COPPER

- **TECHNICAL AND PHYSICAL PROPERTIES**
- **DIMENSIONAL TABLES AND WEIGHTS**

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COPPER: TECHNICAL AND PHYSICAL SPECIFICATIONS - (page 01)

DESIGNATION AND COMPOSITION OF THE COMMERCIAL COPPER

Standard			Designations					
Country	**Standard**	**Number**	**Electrolytic cathodes**	**From smelting of CU-CATH**	**Refined oxygen free**	**Oxidized with low content of phosphorus**	**Oxidized with high content of phosphorus**	**Thermally refined**
ITALY	**UNI**	**1652 5649 12449**	**Cu-CATH**	**Cu-ETP**	**Cu-OF**	**Cu-DLP**	**Cu-DHP**	**Cu-FRT**
GERMANY	DIN	1787	Ke-Cu	E-Cu	SE-Cu		SF-Cu	F-Cu
U.S.A	ASTM	C11000 C12200	Cath					
COMPOSITION								
Copper + Silver	Cu + Ag	min	99,900	99,900	99,950	99,900	99,850	99,850
Bismuth	Bi	max	0,001	0,001	0,001	0,001	0,001	0,002
Lead	Pb	max	0,005	0,005	0,002	0,010	0,010	0,010
Oxygen	O	max	-	0,040	-	-	-	-
Phosphorus	P	min	-	-	-	0,005	0,013	-
		max	-	-	0,012	0,050	0,050	-
Arsenic	As	max	0,0015	-	-	-	-	-

ELECTRICAL PROPERTIES AND APPLICATIONS OF COPPER

COPPER ALLOYS

PROPERTIES AND APPLICATIONS / **ELECTRICAL PROPERTIES AT 20° C**	**Cu-CATH electrolytic in cathodes**	**Cu-ETP from smelting of Cu-CATH**	**Cu-OF refined oxygen free**	**Cu-DLP oxidized with low content of phosphorus**	**Cu-DHP oxidized with high content of phosphorus**	**Cu-FRT thermally refined**
Resistivity ($\Omega \cdot mm^2$) / m	0,0172241	0,017543	0,017241	0,019156	0,02463	0,02
Conductivity % IACS	100	98,28	100	90	70	90
MAIN APPLICATIONS OF THE DIFFERENT TYPES OF COPPER						
Electrical conductors and electrical parts		▮	▮			
Roof coverings, gutters, down pipes				▮	▮	▮
Heating and sanitary systems					▮	
Food containers				▮	▮	▮
Autoclaves and heat exchangers		▮		▮	▮	
Nails and rivets			▮			▮
Deep-drawn cups				▮	▮	▮
Smeltings and alloys	▮					

COPPER: PROPERTIES - (page 02)

MECHANICAL PROPERTIES OF THE SEMIFINISHED PRODUCTS

TYPE OF SEMI-FINISHED PRODUCT	Type of Copper	Physical Condition	Symbol of the Physical Condition	Max. Thickness in mm.	R Ultimate Tensile Strength (min.) (kg/mm^2)	A Elongation (%)	HB Brinell Hardness (kg/mm^2)
EXTRUDED BARS AND PROFILES	**ETP OF DLP-DHP FRTP**	Not treated	Hp		20	18	50
DRAWN BARS AND PROFILES	**ETP OF DLP-DHP FRTP**	Annealed	R	–	20	40	40-60
		hardened 10	H 10	6 - 20	25	10	60 - 75
		hardened 20	H 20	6 - 20	30	15	75 - 90
SHEETS, COILS, STRIPS	**ETP OF DLP-DHP FRTP**	Annealed	R	all	20	40	40 -60
		hardened 10	H 10	7	26	15	60 - 85
		hardened 20	H 20	4	30	5	74 - 100
		hardened 30	H 30	2	37	2	90 min.
TUBES	**ETP OF DLP-DHP FRTP**	Annealed	R	< 3	22	40	40
				≥ 3	20	40	40
		hardened 05 on the surface	H 05	3	23	35	45
		hardened 10	H 10	7	26	18	60
		hardened 20	H 20	5	30	8	75
		hardened 30	H 30	3	37	3	90
WIRES	**ETP OF DHP**	Annealed	R	**Ø mm**	**R (min.)**	**A 100**	**A 500** / **HB**
				0,3 - 0,5	22	20	15 / –
				0,5 - 1,5	22	20	– / –
				1,5 - 8	22	25	– / –
		hardened 10	H10	1,5 - 8	28	6	– / –
		hardened 20	H20	< 1,5	38	–	0,5 / –
				1,5 - 8	38	1	– / –

