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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Procurement Manager
3	Design & Construction Manager
Electronic copy (pdf) on Kenya Power server (currently: Network→stima-fprnt-001→techstd&specs)	

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)

FOREWORD

This specification has been prepared by the Research and Development Department in collaboration with Design & Construction Department both of The Kenya Power and Lighting Company Limited (Kenya Power) and it lays down requirements for High Conductivity Aluminium Alloy Tubes for Electrical Purposes. It is intended for use by Kenya Power in purchasing the items.

1. SCOPE

This specification is for High Conductivity Aluminium Alloy Tubes for Electrical Purposes. It covers seamless High Conductivity Aluminium Alloy Tubes for use as substation busbars.

It shall be the responsibility of the supplier to ensure adequacy of the design and good engineering practice in the manufacture of the High Conductivity Aluminium Alloy Tubes for Kenya Power. The bidder shall submit information which demonstrates satisfactory service experience of the manufacturer with products which fall within the scope of this specification.

2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

BS EN 755: Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles *(all parts)*

BS EN 573-3: Aluminium and aluminium alloys. Chemical composition and form of wrought products. Chemical composition.

3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standard shall apply.

4. REQUIREMENTS

4.1 General

4.1.1 The aluminium alloy tubes shall be suitable for use outdoors in tropical climate with maximum ambient temperature of 40°C, heavy polluting saline conditions and humidity of up to 90%.

4.1.2 The aluminium alloy tubes shall be designed for use as busbars in substations operating at maximum system voltages of 245kV, 50Hz.

4.2 Materials and Construction

4.2.1. The tubes shall be round, seamless, extruded round tubes of high conductivity aluminium alloy for electrical purposes (including substation busbars) manufactured to relevant parts of BS EN 755.

4.2.2. The tubes shall be produced by the seamless die/mandrel method of extrusion.

4.2.3. The tubes shall not be re-drawn/extruded from used tubes.

4.2.4. The tubes shall be supplied in straight lengths (as specified) and the ends shall be cut clean and square with the axis of the tube.

4.2.5. The tubes shall be new, clean, smooth, free from harmful defects and free from any surface defects. They shall be free from sharp edges, abrasions and cuts.

4.2.6. The tubes shall have adequate strength to withstand mechanical forces due to short circuit current of 40kA for 3 seconds.

4.2.7. The temperature of the tubular bus when carrying full load current shall not exceed 50 C above ambient temperature.

4.3 Dimensions

The aluminium alloy tubes shall be in the following sizes and indicated tolerances:

Outside Diameter		Wall thickness		Length	
Size (mm)	Tolerance (mm)	Thickness (mm)	Tolerance (%)	Size (m)	Tolerance (%)
40	±0.35	4.0	±8	6.0	+10, 0
50	±0.35	8.0	±8	6.0	+10, 0
80	±0.35	10.0	±8	6.0	+10, 0

4.4 Chemical Composition, Mechanical and Physical Properties

The aluminium alloy tubes shall be of high conductivity material with the following properties:

4.4.1 Chemical Composition (to BS EN 573-3)

Element	Si	Fe	Cu	Mn	Cr	Zn	Ti	others		Al
								each	total	
Limits (weight %)	0.30–0.60	0.10-0.30	max. 0.05	max. 0.05	-	max. 0.10	-	max. 0.03	max. 0.10	remainder

4.4.2 Mechanical Properties (to BS EN 755-2)

Description	Temper	Yield stress Mpa	Tensile strength Mpa	Hardness HB	Elongation	
					A %	A_{50mm} %
Required	T6	160	215	65	8	6

4.4.3 Physical Properties

Description		**Required**
Density (at 20°C)		2690 Kg/m^3
Melting range (at 20°C)		585-650 °C
Electrical conductivity (at 20°C)		≥30 MS/m
Thermal conductivity (at 20°C)		218 W/m.K
Co-efficient of thermal expansion (at 20°C)		23.5 x 10^{-6}/K
Modulus of elasticity (at 20°C)		~70 GPa
Mass per unit length (at 20°C)	40mm o.d., 4mm thickness	1.2 Kg/m
	50mm o.d., 8mm thickness	2.9 Kg/m
	80mm o.d., 10mm thickness	5.9 Kg/m
Second moment (at 20°C)	40mm o.d., 4mm thickness	7 cm
	50mm o.d., 8mm thickness	24 cm
	80mm o.d., 10mm thickness	137 cm
Current carrying capacity (busbar temperature of 80 °C, ambient temperature of 35 °C)	40mm o.d., 4mm thickness	940 A
	50mm o.d., 8mm thickness	1540 A
	80mm o.d., 10mm thickness	2580 A

5 TESTS AND INSPECTION

5.1 The aluminium alloy tubes shall be tested in accordance with relevant parts of BS EN 755 and the requirements of this specification. It shall be the responsibility of the supplier to perform or to have performed all the relevant tests.

