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Kenya Power

COMPRESSION LUGS
— SPECIFICATION

A Document of the Kenya Power & Lighting Company Plc

September 2021

TABLE OF CONTENTS

0.1 Circulation List

COPY NO.	COPY HOLDER
1	Manager, Standards
Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)	

REVISION OF KPLC STANDARDS

In order to keep abreast of progress in the industry, KPLC standards shall be regularly reviewed. Suggestions for improvements to approved standards, addressed to the Manager, Standards Department, are welcome.

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 2 Rev 0	2010-11-12	Cancels and replaces Issue 1 Rev 0 and all other previous issues	Eng. Simon Kimitei	George Owuor
Issue 3 Rev 0	2015-06-18	Cancels and replaces Issue 2 Rev 0 and all other previous issues	Michael Apudo	Dr. Eng. Peter Kimemia
Issue 3 Rev 1	2020-08-12	I. Amended Tables 2, 3 & 4 II. Amended the title from terminal lugs (compression type) to Compression Lugs	Rotich Benard	Dr. Eng. Peter Kimemia
Issue 3 Rev 2	2021-09-30	I. Harmonized Bolt size diameter, ø, with stud hole dia, d_2, for 120, 150, 185, 240 & 300 mm^2 lugs in Table 2 II. Amended stud hole diameter, E, and Bolt size for 150, 185, 240 & 300 mm^2 lugs in Table 3 to match/maintain Issue 3 Rev 0 dimensions. III. Harmonized stud hole dia, E, with Bolt Size for 150, 185, & 300 mm^2 lugs in Table 4	Rotich Benard	Dr. Eng. Peter Kimemia

FOREWORD

This specification has been prepared by the Standards Department of the Kenya Power & Lighting Company Plc (KPLC) and it lays down requirements for cable terminal lugs – Compression type for use with cables and conductors. It is intended for use by KPLC in purchasing the items.

The specification applies to bare, non-tension, uncoated, compression copper, aluminium and bimetallic lugs, intended to be installed on circular or pre-rounded sectorial shaped, stranded, compacted copper or aluminium conductors of power cables as terminals connected to aluminium or copper bus-bars.

This specification stipulates the minimum requirements for lugs acceptable for use in the company and it shall be the responsibility of the supplier and manufacturer to ensure that the offered design is of the highest quality, good workmanship and good engineering practice in the manufacture of the lugs for KPLC.

The following are members of the team that developed this specification:

Name	Department
Rotich Benard	Standards

1. SCOPE

1.1. This specification is for Terminal Lugs (Compression Lugs) for use on distribution power lines operating at a nominal voltage of up to 66kV and frequency of 50Hz. The lugs are class "A" connectors intended for electricity distribution or industrial networks which can be subjected to short-circuit of relatively high intensity and duration.

1.2. The lugs covered in the specification are the following:

a) Copper Tubular Compression Lugs (copper barrel – copper palm);

b) Tinned Aluminium Tubular Compression Lugs (aluminium barrel – aluminium palm);

c) Bi-metallic Tubular Compression Lugs (aluminium barrel – copper palm).

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 754-1&2:	Aluminium and aluminium alloys. Cold drawn rod/bar and tube –Part 1: Technical conditions and inspection –Part 2: Mechanical properties
BS EN 13600:	Copper and copper alloys. Seamless copper tubes for electrical purposes.
BS EN 61238-1-1:	Compression and mechanical connectors for power cables for rated voltages up to 36 kV (Um = 42 kV)—Part 1: Test methods and requirements
DIN 46235:	Cable lugs for compression connections cover plate type, for copper conductors
DIN 46329:	Cable lugs for compression connections, ring type for aluminium conductors.
IEC 60228:	Conductors of Insulated cables.
ISO 2859-1:	Sampling procedures for inspection by attributes -- Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
ISO 25239-1 to 5:	Friction stir welding – Aluminium (All parts)

3. TERMS AND DEFINITIONS

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

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

The lugs shall be suitable for continuous operation outdoors in tropical areas at:

a) Altitudes of up to 2200m above sea level and humidity of up to 95%,

b) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,

c) Heavy saline conditions along the coast and

d) *Isokeraunic* levels of up to 180 thunderstorm days per year.

