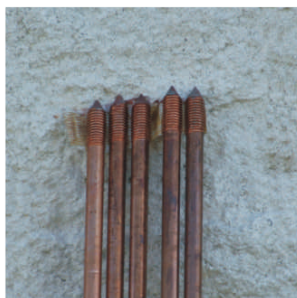


11. Earth Networks and Arresters



● GROUND ELECTRODES



Characteristics

- A ground electrode comprising a steel core of high mechanical strength, threaded at both ends and coated with a layer of electrolytic copper, 99.9% pure, with a minimum thickness of 250 microns.
- Approved by the general direction of energy - Article 156 of the safety regulation of high voltage power lines.

Copper thickness	Sizes		Reference
	mm	inches	
250 microns	16x1500	5/8"	J1558/RR
	16x2000	5/8"	J2058RR
	19x2000	3/4"	J2034RR
50 microns	16x1540	5/8"	15CG
	16x2000	5/8"	20CG

● GROUND ELECTRODE ACCESSORIES

● 'G' TYPE BRONZE CLAMPS WITH BRONZE OR STAINLESS SCREW



Admissible conductors (mm2)		electrode max radius (mm)	Reference
Min	Max		
10	70	16	KR-1 Latão
10	70	16	KR-1 Inox
25	95	20	KR-2

● STEEL STOPPERS



electrode max radius (mm)	Reference
16	ST 200
(5/8")	ST 300

● SCREW JOINTS IN AL/BRONZE



electrode max radius (mm)	Reference
16	CG 270
(5/8")	CG 300

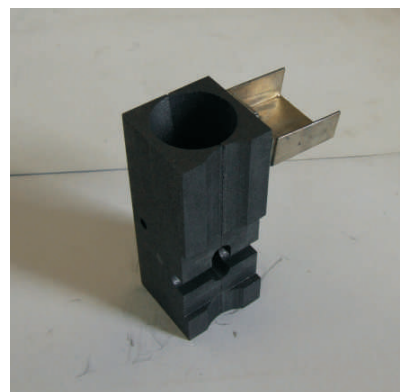
● ALUMINOTHERMIC WELDING - MOLDS

Characteristics

- The aluminothermic welding uses high-temperature chemical reaction between copper oxide and aluminum, to weld parts (cable / cable, etc.) within a graphite mold. Can be welded by this process, copper / copper or copper / regular steel, stainless steel or galvanized, as well as rails, bronze, brass, etc.
- The aluminothermic mixture is contained in the same cartridge (color cap) with the respective charge (black top) for igniting the mixture. Along with these, metal discs that prevent leakage of the mixture through the hole of the mold are provided.
- The respective molds and cartridges are chosen in the following tables, as well as tweezers and rasparadores.
- The molds are made of graphite, heat resistant material and can be normal or mini. Normal allow between 70 to 100 welds, mini between 25 and 30 welds.
- Mini molds are commonly used for copper connections / helisteel, wherein helisteel is already in a structure and uses a special clamp together with a fiberglass board. In case of using ordinary copper molds for welding / helisteel and since the molds are composed of three parts, a pinch clamp beyond the normal gripper is required.

● TYPE 'CR' MINI MOLDS AND ACCESSORIES

Cartridge	Reference
C-45	M/CR-PH 10-40/25
C-45	M/CR-PH 10-40/35
C-90	M/CR-PH 10-40/50
C-90	M/CR-PH 10-40/70
C-90	M/CR-DP 10-40/50
C-90	M/CR-DP 10-40/70
	TSC 50R tweezer
	Gasket