5.2 Copies of previous test reports by a third party testing laboratory accredited to ISO/IEC 17025 shall be submitted with the offer for evaluation (all in English Language). A copy of accreditation certificate (to ISO/IEC 17025) for the testing laboratory shall also be submitted with the tender for evaluation.

Copies of test reports to be submitted for tender evaluation shall include dimensions, chemical composition, mechanical and physical properties tests.

The Manufacturer's Declaration of Conformity to the reference standards shall also be submitted with the tender.

5.3 Routine and sample test reports (including dimensions, chemical composition, mechanical and physical properties) for the aluminium alloy tubes to be supplied shall be submitted to Kenya Power for approval before shipment/delivery of the goods. Kenya Power will witness acceptance tests at the factory before shipment.

5.4 On receipt of the goods Kenya Power may perform any of the relevant tests in order to verify compliance with this specification. The supplier shall replace without charge to Kenya Power aluminium alloy tubes which upon examination, test or use fail to meet any of the requirements in the specification.

6 MARKING AND PACKING

6.1 The aluminium alloy tubes shall be engraved legibly and indelibly with the following information, all in the English language:

- Name of the manufacturer
- Year of manufacture
- Product Designation (including dimensions)
- Standard to which the aluminium alloy tubes comply

6.2 The aluminium alloy tubes shall be supplied in bundles wrapped in plastic foil.

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ANNEX A: Guaranteed Technical Particulars *(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of test reports for tender evaluation, all in the English Language)*

TENDER NO .....

Clause	Description		Bidder's offer
-	Name of the Manufacturer, address and Country of manufacturing		
	Name & address of Bidder		
	Type/Model Reference Number of items offered		
1	Scope: It shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the aluminium alloy tubes for Kenya Power		
2	Applicable Standards		
3	Terms and Definitions		
4.1	General Requirements: 4.1.1 & 4.1.2		
4.2	Materials and Construction		
	4.2.1		
	4.2.2		
	4.2.3		
	4.2.4		
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4.3	Dimensions	Outside diameter (mm)	
		Wall thickness (mm)	
		Length (m)	
4.4.1	Chemical Composition to BS EN 573-3	Silicon, Si (%)	
		Iron, Fe (%)	
		Copper, Cu (%)	
		Manganese, Mn (%)	
		Chromium, Cr (%)	
		Zinc, Zn (%)	
		Titanium, Ti (%)	
		Others — each	
		Others — total	
		Aluminium, Al (%)	
4.4.2	Mechanical Properties	Temper	

	(to BS EN 755-2)	Yield stress (MPa)		
		Tensile strength (MPa)		
		Hardness (HB)		
		Elongation (%)	A	
			A_{50mm}	
4.4.3	Physical Properties, 20 °C	Density (Kg/m^3)		
		Melting range (°C)		
		Electrical conductivity (MS/m)		
		Thermal conductivity (W/m.K)		
		Co-efficient of thermal expansion (10^{-6}/K)		
		Modulus of elasticity (GPa)		
	Mass per unit length, Kg/m (at 20°C)	40mm o.d., 4mm thickness		
		50mm o.d., 8mm thickness		
		80mm o.d., 10mm thickness		
	Second moment, cm (at 20°C)	40mm o.d., 4mm thickness		
		50mm o.d., 8mm thickness		
		80mm o.d., 10mm thickness		
	Current carrying capacity, A (busbar temperature of 80 °C, ambient of 35 °C)	40mm o.d., 4mm thickness		
		50mm o.d., 8mm thickness		
		80mm o.d., 10mm thickness		
5	Tests and Inspection: 5.1			
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-	List of copies of Test Reports submitted			
-	Manufacturer's Declaration of Conformity			
-	List of Acceptance Tests to be witnessed by Kenya Power at the factory before shipment			
-	Catalogues, brochures, technical data, and drawings			
-	Customer sales records and customer reference letters submitted to support the offer.			

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Manufacturer's Name, Signature, Stamp and Date