EDMS 15-300-2

SPECIFICATION

FOR

COMPRESSION TYPE LUGS

For CABLES UP TO 24 kV

(ALUMINUM / COPPER / BIMETALLIC)

Issue: Feb.-2022 / Rev- 2

This revision contains option items that may be requested by distribution company before bidding

CONTENTS

1- SCOPE

This specification describes the minimum technical requirements for the design, engineering, manufacture, testing, supply and delivery of compression type lugs for connecting cables/conductors to distribution points for cables up to 24 kV. The required lugs shall be suitable for use in both indoor and outdoor installations in the distribution system of Egyptian Electricity Distribution Companies (EDCs).

2- APPLICABLE CODES and STANDARDS

This specification shall be read in conjunction with the latest revisions of the following EDMS specifications:

- EDMS 03-300 LV Cables, Aluminum or Copper 0.6/1 kV.
- EDMS 03-400 MV Cables 12/20 kV and 18/30 kV.
- EDMS 04-300 LV Insulated Conductors 0.6/1 kV.
- EDMS 13-100 and EDMS 13-200 MV Cable Termination 12/20 kV and 18/30 kV
- EDMS 13-101 and EDMS 13-201 MV Dead-break Elbow 12/20 kV and 18/30 kV

The equipment/material covered in this specification shall comply with the latest edition/amendment of the following codes and standards. Where any provision of this specification differs from those of the standards listed below, the provisions of this specification shall apply.

- IEC 60228 Conductors for Insulated Cables.
- IEC 61238-1 Compression and Mechanical Connectors for Power Cables for Rated Voltages up to 30 kV (Um= 36 kV) Part: 1–Test Methods and Requirements.
- DIN EN 13600 Copper and copper alloys - Seamless copper tubes for electrical purposes.
- DIN EN 755 Aluminum and aluminum alloys - Extruded rod/bar, tube and profiles.
- DIN 755-7 Manufacturing tolerances
- DIN 46329 Cable Lugs for Compression, Ring Type, for Aluminum Conductors.

- DIN 46235 Cable Lugs for Compression, Cover Plate Type, for Copper Conductors.
- ISO 2859 Sampling procedures for inspection by attributes.
- NEMA/ANSI CC1 Electric Power Connection for Substations.
- ASTM B545 Standard Specification for Electrodeposited Coatings of Tin.

3- SERVICE CONDITIONS

The lugs is required to have a good electrical and mechanical performance under the following local service conditions:

Mean daily temperature	40 °C
Maximum ambient shade temperature	50 °C
Minimum ambient shade temperature	-5 °C
Maximum relative humidity	95 %
Environmental conditions	Humid tropical climate with heavily polluted atmosphere
Maximum Rainfall	250 mm
Altitude	Up to 1000 m above sea-level

4- DESIGN and CONSTRUCTION REQUIREMENTS

4.1 General:

- All lugs intended for electricity distribution or industrial networks shall be Class-A in which they can be subjected to short-circuit of relatively high intensity and duration.
- All lugs shall meet or exceed the performance of conductor in all respects.
- All lugs shall be compression type suitable for hexagonal crimping.
- Manufacturer's drawings shall show the outline of the lugs together with all pertinent dimensions.
- Manufacturing tolerances shall be as per DIN 755-7. The tolerances in lug dimensions shall not exceed the value given in the attached drawings and tables.

- The maximum allowable decrease in weight is 5% of the specified weight.

4.2 Materials:

- Lugs shall be made entirely from copper (Copper lugs), entirely from aluminum (Aluminum lugs) or combination of both metals (Bimetallic lugs) as specified hereafter according to the request of EDC.
- All copper parts shall be made of E-Cu ETP of purity not less than 99.9% as per EN 13600. The minimum acceptable conductivity of copper parts is 96% IACS.
- All aluminum parts shall be made of alloy EN-AW-1050A of purity not less than 99.5% in accordance with DIN EN 755-7. The minimum acceptable conductivity of aluminum parts is 56% IACS.