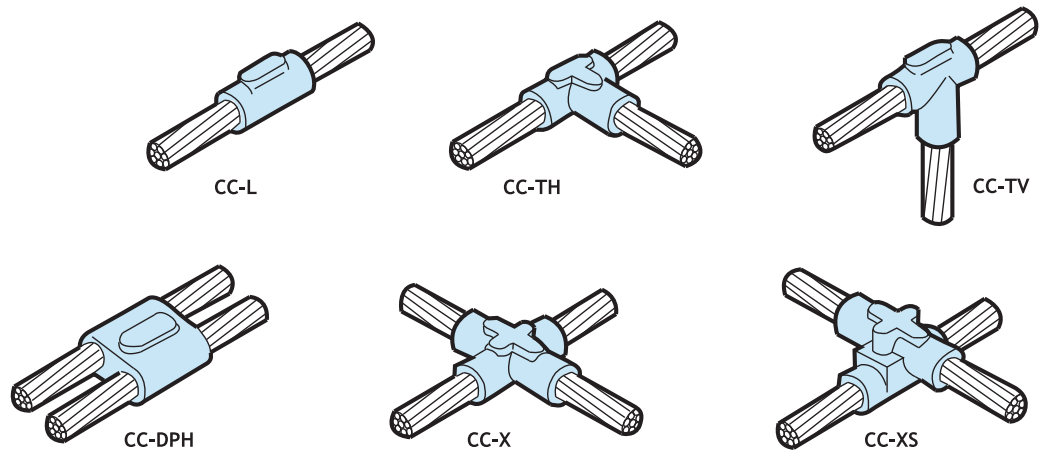


● OTHER MINI MOLDS AND ACESSORIES

Cartucho	Referência
C-45	M/CC-TH 35/35
C-65	M/CC-TH 35/50
C-90	M/CC-TH 50/50
C-65	M/CC-X 35/35
C-90	M/CC-X 35/50
C-90	M/CC-X 50/50
C-90	M/CP-T 58/50
	TSC-50 tweezer

● COMMON CONNECTIONS

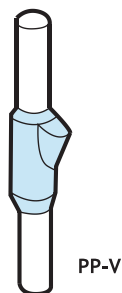
● CABLE / CABLE



CC-L	CC-TH CC-TV	CC-DPH	CC-X	CC-XS	25	35	50	70	95	120	150	185	240
25					C-32								
35					C-45	C-45							
50	25				C-45	C-45	C-45						
70	35				C-45	C-45	C-65	C-65					
95	50				C-65	C-65	C-90	C-90	C-90				
120	70	25	25		C-65	C-65	C-90	C-90	C-90	C-115			
150	95	35	35		C-90	C-90	C-90	C-90	C-115	C-115	C-115		
185	120	50	50		C-90	C-90	C-90	C-90	C-115	C-150	C-150	C-150	
240	150	70	70	25	C-90	C-115	C-115	C-115	C-150	C-150	C-200	C-200	C-200
	185	95	95	35	C-115	C-115	C-115	C-150	C-150	C-200	C-200	C-200	C-250
	240	120	120	50	C-115	C-115	C-150	C-150	C-200	C-200	C-200	C-250	2xC-150
		150	150	70		C-150	C-200	C-200	C-200	C-250	C-250	2xC-150	2xC-200
		185	185	95		C-200	C-250	C-250	C-250	C-250	C-250	C-250	2xC-250
		240	240	120			C-200	C-250	2xC-150	2xC-150	2xC-200	2xC-200	2xC-250
				150			C-250	2xC-150	2xC-150	2xC-200	2xC-200	2xC-200	2xC-250
				185				2xC-200	2xC-200	2xC-250	2xC-250	2xC-250	

