified in data sheet.
- 3.3.8 Provision shall also be available to test the luminaries while lantern carriage is in lower position by connecting the plug to the receptacle.

### **3.4 Winch Assembly**

- 3.4.1 For lowering and raising of lantern carriage assembly, a winch arrangement shall be fixed in the bottom of the mast. This shall have provision to operate both manually and electrically. The capacity, operating speed, safe working load, lubrication oil details and serial no. of the winch shall be marked on the winch.
- 3.4.2 The winch shall be suitable to handle the weight of the lantern carriage assembly with lighting fixtures and all other accessories, with factor of safety not less than two unless otherwise specified.

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- 3.4.3 Minimum two number of winch drum shall be provided for the winch assembly. The winch shall be of self-sustaining type with positive locking arrangement without the need for brake shoe, springs, or clutches. The drums are to be grooved to provide perfect seat for stable and tidy rope lay and arrangement for distortion free rope end termination.
- 3.4.4 The winch shall be self-lubricating type by means of an oil bath.
- 3.4.5 The mast shall be fitted with flexible stranded high tensile strength stainless steel wire ropes, which shall have a factor of safety not less than five times the safe working load of winch. Particular care shall be exercised in all aspects of design, manufacture, testing and installation arrangements of the system to ensure safety under all operation conditions.
- 3.4.6 The material of construction for top pulley block shall be non-corrosive and preferably made up of CRCA sheet steel / SS304, with self-lubricating bearing. The design shall ensure that the operation of pulleys is maintenance-free.

### **3.5 Power Tool for Winch Drive**

Motor shall be single phase for below .18kW and three phase,415V for .18 kW and above, IP55 and suitable for specified hazardous area wherever applicable. The rating and capacity of the electric motor used in power tool shall be compatible to lift the design load of lantern carriage with design margin of minimum 20%. Mechanical torque limiter is to be mounted on motor shaft to stop transmission of motion from motor to winch in case of excess load and thus prevent the damage to winch and breakage of rope. Manual handle shall also be provided for hand operation of winches. Power tool shall have self-alignment arrangement.

### **3.6 Feeder Pillar Box**

- 3.6.1 Each high mast shall be supplied with one power supply feeder pillar distribution box, which shall be located near it. The feeder pillar-box shall be metal enclosed, freestanding type made out of minimum 2mm thick mild sheet steel, epoxy painted and IP-55 weather protected. Additional canopy for rain protection shall also be provided as an integral part of feeder pillar distribution box.
- 3.6.2 The feeder box shall be complete with incomer Switch fuse/MCB, ELCB, motor starters for winch drive, MCB for lighting control and a 3 pin 5/15A socket along with 15A MCB. MCB and ELCB shall be separate unit. Incoming terminals shall be suitable for required size of cable, Outgoing power terminals and motor terminals shall also be suitable for receiving suitable size of cable.
- 3.6.3 Motor starter shall be complete with switch fuse, contactor, and bimetal relay with single phasing prevention feature.
- 3.6.4 LEDs for indication of incoming power supply healthy for feeder pillar incomer shall be provided.
- 3.6.5 Adequately rated space heater with MCB, thermostat shall be provided for the feeder pillars.
- 3.6.6 Feeder pillar shall have adequate space to receive incoming and outgoing cable terminations for 415V, TPN supply loops in and loop out arrangement .The feeder pillar-box shall be complete with double compression nickel-plated brass cable glands and tinned copper glands.
- 3.6.7 The feeder pillar shall have two numbers external earthing terminals.

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- 3.6.8 The feeder pillar-box shall have required wiring interface for taking signals from hand held external control push button station for raising and lowering of lantern carriage. The feeder pillar-box shall be installed on a raised concrete foundation block and foundation shall be up to the level of minimum 300mm above ground level.