4.2. GENERAL REQUIREMENTS

4.2.1. The lugs in this specification shall be classified as Class A connectors and shall undergo both heat cycle and short-circuit tests in accordance with BS EN 61238-1;

4.2.2. The lugs shall be tubular type and be suitable for jointing to insulated cables and stranded conductors by use of compression tools. It shall correctly fit the cable or conductor it is intended for use with.

4.2.3. The lugs shall comprise a barrel (tube) and a straight palm. The palm shall have a hole for making connection between the cable and apparatus by means of a bolt or stud.

4.2.4. To prevent entry of water/moisture in outdoor applications, inspection/filling hole shall not be provided.

4.2.5. The faces on each side of the palm shall be sufficiently parallel and flat to provide a suitable contact surface.

4.2.6. The lugs shall have a current rating at least equal to that of the cable it is to be used with and a mechanical breaking load not less than 60% of that of the conductor it is to be used with.

4.2.7. All parts of the lug including the stud hole shall go through deburring and polishing operations (during manufacture) to eliminate all sharp edges.

4.2.8. The connectors shall be able to pass the tensile tests prescribed in Table 3 of BS EN 61238-1 and the crimping force for each category shall be as follows:

a) Up-to 240 mm^2 - 1.2×10^5 N.

b) 300 mm^2 to 630 mm^2 – 2.0×10^5 N

c) Above 630 mm^2 - 4.0×10^5 N

4.3. COPPER TUBULAR COMPRESSION LUGS

4.3.1. Design and construction

4.3.1.1. The copper tubular compression lugs shall be made from oxygen-free high purity copper that is immune to hydrogen embrittlement suitable for use in a high electrical and thermal conductivity requirement in accordance with BS EN 13600.

4.3.1.2. The copper shall be annealed and electrolytically tin-plated with a minimum thickness of 3µm to avoid oxidation. The annealing process optimizes the structural features of the material allowing an easier crimping.

4.3.1.3. The copper shall easily be joined with all welding and brazing methods and shall be suitable for manufacturing processes requiring extreme deformability.

4.3.1.4. The chemical, physical, electrical/thermal and jointing and machinability characteristics of the copper tube shall be as per Table 1.

Table 1: Characteristics of the tube as per BS EN 13600

Sr. No.	Particulars		Requirements
A	**Chemical properties**		
1	Chemical composition, Cu + Ag, %		99.95
B	**Physical properties**		
1	Coefficient of linear expansion, 1/k		0.0000177
2	Specific heat capacity, J/(kg x K)		385
3	Melting temperature		1083
4	Hardness (Soft temper) , HV		35 - 65
5	Tensile strength, N/mm^2		200 - 220
6	0.2% Yield Strength, N/mm^2		35 - 65
7	Elongation at break, min, %		12
C	**Electrical and thermal properties**		
1	Electrical conductivity	Volume, % IACS, min	100.6
		Mass, % IACS, min	100.0
		MS/m, min	58.3
2	Electrical resistivity	Volume, $\Omega mm^2/m$	0.0171
		Mass, $\Omega.g/m^2$	0.1532
3	Thermal conductivity, W/m.K		390
D	**Jointing and machinability**		
1	Machinability rating (free cutting brass =100)		20
2	Soldering		Excellent
3	Brazing		Good
4	TIG and MIG		Good

4.3.2. **Dimensions**

4.3.2.1. The copper tubular compression lugs shall have a barrel to accommodate stranded copper conductor and palm with a single stud hole. The dimensions are according DIN 46235 and Table 2.

4.3.2.2. The barrel shall be counter-bored to accommodate the insulation of cable. As per Table 2 suitable for cable sizes 1.5 mm^2 – 630 mm^2.