TSC 80 tweezer TSC 100 tweezer

● ELECTRODE / ELECTRODE

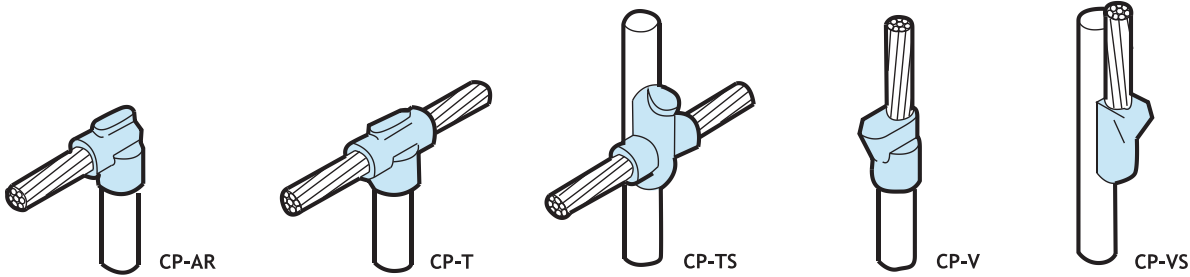


PP-V	
143	C-200
146	C-200
58	C-200
183	2xC-150
34	2xC-150

TSC 80 tweezer

● COMMON CONNECTIONS

● CABLE / ELECTRODE




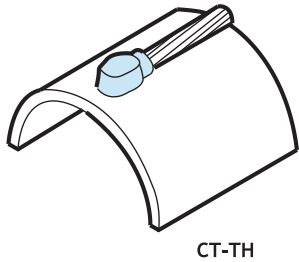
CP-AR	CP-T	P-TS	CP-V	CP-VS	25	35	50	70	95	120	150	185	240
143			143		C-65	C-65	C-90	C-90	C-90	C-90	C-115	C-115	C-150
146			146		C-65	C-65	C-90	C-90	C-90	C-90	C-115	C-115	C-150
58			58		C-65	C-65	C-90	C-90	C-90	C-90	C-115	C-115	C-150
183			183		C-90	C-90	C-90	C-90	C-90	C-90	C-115	C-115	C-150
34			34		C-90	C-90	C-90	C-90	C-90	C-90	C-115	C-115	C-150
	143				C-90	C-90	C-90	C-115	C-115	C-150	C-200	C-200	C-250
	146				C-90	C-90	C-90	C-115	C-115	C-150	C-200	C-200	C-250
	58				C-90	C-90	C-90	C-115	C-115	C-150	C-200	C-200	C-250
	183				C-90	C-90	C-115	C-115	C-115	C-150	C-200	C-200	C-250
	34				C-90	C-90	C-115	C-115	C-115	C-150	C-200	C-200	C-250
		143			C-90	C-90	C-115	C-115	C-115	C-150	C-150	C-250	2xC-200
		146			C-90	C-90	C-115	C-115	C-115	C-150	C-150	C-250	2xC-200
		58			C-90	C-90	C-115	C-115	C-150	C-150	C-150	C-250	2xC-200
		183		143	C-90	C-90	C-115	C-150	C-150	C-200	C-250	2xC-150	2xC-250
		34		146	C-90	C-90	C-115	C-150	C-150	C-200	C-250	2xC-150	2xC-250
				58	C-90	C-90	C-115	C-150	C-200	C-200	C-250	2xC-150	2xC-200
				183	C-90	C-90	C-115	C-150	C-200	C-200	C-250	2xC-150	2xC-200
				34	C-90	C-90							

 TSC 80 tweezer

● CABO / STEEL TUBING

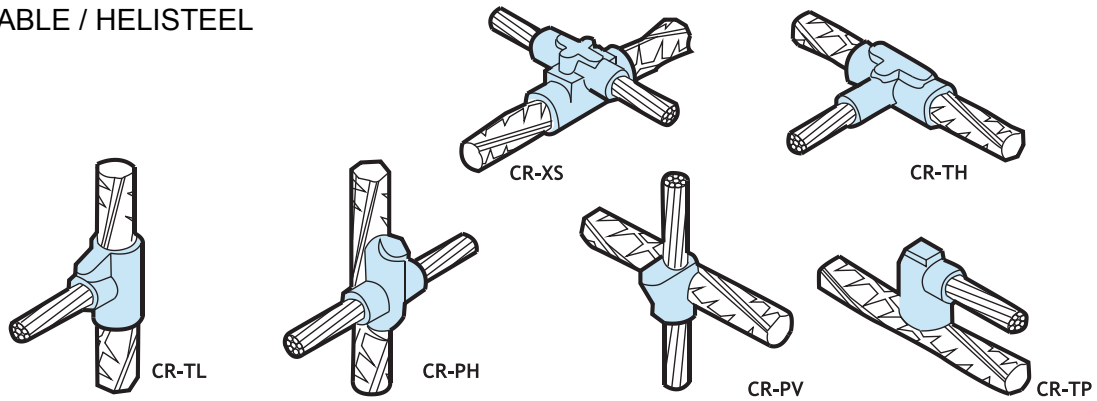
CT-TH	
10	C-15
16	C-15
25	C-25
35	C-32
50	C-45
70	C-65