COPPER: TECHNICAL AND PHYSICAL PROPERTIES - (page 03) (*Rev.30-03-'15*)

SPECIAL COPPER ALLOYS

ALLOY		Beryllium Copper Cu Be 1	Beryllium Copper Cu Be2	Cobalt Beryllium Copper Cu Co2 Be1	Cobalt Nickel Beryllium Cu Co Ni Be	Tellurium Copper Cu Te	Chromium Zirconium Copper Cu Cr Zr
Chemical Composition	Cu	97	98	Resto	Resto	99,5	Remainder
	Be	0,5	1,8 - 2,1	0,4 - 0,7	0,4 - 0,7	–	–
	Ni	2,5	0,3	max. 0,3	0,8 - 1,3	–	–
	Co	–	–	2,4 - 2,7	0,8 - 1,3	–	–
	Cr	–	–	–	-	–	1,0
	Zr	–	–	–	-	–	1,0
	Te	–	–	–	-	0,5	–
	Si	–	–	max. 0,2	max. 0,2	–	–
	Al	–	–	max. 0,1	max. 0,1	–	–
	Fe	–	–	max. 0,1	max. 0,1	max 0,1	–
Analytical correspondence	UNI / EN.		2528	CW104C	CW103C	5649-2a	5649-2a
	DIN	17666	17666	CuCo2Be	CuCoNiBe	17666	17666
	ASTM	C17500	C17200	C 17500	–	C14500	C18100
	AFNOR	U Be1	U Be2	UK 2 Be	–		CC12
MECHANICAL AND PHYSICAL PROPERTIES							
Tensile Strength	N/mm^2	780 ÷ 850	900 ÷ 1200	Min. 650	Min. 750	200÷270	400 ÷ 485
Yield Strength	N/mm^2	500 ÷ 580	700 ÷ 1000	Min. 500	Min. 600		325 ÷ 380
Elongation	A5%	5 ÷ 14	0 ÷6	Min. 8	Min. 8	7 ÷ 20	8 ÷ 25
Brinnell Hardness	HB	230 ÷ 260	340 ÷ 400	Min. 220	Min. 260	40 ÷ 80	110 ÷ 150
Mass	Kg/dm^3	8,45	8,40	8,80	8,80	8,94	8,92
Resistivity	$(\Omega \cdot mm^2)/m$	0,040	0,0714	–	–	0,0203	0,0242
Heat Conductivity	W/cm-K	1,51	0,85	2,1 - 2,4	2,3 -2,5	3,70	2,95
Coeff. of Thermal Expansion	$x \cdot 10^{-6}/K$	17,0	17,0	17,2	17,2	17,0	17,0
Modulus of elasticity	KN/mm^2	120	135	135	135	130	127

APPLICATIONS

BERYLLIUM COPPER Cu Be1	Bars for electric conductivity, nozzles for autogenous and wire welding, pistons for die casting, electrodes for resistance welding, molds for brass smelting, inserts for plastic molds, ingot molds for continuous casting.
BERYLLIUM COPPER Cu Be2	Thermoabsorbent inserts for plastic moulding, items with very high mechanical characteristics and average electrical conductivity.
COBALT BERYLLIUM Cu Co2 Be	Bars for electric conductivity, nozzles for autogenous and wire welding, pistons for die casting, electrodes for resistance welding, molds for brass smelting, inserts for plastic molds, ingot molds for continuous casting.
TELLURIUM COPPER Cu Te	Items for the electromechanical and electronic industry. Electric contacts resistant to erosion from electric arcs, nozzles for wire welding.
CHROMIUM ZIRCONIUM Cu Cr Zr	Electrodes for resistance welding, electrical contacts, ingot molds for continuous casting, rings for short-circuit and bars for rotors. Items with high mechanical and electrical characteristics.