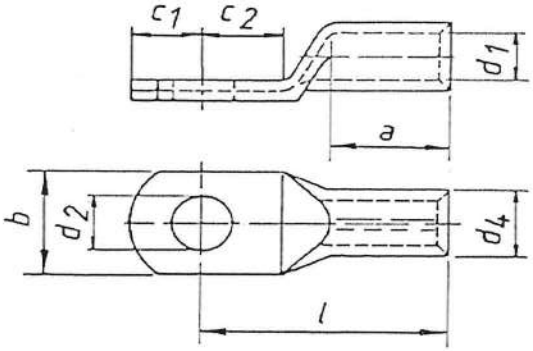

Fig. 1: Illustration of tinned tubular copper compression lugs to DIN 46235

Table 2: Copper Tubular Compression Lugs to *(dimensions as per DIN 46235)*

Conductor nominal cross section	Bolt Size ø	Len. a mm	Len. b mm	Dia. d1 mm	Dia. d2 mm	Dia. d4 mm	Dia. c1 mm	Dia. c2 mm	Len. l mm	Tube thick. mm	Palm thick. mm	Weight/ 100 pcs. ~ kg
Tolerance		min	±2	0, +4	min	min	0, -3	min.	+2.0	±0.5	±0.5	max
1.5	M6	8	11.0	1.8	6.4	2.4	6.0	5.0	15	0.3	1.0	0.07
2.5	M6	8	12.0	2.7	6.4	3.5	6.0	5.0	15	0.4	1.2	0.11
4	M6	10	12.0	3.3	6.4	4.3	6.0	5.5	17.5	0.5	1.5	0.18
6	M8	10	14.0	3.8	8.4	5.5	10.0	10.0	24	0.6	1.5	0.3
10	M8	10	15.0	4.5	8.4	6.0	10.0	10.0	27		1.5	0.38
16	M12	20	17.0	5.5	13.0	8.5	12.0	13.0	36	1.0	2.5	1.30
25	M12	20	19.0	7.0	13.0	10.0	13.0	13.0	38		3.0	1.66
50	M16	28	28.0	10.0	17.0	14.5	16.0	16.0	52		4.0	4.57
70	M16	28	30.0	11.5	17.0	16.5	16.0	16.0	55		4.5	6.13
95	M16	35	32.0	13.5	17.0	19.0	16.0	16.0	65		5.0	9.00
120	M20	35	38.0	16.0*	21.0	21.0	21.0	22.0	70		5.5	11.03
150	M20	35	40.0	17.0	21.0	23.5	21.0	22.0	78	2	6.0	15.90
185	M20	40	40.0	19.0	21.0	25.5	21.0	22.0	82		6.0	18.69
240	M20	40	45.0	21.5	21.0	29.0	21.0	22.0	92		6.5	26.88
300	M20	50	46.0	24.5	21.0	32.0	22.0	22.0	100		7.0	33.24
400	M20	70	54.0	27.5	21.0	38.5	25.0	25.0	115	2	7.5	63.019
500	M20	70	60.0	31.0	21.0	42.0	25.0	25.0	125		8.0	75.264
630	M20	80	64.0	34.5	21.0	44.0	25.0	27.0	135	3	10.0	79.69
*- Sizes shall not be to DIN 46235 but shall be as per KPLC requirement												

4.4. TINNED ALUMINIUM TUBULAR COMPRESSION LUGS

4.4.1. General design requirements

4.4.1.1. The tinned aluminium tubular compression lugs shall be manufactured from a forged high purity electrolytic EC grade Aluminium 99.5% tubes in accordance with DIN 46329 and shall have a tin coating with minimum tin coating thickness of 150µm.

4.4.1.2. The tinned aluminium tubular compression lugs shall be suitable for connecting to aluminium and copper bus-bars/terminations the following types of conductors:

a) Stranded Copper and Aluminium Cables;
b) Stranded All Aluminium Conductors
c) Stranded Aluminium Conductor Steel Reinforced (ACSR)
d) Stranded All Aluminium Alloy Conductor (AAAC)

4.4.1.3. The barrel shall be packed with abrasive neutral high melting point soft grease (oxide inhibiting compound) and the ends sealed (capped). The quantity of grease shall be approximately half the volume of the bore.

4.4.1.4. The tinned aluminium tubular compression lugs shall be attached to the aluminium conductor by compression jointing and recommended compressing positions shall be clearly marked on the barrel.

4.4.1.5. The palm faces shall be flat and shall have a single hole for termination. The palm shall be protected with oil impregnated strippable plastic or other strippable suitable coating.