### **3.7 Local Control Station**

- 3.7.1 Local control station shall be hand held type. This control station shall have necessary raise/lower pushbuttons, emergency stop push button etc.
- 3.7.2 The hand held control Pushbutton station shall be supplied with minimum of 6 meters length of 5Cx2.5 sq mm flexible cable and cable type shall be with copper conductor, XLPE insulation, metal braiding and overall FRLS PVC sheath. The hand held control station and associated cable shall be kept inside feeder pillar-box when not in use and suitable arrangement shall be provided for the same.



### **3.8 Cable and Cable Connections and Foundations**

- 3.8.1 All power and control cables including flexible trailing cables shall be supplied, laid and terminated by the high mast vendor.
- 3.8.2 The electrical connections from base compartment to the junction box on the lantern carriage shall be made through special multicore trailing cable of minimum size 4 sq.mm copper conductor, EPR insulated metal braided and sheathed in heavy duty Polychloroprene or equivalent/superior material.
- 3.8.3 Minimum 5 cores shall be provided unless otherwise specified. Separate cores shall be used for lighting fixtures; aviation fixtures and one dedicated core shall be kept for earthing. Suitable chemicals shall be added to outer sheath of cable to protect cable against birds, rodent and termite attack.
- 3.8.4 All power and control cables shall be 1100V grade, XLPE insulated, FRLS type and shall conform to IS-7098 and all flexible-trailing cables shall also comply with requirement of IS-9968.
- 3.8.5 The trailing cable shall be terminated by means of metal cased plug and socket which shall be provided at the base compartment to enable easy disconnection.
- 3.8.6 The cable for connection to flood lighting fixtures /aviation lighting fixtures from junction box provided on lantern carriage shall be through 3C x 2.5 sq.mm copper conductor, XLPE insulated, armoured and overall FRLS PVC sheathed cable. The trailing cable at the lantern carriage shall be taken in flexible metal conduit.
- 3.8.7 Connection to the power tool motor inside mast at the bottom shall be through metal cased plug and socket arrangement to enable easy disconnection.
- 3.8.8 All cabling from feeder pillars to high mast shall be laid in directly buried trenches with minimum 900 mm depth.
- 3.8.9 Static and Dynamic loading of the high mast shall be provided by the vendor for designing foundation

### **4.0 INSPECTION, TESTING AND ACCEPTANCE AT WORKS**

- 4.1 During fabrication, the High mast lighting system equipment and materials shall be subject to inspection by Owner / Consultant / LSTK Contractor, or by an agency authorized



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by the Owner, to assess the progress of work, as well as to ascertain that only proven raw material is used. The manufacturer shall furnish all necessary information /data concerning the supply to Owner / Consultant / LSTK Contractor inspectors. The vendor shall give at least 15 days notice to the Owner / Consultant / LSTK Contractor regarding the date of testing to enable him or his representative to witness the tests.

4.2 Tests shall be carried out at the manufacturer's works under his care and expense. All routine tests as specified by the applicable standard codes shall be conducted. Type test certificates for the high mast lighting system equipments used shall be furnished from a recognized testing organization.

4.3 Refer Part-III for tests to be carried out on High Mast, motor, cables and panels.

## **5.0 PACKING AND DESPATCH**

5.1 The equipment shall be divided in to several shipping sections for protection and ease of handling during transportation. The equipment shall be properly packed for transportation by ship/rail or trailer. The equipment shall be wrapped in polyethylene sheets before being placed in wooden crates/cases to prevent damage to the finish. Crates/cases shall have skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Weight', 'Owner's particulars', 'PO nos.' etc., shall be clearly marked on the package together with other details as per LSTK Contractor order.

5.2 The equipment may be stored outdoors for long periods before installation. The packing should also be suitable for outdoor storage areas with heavy rains/ high ambient temperature unless otherwise agreed.

## **6.0 FIELD TESTING AND COMMISSIONING**

6.1 Installation, testing and commissioning shall be carried out by vendor's experienced and trained engineer/supervisor. Any defect pointed out by Owner shall be rectified by vendor at no extra cost to the Owner.