 Tweezer cable-tube MS



● COMMON CONNECTIONS

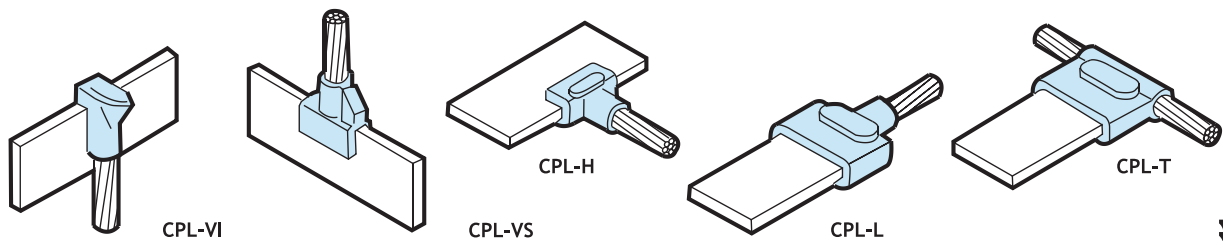
● CABLE / HELISTEEL



CR-XS	CR-TH	CR-TL	CR-PV	CR-PH	CR-TP	25	35	50	70	95	120	150	185	240
	10			10	10	C-90	C-90	C-115	C-115	C-150				
10			10			C-90	C-90	C-115	C-150	C-150				
		10		16	16	C-90	C-90	C-115	C-115	C-150	C-150	C-200		
				20	20	C-90	C-90	C-115	C-115	C-150	C-150	C-200	C-250	C-250
				20		C-90	C-90	C-115	C-115	C-150	C-150	C-200	C-250	2xC-200
			16			C-115	C-115	C-150	C-150	C-200	C-200	C-200		
			20			C-115	C-115	C-150	C-150	C-200	C-200	C-250	C-250	2xC-150
	16	16				C-150	C-150	C-150	C-150	C-200	C-200	C-250		
	20					C-150	C-150	C-200	C-200	C-200	C-250	C-250	2xC-150	2xC-200
16						C-115	C-115	C-150	C-150	C-200	C-200	C-200		
20						C-115	C-115	C-150	C-150	C-200	C-200	C-250	C-250	2xC-150
		20				C-150	C-150	C-200	C-200	C-200	C-250	C-250	2xC-150	2xC-200