4.4.2. Sizes and Dimensions

4.4.2.1. The tinned aluminium tubular compression lugs shall have a barrel to accommodate 10 – 630 mm^2 solid and stranded copper and aluminium cables, ASCR conductors as per clause 4.4.1.2 and the palm shall have a single stud hole. The dimensions shall be according to DIN 46329 and Table 3.

4.4.2.2. The barrel shall be counter-bored to accommodate the insulation of the corresponding cable sizes. The shape of the tinned aluminium tubular compression lugs shall resemble Fig. 2.

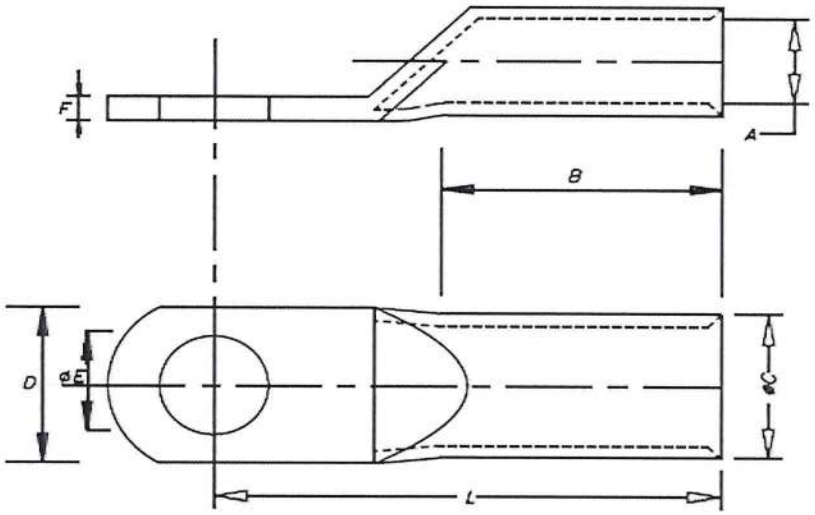

Fig. 2: Illustration of Tinned Aluminium Tubular Compression Lugs to DIN 46329

Table 3: Aluminium Tubular Compression Lugs *(dimensions as per DIN 46329)*

Sr. No.	Cable size	Stud Hole E	Bolt	Dimensions					Palm thickness f
				A	C	D	B	L	
	mm^2	mm		mm	mm	mm	mm	mm	mm
Tolerance	Nominal	min		0, +4	min	min	min	+2.0	min
1	10*	8.4	M8	4.7	10	20	28	45	2.0
2	16	8.4	M8	5.8	12	20	30	50	2.5
3	25*	10.5	M10	7.5*	12	25	30	50	3.0
4	50*	10.5	M10	10.4*	16	25	42	62	3.5
5	70	13.0	M12	11.2	19	25	56	72	4.0
6	95	17.0	M16	13.2	22	25	56	75	5.0
7	120	17.0	M16	14.7	23	30	56	80	5.5
8	150*	21.0	M20	16.3	25	30	60	90	6.0
9	185*	21.0	M20	18.3	28.5	30	60	91	6.0
10	240*	21.0	M20	21.0	30	38	70	103	6.5
11	300*	21.0	M20	25.5*	34	38	70	103	7.0
12	400	21.0	M20	26.0	38	38	73	116	7.2
13	500	21.0	M20	29.0	42	44	79	122	7.5
14	630*	23.0	M20	34.0	48	52	92	135	10.1

*- The starred compression lug sizes shall not be to DIN 46329 but shall be as per KPLC requirement

4.5. BI-METAL TUBULAR COMPRESSION LUGS

4.5.1. Construction Requirements

4.5.1.1. The Bi-Metal tubular compression lugs shall be constructed from forged circular copper palm (grade of copper as per clause 4.3.1.1), friction welded to an EC grade Aluminium (grade of aluminium as per clause 4.4.1.1) circular barrel in accordance with ISO 25239 - thus achieving transition aluminium - copper bi-metal terminals.

4.5.1.2. The Bi-Metal tubular compression lugs shall be manufactured in accordance with DIN 46329 in shape and dimensions and shall be suitable for connecting stranded aluminium conductor to copper bus-bar or equipment with copper terminal studs.