6.2 Before any part of the High mast system is energised, the pre-commissioning tests shall be carried out. This shall include and be not limited to the following:

6.2.1 Insulation resistance tests

6.2.2 Continuity test

6.2.3 Earth continuity check and measurement

6.2.4 Load current in all phases shall be measured in each mast



6.2.5 All safety interlock

6.2.6 Feeder pillar wiring schematics and functional requirements

All pre-commissioning checks and tests both for power distributions and lighting system shall be carried out by vendor in the presence of Engineer-in-charge of Owner/LSTK Contractor.

6.3 After completion of job, vendor shall carry out the measurement of achieved illumination level in different areas and shall furnish test reports. The focusing angle of fixture shall be changed/adjusted where required.



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- 6.4 After inspection and pre-commissioning tests are carried out, vendor shall obtain necessary statutory approval of the system from Electrical Inspector or any other statutory body as specified in the specification. All test results shall be recorded and submitted to Owner in volume as part of system final documentation indicated elsewhere in the tender.

## 7.0 DRAWINGS AND DATA

### 7.1 Data/drawings with the bid

- KW rating, make, frame size, full load speed, full load current, efficiency, power factor, mounting, enclosure type, & specific type of construction (Ex "d", Ex "e" etc) of winch motor. Also Starting torque, starting time, starting torque, thermal withstand time of motor both at 80% and 100% rated voltages for the winch motor.
- GA drawing of the high mast , winch assembly, lantern carriage.
- Single line diagram of power distribution for lighting circuit from input power supply upto lighting fixtures showing ratings & make of motor, panel, MCCB, ELCB, etc. Single line diagram of feeder pillar box.

### 7.2 Data/drawings after the order

- Completed high mast data sheets.
- G.A drawing of Mast & construction/erection/mounting details.
- Details of all lighting fixtures and auxiliaries
- Performance characteristics viz. speed v/s current & speed v/s torque & Thermal withstand curves under hot and cold conditions for winch motor.
- Wiring & schematic diagrams of excitation control & protection panel.
- Lantern carriage G.A drawings & construction details.
- Winch assembly G.A drawings & mounting details.
- G.A drawing & Bill of material of feeder pillar box.
- Aviation lighting details.



## 8.0 GUARANTEE

The technical particulars for High Mast furnished in Part-II shall be guaranteed particulars. The Owner/LSTK Contractor reserves the right to reject the High Mast in the event of failure of High Mast to meet Guaranteed Technical Particulars.


If any of the High Mast supplied by the vendor fails at site due to manufacturing defects during erection, commissioning or service (within guarantee period) the vendor shall replace the failed material within the time frame agreed with the Owner/LSTK Contractor and at no extra cost to the Owner. The Owner/LSTK Contractor also reserves the right to use rejected material till it is replaced.



The period of guarantee of the equipment shall be as indicated elsewhere in the tender.