4.2.1 Copper Lugs:

- All copper lugs shall have tin plated surface of thickness 5 µm to protect against corrosion in accordance with DIN 46235.

4.2.2 Aluminum Lugs:

- All aluminum lugs shall be made of seamless extruded tubes in accordance with DIN 46329.

4.2.3 Bi-metallic Lugs:

- Bi-metallic lugs can be delivered in either friction or insert types according to _ _EDC requirements.
- Friction type consists of aluminum barrel (seamless extruded tube) jointed with copper palm through friction stir welding.
- Insert type consists of aluminum body (seamless extruded tube) with copper ring inserted in the aluminum palm.

4.2.4 Dead-break Elbow Lugs:

- Dead-break elbow lugs should be made by one piece of seamless Aluminum tubes to comply the requirements of EDMS 13-101-1 and EDMS 13-201-1.
- Dead-break elbow lugs shall have tin plated surface of thickness 5 µm to protect against corrosion.

4.3 Construction:

- The construction details and dimensions are given in the attached drawings and tables, which form part of this specification.
- All lugs shall have smooth bright surface without any form of nicks, deformations, and sharp edges.
- The lugs shall be able to pass the tensile tests prescribed in IEC 61238-1 and the tensile force for each category shall be as follows:

Class	Conductor Material	Nominal cross-sectional area A (mm^2)	Tensile force (N)
Class 1	Aluminum	≤ 500 ≥ 630	$40 \times A$ 20000
	Copper	≤ 300 ≥ 400	$60 \times A$ 20000

- The following information shall be legibly engraved or indelibly printed with durable marks onto each barrel surface: Symbol of conductor material (Cu or Al), conductor size, stud size, die size, manufacture name and crimp positions.
- Manufacturer name shall be marked to where it will not be affected or erased by crimping.
- Crimp positions (narrow die and wide die) shall be clearly indicated on the outside surface in accordance with the attached tables.

- The barrel of aluminum and bimetallic lugs shall be filled with joint compound (Contact grease with corundum – nonferrous heavy metal inhibitor). The joint compound shall maintain its characteristics up to 90 °C.
- The barrel of aluminum and bimetallic lugs shall be capped with an easy to be removed plastic plug.

5- TESTING

- Compression lugs shall be tested in accordance to the latest relevant standards and this specification. It shall be the responsibility of the manufacture to perform or to have performed all the tests specified.

5.1 Type Tests

- Type tests had to be performed by accredited laboratories. Single lug of each type can be type-tested to cover its lower sizes. The type test reports shall include:
  - Short-circuit and heat cycling tests (IEC 61238-1)
  - Chemical composition of copper and aluminum (DIN 13600 and DIN 755)
  - Tensile tests prescribed in IEC 61238-1 as per clause 4.3 of this specification.

5.1 Routine Tests

- Routine tests shall be carried out on the charge of the contractor in the presence of EDC representative at the factory. The routine tests shall include:
  - Conductivity test to verify the requirement of clause 4.2 of this specification.
  - Uniformity of the final product with the sample previously attached to the offer.
  - Measurements of dimensions and weights to ensure the compliance with the attached drawings and tables.

- Sample size: Test specimens shall be selected at random from each inspection lot in accordance to ISO 2859-1. The number of selected samples shall be as follows:

Lot Size	Sample Size	Lot Size	Sample Size
100 pcs. or less	2 pcs.	1001 to 5000 pcs.	25 pcs.
101 to 500 pcs.	6 pcs.	5001 to 20000 pcs.	40 pcs.
501 to 1000 pcs.	12 pcs.	20001 pcs. to over	60 pcs.

- In case of failure of test sample to comply with routine tests, the EDC reserves the right to disqualify the contractor or postpone the delivery until succeeding all the tests. In this case, any delay of supplying shall be on the charge and responsibility of the contractor.