COPPER: DIMENSIONAL TABLES AND WEIGHTS - (page 04)

DRAWN RECTANGULAR BARS IN COPPER E.T.P. 99,9 SHARP EDGES

Dimension (mm)	Weight Kg/mt	Dimension (mm)	Weight Kg/mt	Dimension (mm)	Weight Kg/mt
2 x 10	0,18	6 x 50	2,67	20 x 30	5,33
2 x 15	0,27	6 x 60	3,20	20 x 35	6,25
2 x 20	0,36	6 x 80	4,32	20 x 40	7,11
2 x 25	0,44	6 x 100	5,34	20 x 50	8,89
2 x 30	0,53	8 x 15	1,07	20 x 60	10,70
2 x 35	0,62	8 x 20	1,42	20 x 70	12,46
2 x 40	0,71	8 x 25	1,78	20 x 80	14,20
3 x 10	0,27	8 x 30	2,14	20 x 90	16,02
3 x 12	0,32	8 x 35	2,50	20 x 100	17,80
3 x 15	0,40	8 x 40	2,85	20 x 120	21,40
3 x 20	0,53	8 x 50	3,56	20 x 150	26,80
3 x 25	0,67	8 x 60	4,27	20 x 200	35,60
3 x 30	0,80	8 x 80	5,68	25 x 30	6,68
3 x 40	1,07	8 x 100	7,12	25 x 40	8,90
3 x 50	1,34	8 x 120	8,56	25 x 50	11,13
4 x 10	0,36	10 x 15	1,34	25 x 60	13,35
4 x 12	0,43	10 x 20	1,78	25 x 70	15,60
4 x 15	0,53	10 x 25	2,23	25 x 80	17,80
4 x 20	0,71	10 x 30	2,67	25 x 100	22,25
4 x 25	0,89	10 x 35	3,12	25 x 120	26,76
4 x 30	1,07	10 x 40	3,56	25 x 200	44,60
4 x 35	1,25	10 x 50	4,45	30 x 40	10,68
4 x 40	1,42	10 x 60	5,34	30 x 50	13,34
4 x 45	1,60	10 x 70	6,23	30 x 60	16,20
4 x 50	1,78	10 x 80	7,12	30 x 70	18,80
4 x 60	2,14	10 x 100	8,90	30 x 80	21,40
4 x 70	2,49	10 x 120	10,70	30 x 100	26,70
4 x 80	2,85	10 x 150	13,40	30 x 120	32,10
5 x 10	0,45	10 x 160	14,30	30 x 150	40,20
5 x 12	0,53	10 x 200	17,80	30 x 200	53,40
5 x 15	0,67	12 x 25	2,67	40 x 50	17,84
5 x 20	0,89	12 x 30	3,20	40 x 60	21,36
5 x 25	1,10	12 x 40	4,27	40 x 80	28,80
5 x 30	1,34	12 x 50	5,34	40 x 100	36,00
5 x 40	1,78	12 x 60	6,40	40 x 120	43,20
5 x 45	2,00	12 x 80	8,54	40 x 150	53,40
5 x 50	2,23	12 x 100	10,68	40 x 200	71,20
5 x 55	2,44	12 x 120	12,84	50 x 60	26,76
5 x 60	2,67	12 x 150	16,50	50 x 80	35,60
5 x 70	3,12	15 x 20	2,67	50 x 100	45,00
5 x 80	3,65	15 x 30	4,00	50 x 120	53,40
5 x 100	4,45	15 x 40	5,34	50 x 150	67,50
5 x 120	5,35	15 x 50	6,68	50 x 200	89,00
6 x 15	0,80	15 x 60	8,01	60 x 100	53,40
6 x 20	1,07	15 x 70	9,37	60 x 150	80,10
6 x 25	1,34	15 x 80	10,70	60 x 200	106,80
6 x 30	1,60	15 x 100	13,40	70 x 100	62,30
6 x 35	1,87	15 x 120	16,02	70 x 120	74,76
6 x 40	2,14	15 x 150	20,00	70 x 200	124,60
6 x 45	2,41	15 x 200	26,70		

Standard length of the bars 4'000 / 4'200 mm.

Other dimensions, heat treatments and alloys can be made upon customer request.

COPPER: DIMENSIONAL TABLES AND WEIGHTS - (page 05)

DRAWN COPPER BARS E.T.P. 99,9

RECTANGULAR BARS FULL RADIUS

Dimension (mm)	Weight Kg/mt.	Dimension (mm)	Weight Kg/mt.
2 x 25	0,42	6 x 100	5,27
3 x 15	0,40	8 x 20	1,42
3 x 20	0,52	8 x 25	1,78
3 x 25	0,65	8 x 30	2,01
3 x 30	0,78	8 x 40	2,73
3 x 40	1,03	8 x 50	3,44
4 x 20	0,71	8 x 60	4,15
4 x 25	0,86	8 x 80	5,48
4 x 30	1,04	8 x 100	7,00
4 x 40	1,39	10 x 20	1,78
4 x 50	1,72	10 x 25	2,23
4 x 60	2,14	10 x 30	2,48
5 x 20	0,86	10 x 40	3,37
5 x 25	1,11	10 x 50	4,35
5 x 30	1,29	10 x 60	5,15
5 x 40	1,73	10 x 80	6,93
5 x 50	2,18	10 x 100	8,71
5 x 45	1,90	10 x 120	10,49
5 x 60	2,62	10 x 160	14,30
5 x 80	3,15	10 x 200	17,84
5 x 100	4,30	12 x 60	6,40
6 x 20	1,07	12 x 80	8,56
6 x 25	1,34	12 x 100	10,70
6 x 30	1,53	15 x 30	4,00
6 x 40	2,07	15 x 50	6,63
6 x 50	2,60	15 x 60	8,01
6 x 60	3,09	15 x 80	10,54
6 x 80	4,17	20 x 40	7,11