□ TSC 80 tweezer ▤ TSC 100 tweezer

● CABLE / BAR

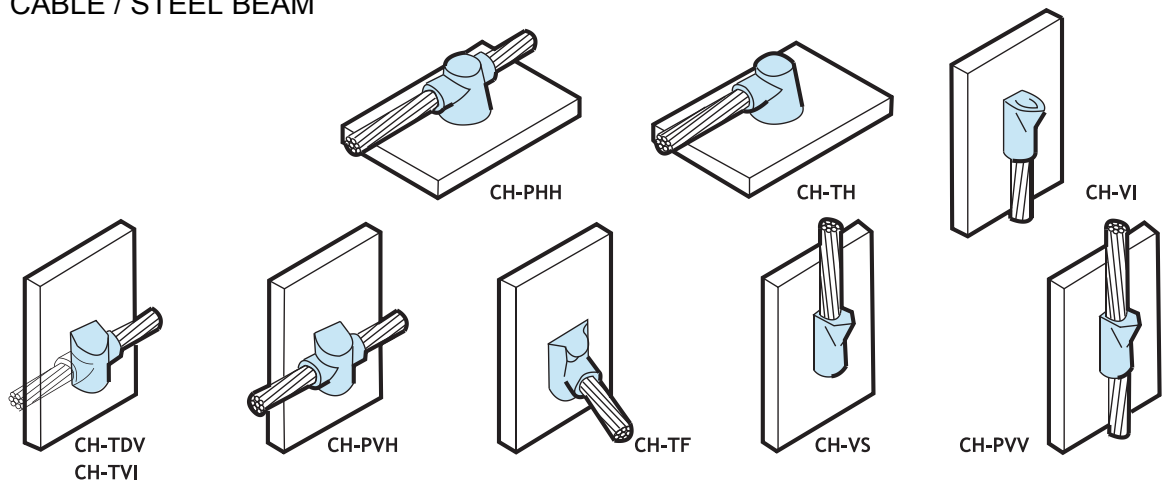


CPL-VI	CPL-VS	CPL-H	CPL-T	CPL-L	20x2	20x3	20x5	25x3	25x5	30x3	30x5	40x3	40x5	50x5	60x5
		25		25	C-32	C-45									
		35	25	35	C-45	C-45	C-45	C-45							
		50	35	50	C-45	C-45	C-65	C-65							
	25	70	50	70	C-45	C-65	C-65	C-90	C-90						
25	35	95	70	95	C-65	C-90	C-90	C-90	C-115	C-115					
35	50	120		120		C-115	C-115	C-115	C-115	C-115	C-115	C-115			
50	70	150		150		C-115	C-115	C-115	C-115	C-150	C-115	C-115	C-115	C-150	
70	95	185	95	185		C-115	C-150	C-150	C-150	C-150	C-150	C-150	C-150	C-200	
95	120	240	120	240		C-150	C-150	C-150	C-150	C-200	C-200	C-200	C-200	C-250	2xC-150
120	150			150			C-200	C-200	C-200	C-200	C-200	C-250	C-250	2xC-150	2xC-150
150	185			185				C-200	C-200	C-250	C-250	C-250	C-250	2xC-150	2xC-150
185	240			240					C-250	C-250	C-250	2xC-150	2xC-150	2xC-150	2xC-200
240										C-250	C-250	C-250	2xC-150	2xC-150	2xC-200