4.5.1.3. The barrel shall be packed with abrasive neutral high melting point soft grease (oxide inhibiting compound) and the ends sealed (capped). The quantity of grease shall be approximately half the volume of the bore.

4.5.1.4. The lugs shall be suitable for use in cable sizes $10mm^2$ to $630mm^2$ as per Table 4.

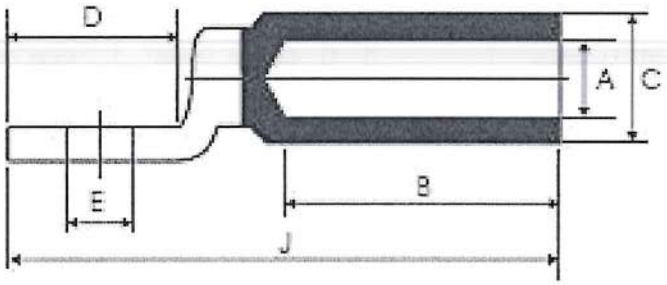

Fig. 2: Bi-Metal tubular compression lugs

Table 4: Illustration of Bi-Metal tubular compression lugs *(dimensions as per DIN 46329)*

Sr. No.	Cable size	Stud Hole E	Bolt	Dimensions						
				A	C	D	E	J	B	Palm thickness
	mm^2	mm		mm	mm	mm	mm	mm	mm	mm
Tolerance		min		0, +4	min	min	min	min	+2.0	min
1	10	10.5	M10	4.7	13	26	10.5	76	40	2.0
2	16	10.5	M10	5.8	15	26	10.5	76	40	2.5
3	25*	13.0	M12	7.2	16	26	13.0	79	43	3.0
4	35	13.0	M12	8.0	16	32	13.0	79	43	3.0
5	50*	13.0	M12	10.4	20	32	13.0	85	43	3.5
5	70	17.0	M16	11.0	20	32	17.0	85	43	4.0
6	95	17.0	M16	12.5	20	32	17.0	85	43	5.0
7	120*	17.0	M16	14.8	25	36	17.0	108	59	5.5
8	150*	21.0	M20	16.5	25	36	21.0	108	59	6.0
9	185*	21.0	M20	20.0	32	36	21.0	115	59	6.0
10	300*	21.0	M20	26.0	35	43	21.0	137	86	6.5
11	400*	21.0	M20	27.8	40	44	21.0	153.5	86	7.0
12	630*	21.0	M20	33.5	47	60x60	4Ø9	196	95	10.0

*- The Bi-metal compression lug for the starred sizes shall not be to DIN 46329 but shall be as per KPLC requirement.

5. TESTS AND INSPECTION

5.1. TEST STANDARDS

The compression lugs shall be tested in accordance with the relevant requirements of BS EN 61238-1, ISO 25239-1 to 5, BS EN 13600, BS EN 754-1&2, DIN 46235, DIN 46329 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

5.2. SAMPLING FOR TESTS

5.2.1. Test specimens shall be selected at random from each inspection lot (or articles) in accordance with ISO 2859-1.

5.2.2. The number of samples selected from each lot shall comply with Table 5 of this specification.

Table 5: Number of test samples

Lot size	Sample size	Lot size	Sample size
25 or less	5	501 to 1,200	80
26 to 50	8	1,201 to 3,200	125
51 to 90	13	3,201 to 10,000	200
91 to 150	20	10,000 to 35,000	315
151 to 280	32	35,001 to over	500
281 to 500	50		

6. MARKING AND PACKING

6.1. MARKING

The following information shall be marked by engraving/etching and legibly, indelibly and in a permanent manner on each compression lug:

a) Name or trade mark of the manufacturer,
b) Type reference number,
c) Cable sizes applicable and inside diameters of the lug,
d) Crimping force and position,
e) The letters '**KPLC**'.

6.2. PACKING

6.2.1. The compression lugs shall be packed in such a manner so as to avoid damage during transportation and storage.

6.2.2. Instructions for installation and details on applicable tools shall be included in each package, all in English Language.

APPENDICES

APPENDIX A: TESTS AND INSPECTION (NORMATIVE)

A.1. Copies of test certificates by a third party testing laboratory accredited to ISO/IEC 17025 shall be submitted with the offer for evaluation. A copy of the accreditation certificate for the testing laboratory shall also be submitted with the tender (all in English Language). Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority. A copy of the accreditation certificate to ISO/IEC 17025 for the testing laboratory shall also be submitted (all in English language).