6- PACKING and MARKING

Packing and delivery shall generally be in suitable carton boxes of maximum 15 kg for each. Each box shall bear the following information legibly printed in a visible place:

- Purchase order number / Tender number
- Lugs catalogue number
- Manufacturer’s name
- Year of manufacture
- Quantity of pcs. in the box
- Gross weight in kilograms (kg)
- Position of slinging points and other relevant handling instructions

7- GUARANTEE

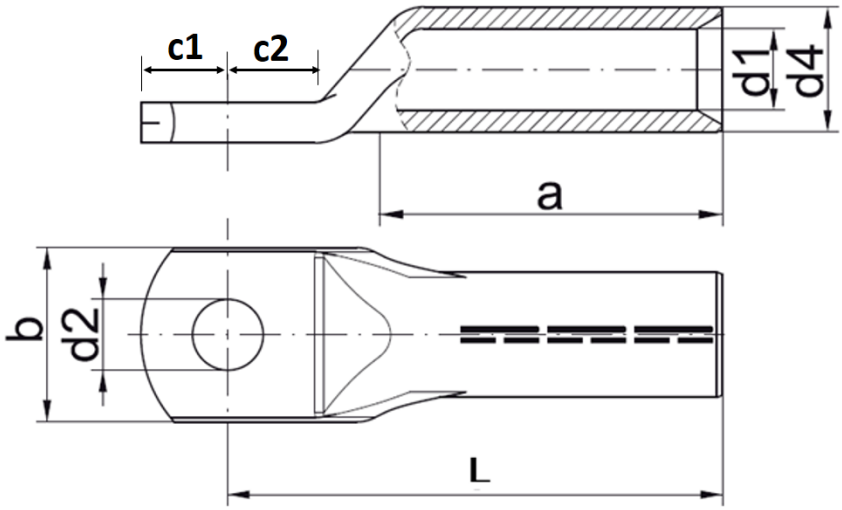
- The supplier shall guarantee the products against all defects arising out of faulty design or manufacturing defects or defective material for a period of two (2) years from the date of delivery.
- The supplier shall guarantee the uniformity of the products delivered with the approved samples.

8- SUBMITTALS

- Technical data and original catalogues shall be submitted. The submitted data shall include manufacturer CAD drawings for each of the items offered.
- One specimen of each offered type shall be submitted with the offer for evaluation prior to issuance of the purchase order. Dimensional verification, indelible markings and finishing shall be checked.
- The tenderer must fill in thoroughly the attached technical data schedule for each offered item. Any offer does not accompanied with clear and complete technical data schedule shall be rejected.
- Product type test reports/certificates.
- Approval certificate issued by Egyptian Electricity Holding Company.
- List of deviations and clauses to which exception is taken (if any).

9- DRAWINGS

Aluminum Lug



Conductor Cross-section mm^2	Stud dia.	a (*) Min.	b ±2	c1 ±1	c2 ±1	d1 ±0.6	d2 ±0.5	d4 ±0.6	L ±3	Weight g/pc without inhibitor	No. of Press (crimps) narr/wide
	All dimensions are in mm										
10	8	32	18	9.5	12	5	8.5	10	52	11	4 / 2
16	8	32	18	9.5	12	6.5	8.5	12	52	12	4 / 2
25	8	38	18	9.5	12	6.8	8.5	12	60	12.6	4 / 2
35	10	42	21	12	14	8	10.5	14	67	20.8	5 / 2
50	10	42	25	14	14.5	9.8	10.5	16	72	25.4	5 / 2
70	12	52	28	15	17.5	11.2	13	18	86	40	6 / 3
95	12	52	32	16	18	13.2	13	22	90	65	6 / 3
120	12	52	32	16	18	14.7	13	22	91	55	6 / 3
150	12	60	35	17.5	21.5	16.3	13	25	103	91	6 / 3
185	16	60	40	21.5	25	18.3	17	28	106	110	6 / 3
240	16	65	45	24	26	21	17	32	116	157	6 / 3
300	16	75	49	24	26	23.3	17	34	124	179.5	8 / 3
400	20	100	58	30.5	32	26	21	38	165	290	- / 4
500	20	120	62	31	32	29	21	44	185	479	- / 4

(*) Dimension “a” denotes the length of the conductor part inside the lug barrel.