□ TSC 80 tweezer ▤ TSC 100 tweezer

● COMMON CONNECTIONS

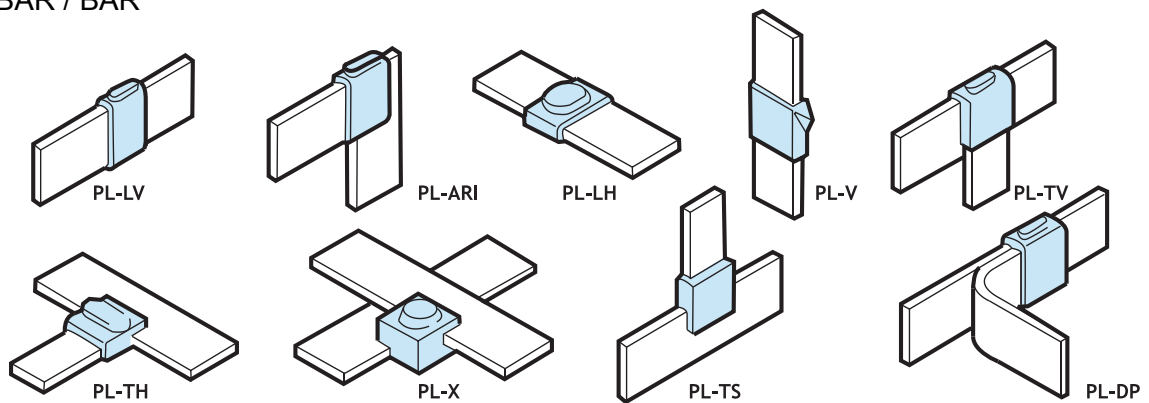
● CABLE / STEEL BEAM





	CH-TF	CH-TH	CH-VI	CH-TDV CH-TVI	CH-PHH	CH-PVH	CH-VS	CH-PVV
25	C-45	C-45	C-45	C-45	C-65	C-65	C-65	C-90
35	C-45	C-65	C-65	C-65	C-90	C-90	C-90	C-115
50	C-90	C-90	C-90	C-90	C-90	C-115	C-115	C-150
70	C-90	C-90	C-90	C-90	C-115	C-115	C-150	C-200
95	C-11	C-115	C-115	C-115	C-115	C-150	C-200	C-250
120	C-115	C-115	C-115	C-115	C-150	C-150	C-200	C-250
150	C-150	C-150	C-150	C-150	C-200	C-200	C-250	2xC-150
185	C-200	C-200	C-150	C-200	C-250	C-250	2xC-150	2xC-150
240	C-200	C-200	C-200	C-200	2xC-150	2xC-150	2xC-150	2xC-200

 TSC 80 tweezer
 TSC 100 tweezer

● BAR / BAR

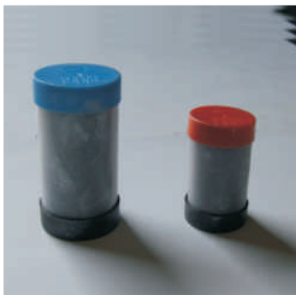


	PL-LV	PL-ARI	PL-TV	PL-V	PL-TS	PL-DP	PL-LH	PL-TH	PL-X
20x2	C-45	C-45	C-45	C-65	C-115	C-90	C-45	C-45	C-45
20x3	C-45	C-45	C-65	C-65	C-115	C-90	C-45	C-45	C-65
20x5	C-65	C-65	C-65	C-90	C-150	C-90	C-65	C-65	C-65
25x3	C-65	C-65	C-90	C-90	C-150	C-90	C-65	C-65	C-65
25x5	C-90	C-90	C-90	C-115	C-200	C-90	C-90	C-90	C-90
30x3	C-90	C-90	C-90	C-115	C-200	C-115	C-90	C-90	C-90
30x5	C-115	C-115	C-115	C-150	C-250	C-115	C-115	C-115	C-115
40x3	C-115	C-115	C-115	C-150	C-250	C-115	C-150	C-150	C-115
40x5	C-150	C-150	C-150	C-200	2xC-150	C-200	C-150	C-150	C-150
50x5	C-200	C-200	C-200	C-250	2xC-200	C-200	C-200	C-200	C-200
60x5	2xC-150	2xC-150	2xC-150	2xC-150	2xC-250	2xC-200	2xC-150	2xC-150	C-250

 TSC 80 tweezer
 TSC 100 tweezer

● ALUMINOTHERMIC WELD - ACCESSORIES

● CARTRIDGES



Reference

C-32
C-45
C-65
C-90
C-115
C-150
C-200
C-250

● MOLD SCRAPERS



Reference

R-45 (P/C-45 e C-65)
R-90 (P/C-90 e C-115)
R-150 (P/C-150 e C-250)

● TWEEZERS



Reference

TSC-80
TSC-100
TSC-50
TSC-50 R

● CLEANING BRUSH / CABLES



Reference

Cleaning brush

● ALUMINOTHERMIC WELD - ACCESSORIES

● LIGHTER AND FILLING MASS

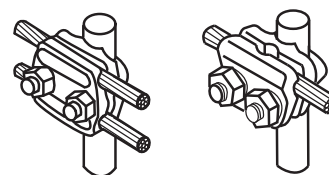
Reference
Lighter
Mass (1kg package)



● CONNECTORS FOR ELECTRODES

Characteristics

- Bronze connectors with galvanized screws
- Stainless alternative

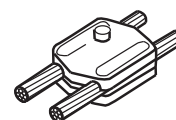


Permissible conductors (mm ²)				maximum radius of the electrode (mm)	Reference
Cable: Min.	Max.	Ø Wire: Min.	Max.		
16	16	4	6	16	KU-16.16
25	25	6	11	(5/8")	KU-16.25
25	25	6	11	16	KU-20.25
70	70	10	13	20	KU-16.63
95	95	10	18	(3/4")	KU-20.12
25	25	6	11	16 e 20	KB-16.25
70	70	10	13	20	KB-16.63
95	95	13	18	16 e 20	KB-20.12

