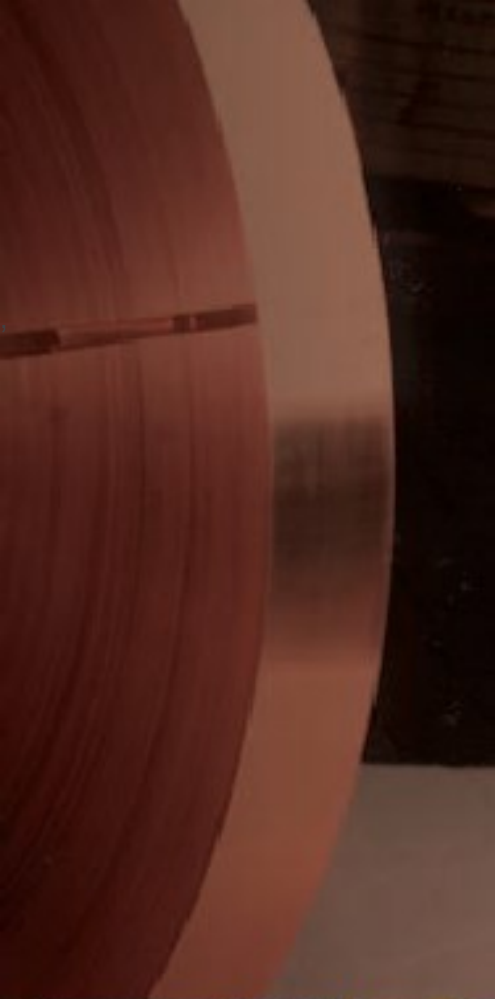




ROLLED PRODUCTS



Termomecanica



Termomecanica

TERMOMECANICA is one of the largest private industries in Brazil and a leader in the non-ferrous metal processing sector, specifically copper and its alloys, into semi-finished and finished products.

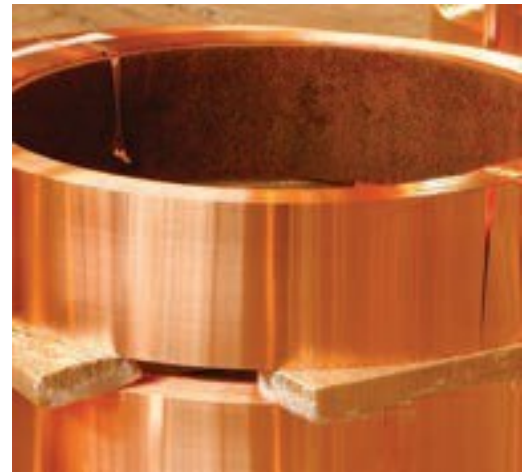
Founded in 1942 by Engineer Salvador Arena with a capital of US\$200 dollars, the company now operates six production units, with four in Brazil and two overseas, and has a capital worth over US\$800 million dollars. The company maintains a healthy growth rate, thanks to ongoing modernization and expansion programs that define its traditional profit reinvestment strategy.



OUR PRODUCTS

Bars, Rods, and Profiles, Strips and Sheets
Sections, Wires, Tubes, and Fittings,
Flexible Tubes, Hard Tubes,
Tubes for Industrial Application,
Refrigeration Tubes, Bronze bushing and
bearing sleeves produced with patent alloys

TM620 and TM23, anodes, copper ingots, and
copper alloys granules. Aluminum tubes, bus bars
and wire rods and its alloys.



Copper foils, including anodized
and electrolytic copper foils,
are used in the production of waveguides
and flexible cables,
electronic components, telecommunication
cable shielding,
gutters, and roofing tiles.

Fins for tubes and gutters are made of phosphor
bronze, as phosphorus added to copper acts as a
deoxidizer.

Red Brasses and Cartridge Brass are used in the
manufacturing of ammunition components, as well
as ornaments and electrical contacts.

Machine wire brass is used in the production of
musical instruments, lamp sockets, eyelets,
electronic components, radiator tanks, springs,
trays, ornaments, hinges, and sanitary metals.

APPLICATIONS

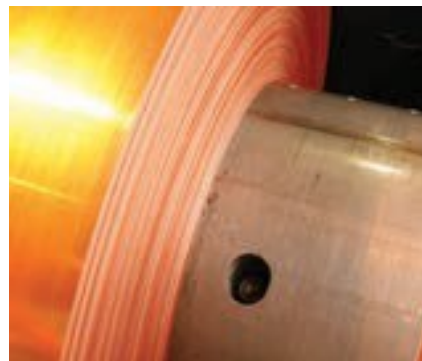
The Rolled Products, a generic term for tapes, strips and sheets, are manufactured with different alloys, dimensions, and shapes.