A.2. Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall include:

a) Short circuit and heat cycle tests – BS EN 61238-1
b) Chemical composition of copper and aluminium – BS EN 13600 & BS EN 754-1&2
c) Friction stir welding – ISO 25239-1
d) Crimping force as per clause 4.2.8.
e) Dimensional checks to DIN 46235 & DIN 46329

A.3. Routine test reports for the compression lugs to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC may witness acceptance tests at the factory. Supplier shall invite KPLC in adequate time to facilitate good preparation for the exercise. The witness/acceptance tests shall include:

a) Crimping force as per clause 4.2.8.
b) Dimensional checks to DIN 46235 & DIN 46329

A.4. On receipt of the compression lugs, KPLC shall inspect and may perform tests in order to verify compliance with this specification. The supplier shall replace without charge to KPLC, any compression lugs which upon examination, test or use fail to meet any of the requirements in this specification

APPENDIX B: QUALITY MANAGEMENT SYSTEM (NORMATIVE)

B.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the lugs design, material, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2015

B.2. The Manufacturer's Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2015 certificate shall be submitted with the tender for evaluation.

APPENDIX C: TECHNICAL DOCUMENTATION (NORMATIVE)

C.1. The bidder shall submit its tender complete with technical documents for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.

b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;

c) Copies of required type test certificates and type test reports by a third party testing laboratory accredited to ISO/IEC 17025;

d) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;

e) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2015 certificate and other technical documents required in the tender.

C.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.

b) Manufacturer's drawings and technical data; stamped and signed by the manufacturer.

c) Packaging details (including packaging materials and marking and identification of component packages).

C.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the bolts, nuts and washers to KPLC stores

APPENDIX D: GUARANTEED TECHNICAL PARTICULARS (GTPS) — NORMATIVE

(to be filled and signed by the Supplier and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete type test certificates and test reports for tender evaluation, all in English Language)

Tender No. .....

Bidder's name and Address.....

Clause	Description	KPLC REQUIREMENTS		Bidder's offer (indicate full details of the values offered)
	Bidder's Name and address			State
	Name of Manufacturer			State
	Country of manufacture			State
1	Scope			List type of lugs offered
2	Manufacturing standards applicable			State
3	Terms and definitions			State
4	**Requirements**			
4.1	Service conditions - compliance			State conditions applicable
4.2	**General requirements**			
4.2.1	Lugs classification			State
4.2.2	Lugs type and suitability			State
4.2.3	Parts that make up the lug			State
4.2.4	Inspection/filling hole shall not be provided			Specify
4.2.5	Faces on each side of the palm are sufficiently parallel and flat			State
4.2.6	Current rating of the lug			Specify
	Minimum mechanical breaking load of the lug			Specify
4.2.7	Finishing on the lug			Specify
4.2.8	Crimping force	Up to 240mm^2	1.2 x 10^5 N	Provide a test report
		300mm2 – 630mm^2	2.0 x 10^5 N	
		Above 630mm^2	4.0 x 10^5 N	
4.3	**Copper compression lugs**			
	Type/Model Reference Number			State