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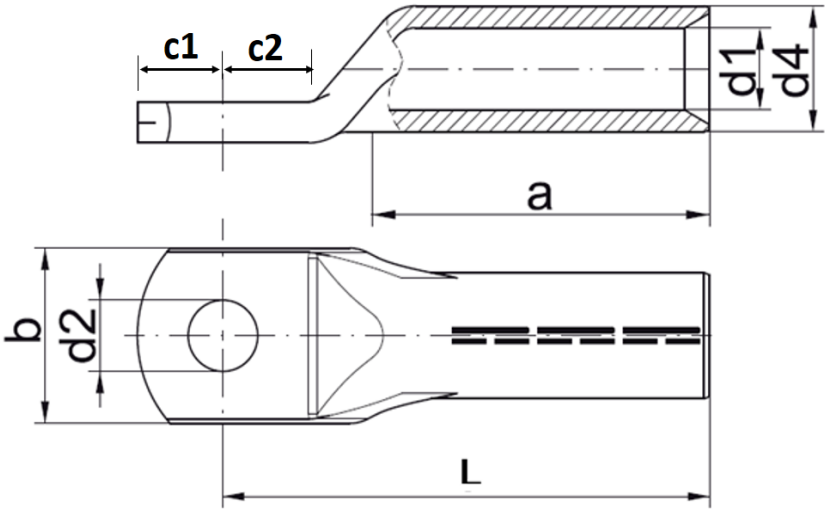
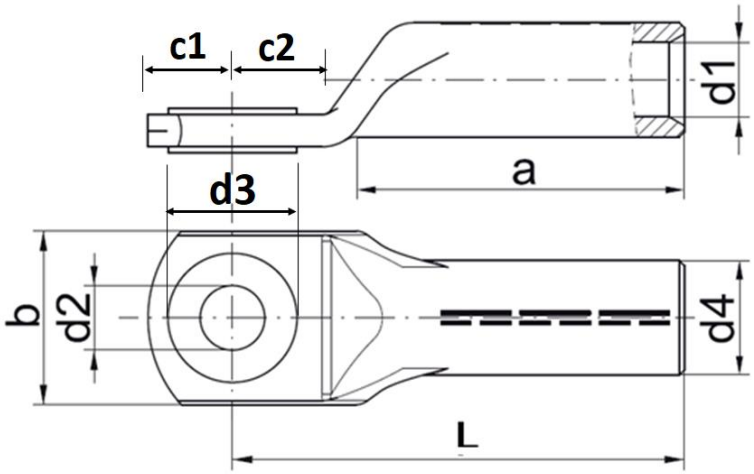
Copper Lug



Conductor Cross-section mm^2	Stud dia.	a (*)	b	c1	c2	d1	d2	d4	L	Weight g/pc	No. of Press (crimps) narr/wide
	All dimensions are in mm (**)										
10	6	10	9	7.5	8.5	4.5	6.4	6	27	3.6	1 / -
16	8	20	13	10	10	5.5	8.4	8.5	36	12.2	2 / -
25	8	20	16	10	10	7	8.4	10	38	15	2 / -
35	10	20	19	12	12	8.2	10.5	12.5	42	26	2 / -
50	10	28	22	12	12	10	10.5	14.5	52	44	3 / -
70	12	28	24	12	12	11.5	13	16.5	55	61	3 / -
95	12	35	28	13	13	13.5	13	19	65	86	4 / 2
120	12	35	32	16	13	15.5	13	21	70	113	4 / 2
150	12	35	34	16	17	17	13	23.5	78	163	4 / 2
185	16	40	37	19	20	19	17	25.5	82	187.5	4 / 2
240	16	40	42	19	20	21.5	17	29	92	273	- / 2
300	16	50	46	19	22	24.5	17	32	100	333	- / 2
400	20	70	54	25	22	27.5	21	38.5	115	654	- / 3
500	20	70	60	25	22	31	21	42	125	793	- / 3

(*) Dimension “a” denotes the length of the conductor part inside the lug barrel.
(**) Tolerances are according to DIN 46235.