SQUARE BARS

Dimension (mm)	Weight kg/mt	Dimension (mm)	Weight kg/mt
10 x 10	0,89	50 x 50	22,24
15 x 15	2,00	60 x 60	32,25
20 x 20	3,56	70 x 70	43,61
25 x 25	5,56	80 x 80	56,90
30 x 30	8,01	100 x 100	90,00
35 x 35	10,50	120 x 120	128,16
40 x 40	14,24		

ROUND BARS

Dimension (mm)	Weight Kg/mt.
3	0,06
4	0,11
5	0,18
6	0,25
7	0,34
8	0,45
9	0,57
10	0,70
11	0,85
12	1,01
13	1,18
14	1,37
15	1,58
16	1,79
18	2,27
20	2,80
22	3,39
25	4,38
28	5,49
30	6,30
32	7,17
35	8,58
40	11,20
45	14,18
50	17,50
55	21,15
60	25,13
65	29,50
70	34,20
75	39,30
80	44,66
85	50,50
90	56,53
100	69,79
110	85,20
120	101,20
130	118,00
150	158,40

Standard length of the bars 4.000 / 4.200 mm.
Other dimensions, heat treatments (physical condition) and special alloys can be made upon specific customer request.
We invite you to contact us to examine the feasibility.

COPPER: DIMENSIONAL TABLES AND WEIGHTS - (page 06)

COPPER SHEETS UNI EN 1652 D.H.P. 99,9 - E.T.P. 99,9 SIZES 1'000 X 2'000

PHYSICAL CONDITION: SOFT - HALF HARD - HARD

THICKNESS	WEIGHT OFTHE SHEET	THICKNESS	WEIGHT OFTHE SHEET
0,4	7,11	3	53,34
0,5	8,89	4	71,12
0,6	10,67	5	89,90
0,8	14,22	6	100,00
1	17,78	8	145,00
1,2	21,34	10	180,00
1,5	26,67	12	213,30
2	35,56	15	266,70
2,5	44,45	20	355,60

OTHER COPPER PRODUCTS TO BE PRODUCED OR SOURCED UPON REQUEST

COPPER coils - ETP 99,9 and DHP 99,9 in Hard - Half-hard and Annealed physical condition

Cutting width on customer request ranging from thickness 0.03 to 1 mm.

COPPER wire - ETP 99,9 - UNI EN 13602 from Ø 0,5 to Ø 10mm. annealed in rolls.

COPPER TUBES DHP 99,9 - UNI EN 12449

ANNEALED IN ROLLS of 50 meters

THICKNESS mm 1

Out.Ø x Ins.Ø (mm)	Weight kg/meter
4 x 2	0,084
5 x 3	0,112
6 x 4	0,140
7 x 5	0,168
8 x 6	0,195
10 x 8	0,251
12 x 10	0,308
14 x 12	0,363
15 x 13	0,391
16 x 14	0,419
18 x 16	0,475
22 x 20	0,587

THICKNESS mm 1,5

Out.Ø x Ins.Ø (mm)	Weight kg/meter
22 x 19	0,86

HARD IN BARS

THICKNESS mm 1

Out.Ø x Ins.Ø (mm)	Weight kg/meter
8 x 6	0,195
10 x 8	0,251
12 x 10	0,308
14 x 12	0,363
15 x 13	0,391
16 x 14	0,419
18 x 16	0,475
22 x 20	0,587
28 x 26	0,753
35 x 33	0,950
42 x 40	1,130

THICKNESS mm 1,5

Out.Ø x Ins.Ø (mm)	Weight kg/meter
22 x 19	0,860
28 x 25	1,111
35 x 32	1,403
42 x 39	1,705
54 x 51	2,160

Other dimensions, heat treatments (physical condition) and special alloys can be made upon specific customer request.

We invite you to contact us to examine the feasibility.