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GENERAL	001		Rated input voltage	: 415 V ± 10			
	002		Supply frequency	: 50 Hz ± 5			
	003		Combined vibration & frequency variation	: 10% (absolute)			
	004		System earthing	: Solid			
	005		Quantity	: *			
CODES & STANDARDS	006		IS 325 : Three-phase induction motors				
	007		IS 7098 (Pt-1) : Specification for cross linked polyethelene insulated PVC sheathed cables				
	008		IS/IEC 62305 : Protection against lightning				
	009		IS 2629 : Code of practice for galvanising				
	010		IS 3043 : Code of practice of earthing				
	011		IS 3618 : Phosphate treatment of iron and steel for protection against corrosion				
	012		IS 4691 : Degree of protection provided by enclosure of rotating machines				
	013		IS 4759 : Code of practice for hot dip galvanising				
	014		IS 9968 : Elastomer insulated cables (Part-1) for working voltage upto and including 1100 Volts				
	015		IS 13947 : Low voltage switchgear and control gear - General rules.				
	016		TR.No.-7 High Masts for Lighting and CCTV (2000edition) of ILE, U.K.				
	017		SABS 0225-1991 : High Mast natural Frequency calculation				
	018		IS 875, Part 3 : Wind Loading				
	019		BS EN 10025-1993 : High Tensile Steel Sheets				
	020		IS 2062 : Mild Steel				
	021		BS EN ISO 1461 : Galvanization				
	022		IS 9968 Par - 1 : Trailing Cable				
	023		IS 5135 : Welding				
	024		IS 16101/IEC 62504 : General Lighting - LEDs and LED Modules - Terms and definitions				
	025		IES LM-79 : Electrical and photometric measurements of solid state lighting products				
	026		IES LM-80 : Approved method for measuring lumen depreciation of LED light sources				
	027		IS 3459 /2266 : Stainless Steel Wire Rope				
	GENERAL REQUIREMENTS	028		Height of the mast	: 30 m		
029			No. of sections	: Two			
030			Method of operation of winch	: Both Manual & Electrical			
031			Type of Fixture	: LED			
032			Fixture wattage	: 1 x 200W			
033			No. of Fixture on each mast	: *			
034			No. of layer for fixture arrangement	: 1 no.			
035			No. of aviation fixture on each mast	: 1 no.			
036			Type and rating of aviation fixture	: Neon Spiral, 40W (minimum)			
037			Feeder pillar loop in loop out facility	: Yes			
038			Area Classification	: i) Safe area			
039			Type of Hazardous Area	: Not applicable			
040			Lightning protection down conductor	: Yes			
041			Shape of mast	: Telescopic tubular, Continuously tapered			
042				polygonal cross section			
043			Material of construction	: Steel plates (As per BS-EN10025)			
044			Base diameter and top diameter	: Top-150mm (minimum), Bottom-460mm (minimum)			
045			Cross section of the Mast in polygon(no.of sides)	: 20 Sides(Minimum)			
046			Galvanization	: As per BS EN ISO 1461			
047			Thickness of the Galvanization	: 85 Microns (Minimum)			
048			Size of the Door opening	: 1200 x 250 mm (Minimum)			
049			Lightning Protection Finial	: G.I single spike of length 1200mm			
050			Material of construction	: Steel plates (As per BS-EN10025)			

 		<b>HIGH MAST FOR LIGHTING</b> <b>PART - IIB</b> <b>DESIGN DATA SHEET (VENDOR DATA)</b>		Code		NAL	
				Contract no.		66-6695	
				Doc.		6695-ELT-000-EC-0031	
				Rev.		00	Page 1 OF 2
<b>HIGH MAST STRUCTURE</b>	001	Height of mast	: 30 m				
		i) Type	: *				
		ii) Make	: As per Vendor List- Electrical				
	002	Material of construction	: *				
	003	Cross section of mast	: Polygonal				
	004	Length of individual section	Top:	Middle:	Bottom:	*	
	005	Thickness of individual section	Top:	Middle:	Bottom:	*	
	006	Base and top diameter	: *				
	007	Type of joints	: *				
	008	Length of overlap joint	: *				
	009	Type of metal protection treatment	: Hot dip Galvanized				
	010	Thickness of galvanization	: *				
	011	Size of door opening	: *				
	012	Thickness of base plate	: mm *				
	013	Size of anchor plate and thickness	: *				
	014	Weight of mast including	: Kgs *				
		base plate. door, head frame,etc	: *				
	015	Lightning protection provided	: Yes				
<b>LATERN CARRIAGE</b>	016	Material of construction	: *				
	017	Diameter of carriage ring / pipe(mm)	: *				
	018	Buffer arrangement between carriage and musts.	: *				
	019	Load carrying capacity	: *				
	020	Total weight of assembly with fittings	: *				
<b>WINCH</b>	021	Make of winch	: *				
	022	Number of drums per winch	: *				
	023	Gear ratio/materials	: *				
	024	Capacity	: *				
	025	Operating speed	: *				
	026	Time to raise/lower	: *				
	027	Method of operation	: *				
	028	Type of lubrication arrangement	: *				
	029	Type of lubricants	: *				
	030	Tested load per drum (Kg.)	: *				
	031	Factor of safety	: *				
	032	Positive locking	: *				
<b>STAINLESS STEEL WIRE ROPE</b>	033	Make	: *				
	034	Grade	: *				
	035	Number of ropes	: 2 continuous (minimum) *				
	036	Material and Construction	: *				
	037	Diameter(mm)	: 6 mm (Minimum) *				
	038	Breaking load capacity	: *				
	039	Factor of safety	: *				