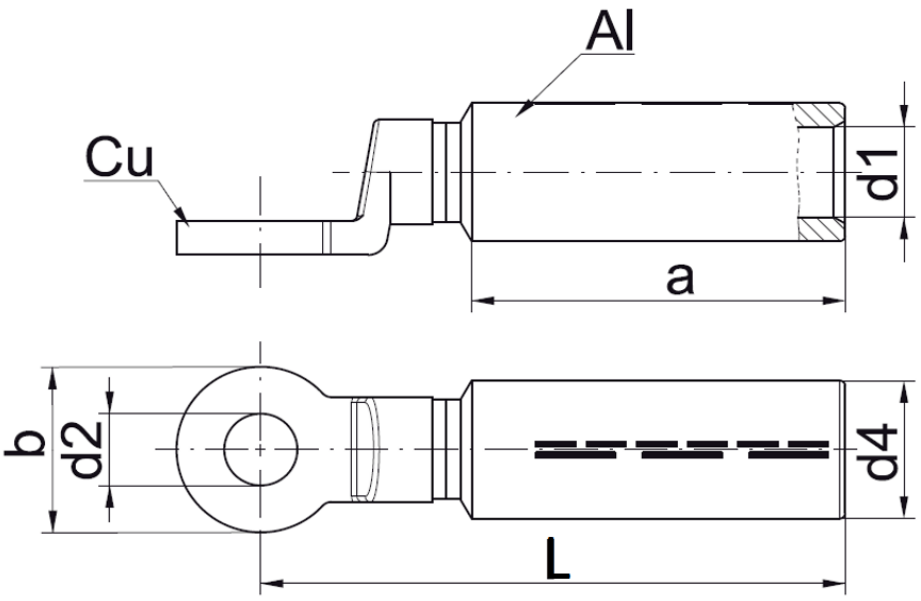
Bimetallic (Al – Cu) Lug (Insert type)



Conductor Cross-section mm^2	Stud dia.	a (*) Min.	b ±2	c1 ±1	c2 ±1	d1 ±0.6	d2 ±0.5	d3 Min.	d4 ±0.6	L ±3	Weight g/pc without inhibitor	No. of Press (crimps) narr/wide
	All dimensions are in mm											
16	8	32	22.5	13.6	15.6	6.5	8.5	17.5	12	52	20	4 / 2
25	8	38	22.5	13.6	15.6	6.8	8.5	17.5	12	61	20	4 / 2
35	10	42	25	14	16	8	10.5	19.5	14	67.5	30	5 / 3
50	10	42	26	14	16	9.8	10.5	19.5	16	72	33.6	5 / 3
70	12	52	31.5	17	17.5	11.2	13	24.5	18	86	60.5	6 / 3
95	12	52	33.5	17.5	17	13.2	13	26	22	90	92	6 / 3
120	12	52	35	17.5	17	14.7	13	26	22	90	78	6 / 3
150	12	60	37	18.8	21.5	16.3	13	26	25	103	112	6 / 3
185	12	60	42.5	22.3	25	18.3	13	28	28	107	138	6 / 3
240	16	65	48	25	26	21	17	33	32	116	195	6 / 3
300	16	75	50.5	25	26	23.3	17	34	34	124	218	8 / 3
400	16	100	56	31.3	32	26	17	35	38	165	333	- / 4
500	16	120	63	30.5	32	29	17	35	44	185	524	- / 4

(*) Dimension “a” denotes the length of the conductor part inside the lug barrel.