● VARIOUS CONNECTORS - REN TYPE

Characteristics

- Bronze connectors with galvanized screws
- Stainless screw alternative, REN type



Permissible conductors (mm ²)				Thread	Type	Reference
Cable: Min.	Max.	Ø Wire: Min.	Max.			
25	70	6	11	M8x35	-	KBL-25
70	95	11	13	M12x60	-	KBL-63
95	185	13	18	M10x55	-	KBL-125
25	70	6	11	M8x35	'C'	KBL-25I
25	70	6	11	M12x60	'M'	KBL-25S-M12
25	70	11	11	M16x60	'M'	KBL-25S-M16
Cable		Electrode		M10	'E'	KB-16.5I
25	70	16	20			

● BROKEN PIN CONNECTORS

Characteristics

- High electrical and mechanical characteristics
- Made of anticorrosion bronze
- Suitable for joints and derivations between AL / CU or CU / CU conductors with central tab

● KSU AL-AL/ AL-CU



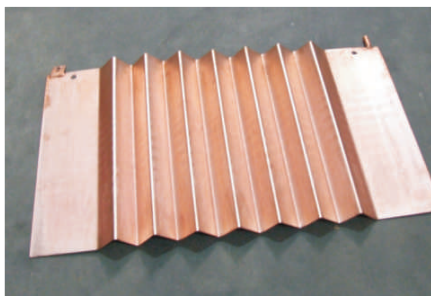
Passer AL (mm ²)	Derived CU/AL (mm ²)	Reference
4-10	2-10	KSU17
6-16	6-16	KSU20
6-25	6-25	KSU22
10-35	10-35	KSU23
35-50	6-50	KSU25
35-70	10-70	KSU26
50-120	10-120	KSU29
50-185	25-185	KSU31
185-240	35-240	KSU34

● KS CU-CU



Passer CU (mm ²)	Derived CU (mm ²)	Reference
4-6	1,5-6	KS90
6-8	2,5-8	KS15
10	2,5-8	KS17
10-16	2,5-16	KS20
16-25	2,5-25	KS22
16-35	2,5-35	KS23
25-50	2,5-50	KS25
35-70	2,5-70	KS26
50-95	10-95	KS27
50-120	10-120	KS29
50-185	10-185	KS31
70-240	70-240	KS34
95-400	95-400	KS39
150-500	95-500	KS44

● GROUND PLATES



Characteristics

- Solid copper or coppery
- Used for dispersion of discharges

length	Sizes (mm)		Reference
	width	thick.	
1000	500	2	Wavey coppery
1000	1000	2	Solid wavey

● LIGHTNING RODS AND ACCESSORIES

Characteristics

- A system for lightning protection, consists of capture devices of the type:

- Ionizing lightning rods
- Franklin type lightning rods
- Shanks for Faraday cage

And the following elements:

- Mast with fastening set
- Conductor and clamps
- Ground measuring case / removable connector
- Protection gutter
- Ground electrode, clamp / aluminothermic welding

● IONIZING LIGHTNING RODS

Range with 6m mast			
Level I	Level II	Level III	Reference
40 mts	60 mts	70 mts	9001
50 mts	70 mts	80 mts	9002
65 mts	80 mts	90 mts	9003
80 mts	93 mts	107 mts	9004



● FRANKLIN TIP

Designation	Reference
Franklin tip in stainless steel	13001



● ACCESSORIES

Designation	Reference
Adapter piece for lightning rod / pole / conductor	15001
Mast extension - galvanized steel 6m	16001
Wall mount for mast	17001
Plastic clamp for cable / tape	18008
Box proving ground / removable	21011
Metallic protection tube 3m	21013
Compound for land improvement	21015
Visit box in PCV 300x300	21018B
Solid copper conductor 8mm / 50m2	18005
Flat galvanized steel conductor 30x3.5	215025
Flat stainless steel conductor 30x2	215026
Discharges conductor	21012