This product family is supplied in coils or straight sheets, with variable widths and thicknesses according to customer specifications.



ALLOYS

C10200, C10400, C11000, C12200, C21000, C22000, C22600, C23000, C26000, C26800, C35000, C42500, C51000, C51100, C51900 e C52100.



The brass key is also used for the gear train of watches, as well as keys for the automotive industry and conventional locks. In the manufacturing of fins for heat dissipation in radiators, microadditions of copper are used.

Phosphor bronze strips and sheets are the preferred option for application where the desired behavior of the final product is known as the "spring effect" found in different alloys with varied mechanical properties depending on the tin content.

The main applications are in contacts, switch parts, fuse holders, among others.

In addition to the highlighted alloys, Termomecanica also produces rolled products in special alloys that are developed based on market needs or according to customer specifications.

MANUFACTURING PROPERTIES

MECHANICAL PROPERTIES

ALLOY	TEMPER	ANNEALED	1/8 HARD	1/4 HARD	1/2 HARD	3/4 HARD	HARD	EXTRAHARD	SPRING	EXTRASPRING
COPPERS										
Oxygen free copper (OF) - C10200 Oxygen free silver (0.03%) - C10400 Electrolytic tough pitch (ETP) - C11000 Deoxidized high phosphorus (DHP) - C12200	Tensile Strength(MPa)	-	220 - 275	235 - 295	255 - 315	285 - 345	295 - 360	325 - 385	345 - 400	360 Minimum
	Tensile Strength(KSI)	-	32 - 40	34 - 42	37 - 46	41 - 50	43 - 52	47 - 56	50 - 58	52 Minimum
	Hardness (HRF)	65 maximum	54-82	60-84	77-89	82-91	86-93	88-95	91-97	92 Minimum
	Hardness (HR30-T)	-	49 maximum	18-51	43-57	47-59	54-62	56-64	60-66	61 Minimum
BRASS										
Tomback 95/05 Gilding, 95 % -C21000	Tensile Strength (MPa)	-	-	255 - 325	290 - 355	315 - 385	345 - 405	385 - 440	415 - 470	420 - 475
	Tensile Strength (KSI)	-	-	37 - 42	42 - 52	46 - 56	50 - 59	56 - 64	60 - 68	61 - 69
	Hardness (HRB)	50 - 61HRF*	-	20 - 52	40 - 60	50 - 64	57 - 67	64 - 72	68 - 75	69 - 76
	Hardness (HR30-T)	1 - 17*	-	34 - 54	46 - 59	52 - 62	57 - 64	62 - 67	64 - 69	65 - 70
Tomback 90/10 Commercial Bronze, 90 % - C22000	Tensile Strength (MPa)	-	-	275 - 345	325 - 395	355 - 425	395 - 455	440 - 495	475 - 530	495 - 550
	Tensile Strength (KSI)	-	-	40 - 50	47 - 57	52 - 62	57 - 66	64 - 72	69 - 77	72 - 80
	Hardness (HRB)	58 - 70HRF*	-	27 - 56	50 - 66	59 - 71	65 - 75	72 - 79	76 - 81	78 - 83
	Hardness (HR30-T)	13 - 31*	-	34 - 54	50 - 61	55 - 64	60 - 67	64 - 69	67 - 70	68 - 71
Tomback 87/13 Jewelry Bronze, 87 1/2 % - C22600	Tensile Strength (MPa)	-	-	290 - 355	330 - 400	365 - 435	400 - 460	450 - 505	485 - 540	510 - 565
	Tensile Strength (KSI)	-	-	42 - 52	48 - 58	53 - 63	58 - 67	65 - 73	70 - 78	74 - 82
	Hardness (HRB)	55 - 67HRF*	-	29 - 58	52 - 68	61 - 73	67 - 77	74 - 81	78 - 83	81 - 86
	Hardness(HR30-T)	14 - 29*	-	39 - 58	54 - 64	59 - 68	64 - 70	68 - 73	71 - 74	73 - 76