[illegible]

 नालको NALCO नेशनल एल्युमिनियम कंपनी लिमिटेड National Aluminium Company Ltd.		<b>HIGH MAST FOR LIGHTING</b>  <b>PART - III</b> <b>INSPECTION TEST PLAN</b>			Code		NAL	
					Contract no.		66-6695	
					Doc.		6695-ELT-000-EC-0031	
					Rev.		0	Page 1 OF 2
	Sr. No.	Tests	Reference documents	Sample Size	Scope of Inspection			
					Vendor	Owner / Consultant / LSTK Contractor	Remark	
	<b>A)</b>	<b>Type Tests</b>						
	<b>a)</b>	<b>Tests for High Mast</b>						
	i.	Galvanization Check	BSEN ISO1461		P	R		
	ii.	Type Tests applicable for the Steel Wire Rope	IS 3459:2004		P	R		
	iii.	Type Tests applicable for the Steel Tubes	IS 1161:1998		P	R		
	<b>b)</b>	<b>Tests for LV Cable</b>						
	i.	Tests for cable conductor	IS 1554, IS 7098, IS 10810		P	R		
	ii.	Tests for Armouring	IS 3975, IS 1554, IS 7098, IS 10810		P	R		
	iii.	Test for PVC Insulation and Sheath	IS 3975, IS 1554, IS 7098, IS 10810		P	R		
	iv.	Test for XLPE Insulation	IS 7098, IEC 60502		P	R		
	<b>c)</b>	<b>Tests for LV Motor</b>						
	i.	Full load test to determine efficiency, power factor & slip	IS 12615, IS 325, IS 4029, IEC-60034-2, IS 15999		P	R		
	ii.	Temperature rise test	IS 12615, IS 325, IS 4029, IEC-60034-2, IS 16000		P	R		
	iii.	Momentary overload test	IS 12615, IS 325, IS 4029, IEC-60034-2, IS 16001		P	R		
	iv.	Overspeed test (120% of rated speed for 2 min.)	IS 12615, IS 325, IS 4029, IEC-60034-2, IS 16002		P	R		
	<b>d)</b>	<b>Tests for LV Panel</b>						
	i.	Temperature Rise Test	IS 8623, IS/IEC 60947		P <sub>PROTO</sub>	R		
	ii.	Short Circuit withstand capacity	IS 8623, IEC 61439		P <sub>PROTO</sub>	R		
	<b>e)</b>	<b>Tests for LED Luminaires</b>						
		Ingress Protection	IS-10322-4		P <sub>PROTO</sub>	W		
		Test for Temperature rise	IS-2206		P <sub>PROTO</sub>	W		
		Luminaire Power	IS-16107		P <sub>PROTO</sub>	W		
		Moisture resistance	IS-15885-2-13		P <sub>PROTO</sub>	W		
		Creepage distances and clearances	IS-15885-2-13		P <sub>PROTO</sub>	W		
		Marking	IS-16107		P <sub>PROTO</sub>	W		
		Luminous Flux	IS-16107		P <sub>PROTO</sub>	W		
		Lighting Intensity	IS-16107		P <sub>PROTO</sub>	W		
		Angular beam distribution	IS-16107		P <sub>PROTO</sub>	W		
		Luminaire intensity distribution	IS-16107		P <sub>PROTO</sub>	W		
		Luminaire efficiency	IS-16107		P <sub>PROTO</sub>	W		
		Chromocity coordinates and correlated colour temperature (CCT)	IS-16107		P <sub>PROTO</sub>	W		
		Colour rendering index (CRI)	IS-16107		P <sub>PROTO</sub>	W		
		Life	IS-16107		P <sub>PROTO</sub>	W		
		Lumen maintenance	IS-16107		P <sub>PROTO</sub>	W		
		Endurance test	IS-16107		P <sub>PROTO</sub>	W		
		<b>Notes:</b>						
		1) W = Witness, R = Review, P = Perform (on project equipment), P <sub>PROTO</sub> = Perform (on prototype).						