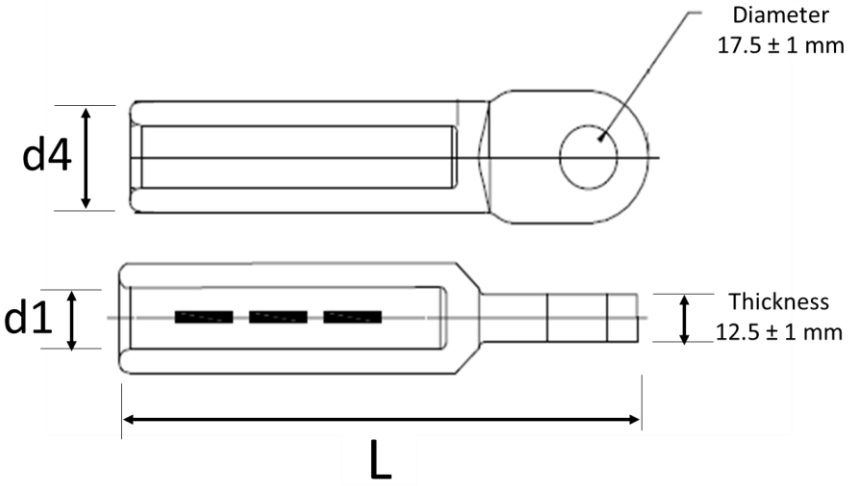
Bimetallic (Al – Cu) Lug (Friction type)



Conductor Cross-section mm^2	Stud dia.	a (*) Min.	b ±2	d1 ±0.6	d2 ±0.5	d4 ±0.6	L ±3	Weight g/pc without inhibitor	No. of Press (crimps) narr/wide
	All dimensions are in mm								
16	10	43	25	6.5	10.5	20	72.5	77	4 / 2
25	10	43	25	6.8	10.5	20	72.5	77	4 / 2
35	10	43	25	8	10.5	20	72.5	75	4 / 2
50	12	43	25	10	13	20	72.5	69	4 / 2
70	12	43	25	11.2	13	20	72.5	68	4 / 2
95	12	43	25	13.2	13	20	72.5	66	4 / 2
120	12	59	30	14.7	13	25	97	136	5 / 2
150	12	59	30	16.3	13	25	97	124	5 / 2
185	12	59	35	18.5	13	32	100	224	5 / 2
240	16	59	35	21	17	32	100	203	5 / 2
300	16	73	36	23.3	17	34	128	252	- / 4

(*) Dimension “a” denotes the length of the conductor part inside the lug barrel.

Deadbreak Elbow Lug



Conductor Cross-section mm^2	d1	d4	L Min.	Crimping die size
	All dimensions are in mm (*)			
25	7	22	130	22
35	8	22	130	22
50	8.8	22	130	22
70	11.2	22	130	22
95	12.3	22	130	22
120	14	22	130	22
150	15	28.5	130	28
185	18.3	28.5	130	28
240	20.2	32.5	130	32
300	22.7	32.5	130	32
400	25.5	42	130	42
500	28.6	44	130	44
630	32.5	44.5	130	44

(*) The above dimensions are subjected to a manufacturing tolerance up to ± 1 mm.
The recommended die is the Hexagonal type, with hydraulic crimping tool.
The crimping area of the lug should not be less than 70% of the lug barrel length.
Minimum number of compressions charts are 3.

TECHNICAL DATA SCHEDULE

_ _ EDC Inquiry No:_____ Item No:_____

No.	DESCRIPTION	_ _ EDC Specified Values	Vendor Proposed Values
	Lugs		
1	Manufacturer	---	
2	Manufacturer Catalogue No.	---	
3	Country of Origin	---	
4	Material	Cu / Al / Bimetallic	
5	Material Compliance	Yes / No	
6	Material purity (%)	Cu 99.9 % / Al 99.5 %	
7	Material conductivity (IACS)	Cu 96 % / Al 56 %	
8	Cable / Conductor Size (mm^2)	10 up to 500	
9	Bolt Size	M6 / M8 / M10 / M12 / M16 / M20	
10	Tin-Plating Thickness (µm)	- / 5	
11	Submittals Required Included	Yes / No	

I / We guarantee the technical date given above for the offered material/equipment.

Description	Manufacturer of Material/Equipment	Vendor/Supplier
Vendor/Supplier		
Location and Office Address		
Name and Signature of Authorized Representative with Date		
Official Seal / Stamp		