4.3.1	Design & Construction		Specify
4.3.1.1	Material of manufacture of copper lug		Specify. Provide a test report
4.3.1.2	Copper for manufacture shall be annealed and electrolytically tin-plated		Specify
	Minimum thickness of tin	3µm	State
4.3.1.3	Copper used to manufacture lugs shall easily be joined with all welding and brazing methods		Specify
4.3.1.4	**Characteristics of the copper tube as per BS EN 13600**		
A	**Chemical properties**		
1	Chemical composition, Cu + Ag, %	99.95	State
B	**Physical properties**		
1	Coefficient of linear expansion, 1/k	0.0000177	State
2	Specific heat capacity, J/(kg x K)	385	State
3	Melting temperature	1083	State
4	Hardness (Soft temper) , HV	35 - 65	State
5	Tensile strength, N/mm^2	200 - 220	State
6	0.2% Yield Strength, N/mm^2	35 - 65	State
7	Elongation at break, min, %	12	State
C	**Electrical and thermal properties**		
1	Electrical conductivity	Volume, % IACS, min: 100.6	State Provide a test report
		Mass, % IACS, min: 100.0	
		MS/m, min: 58.3	
2	Electrical resistivity	Volume, $\Omega mm^2/m$: 0.0171	State Provide a test report
		Mass, $\Omega.g/m^2$: 0.1532	
3	Thermal conductivity, W/m.K	390	State Provide a test report
D	**Jointing and machinability**		
1	Machinability rating (free cutting brass =100)	20	State
2	Soldering	Excellent	State
3	Brazing	Good	State
4	TIG and MIG	Good	State
4.3.2.1	Sizes and dimensions	As per fig. 1 and table 2	Give dimensions as per Table 2 & Provide a drawing
4.3.2.2	Type of boring on the barrel to receive insulation		Specify

4.4	**Tinned Aluminium Compression lugs**		
	Type/Model Reference Number		State
4.4.1.1	Material of manufacture of lug	high purity electrolytic EC grade Aluminium 99.5%	Specify Provide a test report
	Thickness of tin coating	150µm	State
4.4.1.2	Types of cables and conductors suitable for use with these lugs		List
4.4.1.3	Type of compound packed in the barrel to prevent oxidation		Specify
	Volume of the compound in the barrel		Specify
	End seals shall be provided		State
4.4.1.4	How the conductor is attached to the lugs		Specify
4.4.1.5	Palm faces are be flat on both sides		Specify
4.4.2.1	Sizes and dimensions	As per table 3 and Fig. 2	Give dimensions as per Table 3 of what is offered & Provide a drawing
4.4.2.2	Type of boring on the barrel to receive insulation		Specify
4.5	**Bi-metal compression lugs**		
	Type/Model Reference Number		State
4.5.1.1	Material of manufacture of palm	oxygen-free high purity copper	Specify
	Material of manufacture of barrel	high purity electrolytic EC grade Aluminium 99.5%	Specify
	Type of welding		Specify
4.5.1.2	Suitability of use		Specify
4.5.1.3	Type of compound packed in the barrel to prevent oxidation		Specify
	Volume of the compound in the barrel		Specify
	End seals shall be provided		State
4.5.1.4	Sizes and dimensions	As per table 4 and Fig. 3	Give dimensions as per Table 4 of what is offered & Provide a drawing
5	TESTS AND INSPECTION		
5.1	Test standards and responsibility of carrying out tests		Provide
5.2	**Sampling**		Provide
5.2.1	Method of sampling for inspection and testing		Specify
5.2.2	Number of test samples	As per table 5	Specify
6	MARKING AND PACKING		
6.1	Marking		State
6.2	Packing		State
A	**TESTS AND INSPECTION**		

A1	Copies of test certificates by a third party testing laboratory accredited to ISO/IEC 17025 shall be submitted	List the Report Nos
A2	Lists of tests in the submitted test reports	List
A3	All manufactured lugs shall be offered for FATs and inspection in the presence of KPLC engineers at manufacturers site	State
A4	Supplier shall replace without charge to KPLC items that don't meet specification	State
B	**QUALITY MANAGEMENT SYSTEM**	
B1	QAP	State
B2	Submit ISO 9001:2015	State
C	**TECHNICAL DOCUMENTATION**	
C1	Technical documents to be submitted with tender documents	
	a. Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.	Specify
	b. Drawings with dimensions of all the items offered	state
	c. Manufacturer's catalogues, brochures, and technical data;	Specify
	d. Copies of required type test certificates and type test reports by a third party testing laboratory accredited to ISO/IEC 17025;	State
	e. Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;	State
	f. Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2015 certificate and other technical documents required in the tender.	State
C2	Documents to be submitted for approval before manufacture	
	a. Fully filled clause by clause Guaranteed Technical Particulars (GTPs	State
	b. Drawings and technical data of the lugs; stamped and signed by the manufacturer.	State
	c. Marking and packaging details	State
C3	Recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the lugs to KPLC stores shall be submitted	Specify

** Words like 'agreed', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

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Manufacturer's Name, Signature, Stamp and Date