 नालको NALCO नेशनल एल्युमिनियम कम्पनी लिमिटेड National Aluminium Company Ltd.		<b>HIGH MAST LIGHTING</b>			Code		NAL	
					Contract no.		66-6695	
					Doc.		6695-ELT-000-EC-0031	
					Rev.		0	Page
 thyssenkrupp		<b>PART - III</b> <b>INSPECTION TEST PLAN</b>			Scope of Inspection			
Sr. No.	Tests				Reference documents	Sample Size	Vendor	Owner / Consultant / LSTK
<b>B)</b>	<b>Routine Tests</b>							
<b>a)</b>	<b>Tests for High Mast</b>							
i.	Mechanical operation of the lantern carriage	Approved Vendor Drawings/Relevant Standards	100%	P	W			
ii.	Load carrying capacity test			P	W			
iii.	Operation of winch for over speeding/time to raise and lower			P	W			
iv.	Visual check of positive locking arrangement of winch system			P	W			
v.	Visual and breaking test of the steel wire rope			P	W			
vi.	Test of remote control function and manual operation			P	W			
vii.	Test on the power tool as per relevant standards			P	W			
viii.	Component / Auxiliary Component Failure			P	W			
ix.	Test of all protection, alarm and trip functions			P	W			
x.	Check degree of protection of cubicles			P	W			
xi.	Check simulation facility control signals for testing purposes			P	W			
xii.	Check space available for cable termination size and number of terminals, cable supporting devices			P	W			
xiii.	Check accessibility of components			P	W			
xiv.	Check earthing of cubicles and cubicle doors			P	W			
xv.	Check the quality of galvanization of mast structure.			P	W			
xvi.	In addition to above, all functional and electrical tests shall also be conducted on feeder pillars/control cubicles.			P	W			
<b>b)</b>	<b>Tests for LV Panel (feeder pillars/control cubicles).</b>							
i.	Visual and dimensional check	Approved GA drawings	100%	P	W			
ii.	Bill of material and make of components	Approved GA drawings		P	W			
iii.	Operation checks for all control functions and safety interlocks	Approved Vendor Drawings		P	W			
iv.	Operation of components	Approved Vendor Drawings		P	W			
<b>c)</b>	<b>Tests for LED Luminaires</b>							
	Visual inspection and dimensional check-up	Approved GA drawings	One sample of each type/rating	P	W			
	Marking	IS-16107		P	W			
	Luminaire Power	IS-16107		P	W			
	Luminous flux	IS-16107		P	W			
	Lighting intensity	IS-16107		P	W			
	Angular beam distribution	IS-16107		P	W			
	Luminaire efficacy	IS-16107		P	W			
	Chromocity coordinates and correlated colour temperature (CCT)	IS-16107		P	W			
	Colour rendering index (CRI)	IS-16107		P	W			
	Luminaire intensity distribution	IS-16107		P	W			
<b>Notes:</b>								
1) W = Witness, R = Review, P = Perform (on project equipment), P <sub>PROTO</sub> = Perform (on prototype).								