Tomback 85/15 Red Brass, 85 % - C23000	Tensile Strength(MPa)	-	-	305 - 370	350 - 420	395 - 460	435 - 495	495 - 550	540 - 595	565 - 620
	Tensile Strength(KSI)	-	-	44 - 54	51 - 61	57 - 67	63 - 72	72 - 80	78 - 86	82 - 90
	Hardness(HRB)	60 - 72HRF*	-	33 - 62	56 - 71	66 - 76	72 - 80	78 - 85	82 - 87	84 - 89
	Hardness(HR30-T)	16 - 34*	-	42 - 60	56 - 66	63 - 70	67 - 72	70 - 75	74 - 77	75 - 78
Cartridge 70/30 Cartridge Brass, 70 % - C26000	Tensile Strength(MPa)	-	-	340 - 405	395 - 460	440 - 510	490 - 560	570 - 635	625 - 690	655 - 715
	Tensile Strength(KSI)	-	-	49 - 59	57 - 67	64 - 74	71 - 81	83 - 92	91 - 100	95 - 104
	Hardness(HRB)	67 - 79HRF*	-	40 - 65	60 - 77	72 - 82	79 - 86	85 - 91	89 - 93	91 - 95
	Hardness(HR30-T)	27 - 42*	-	43 - 60	56 - 68	65 - 72	70 - 74	74 - 77	76 - 78	77 - 79
Wire Machine 67/33 Yellow Brass, 66 % - C26800	Tensile Strength(MPa)	-	-	340 - 405	380 - 450	425 - 495	470 - 540	545 - 615	595 - 655	620 - 685
	Tensile Strength(KSI)	-	-	49 - 59	55 - 65	62 - 72	68 - 78	79 - 89	86 - 95	90 - 99
	Hardness(HRB)	67 - 79HRF*	-	40 - 65	57 - 74	70 - 80	76 - 84	83 - 89	87 - 92	88 - 93
	Hardness(HR30-T)	27 - 42*	-	43 - 60	54 - 66	65 - 71	68 - 73	73 - 76	75 - 78	76 - 79
Brass 425 UNS C 42500	Tensile Strength(MPa)	-	-	340 - 405	395 - 475	425 - 510	485 - 565	525 - 605	580 - 650	635 Minimum
	Tensile Strength(KSI)	-	-	49 - 59	57 - 69	62 - 74	70 - 82	76 - 88	84 - 94	92 Minimum
	Hardness(HRB)	69 - 75HRF*	-	46 - 73	67 - 83	74 - 86	81 - 90	86 - 94	89 - 95	92 Minimum
	Hardness(HR30-T)	30 - 42*	-	45 - 67	63 - 72	66 - 73	70 - 76	71 - 77	73 - 78	76 Minimum
LEAD BRASS										
Medium Leaded Brass, 62% UNS C 35000	Tensile Strength(MPa)	-	-	340 - 405	380 - 450	-	470 - 540	545 - 615	595 - 655	620 - 685
	Tensile Strength(KSI)	-	-	49 - 59	55 - 65	-	68 - 78	79 - 89	86 - 95	90 - 99
	Hardness(HRB)	67-69HRF*	-	40 - 65	57 - 74	-	76 - 84	83 - 89	87 - 92	88 - 93
	Hardness(HR30-T)	27-42*	-	43 - 60	54 - 66	-	58 - 73	73 - 76	75 - 78	76 - 79
BRONZES										
Phosphor Bronze 96-4 (511) UNS C 51100	Tensile Strength(MPa)	275 - 380	-	-	380 - 485	-	495 - 600	580 - 685	625 - 730	660 - 745
	Tensile Strength(KSI)	40 - 55	-	-	55 - 70	-	72 - 87	84 - 99	91 - 106	96 - 108
	Hardness(HRB)	50 máximo	-	-	53 - 81	-	80 - 90	86 - 94	86 - 98	89 - 97
	Hardness(HR30-T)	16 - 50	-	-	52 - 73	-	69 - 77	73 - 80	75 - 81	76 - 82
Phosphor Bronze 95-5 (510) UNS C 51000	Tensile Strength(MPa)	295 - 400	-	-	400 - 505	-	525 - 625	605 - 710	655 - 760	690 - 785
	Tensile Strength(KSI)	43 - 58	-	-	58 - 73	-	76 - 91	88 - 103	95 - 110	100 - 114
	Hardness(HRB)	12 - 64	-	-	60 - 85	-	84 - 93	89 - 96	92 - 98	94 - 99
	Hardness(HR30-T)	24 - 59	-	-	53 - 73	-	71 - 78	74 - 81	76 - 82	77 - 83
Phosphor Bronze 94-6 (519) UNS C 51900	Tensile Strength(MPa)	330 - 435	-	-	440 - 545	-	550 - 660	-	-	-
	Tensile Strength(KSI)	48 - 63	-	-	64 - 79	-	80 - 96	-	-	-
	Hardness(HRB)	18 - 66	-	-	65 - 88	-	86 - 95	-	-	-
	Hardness(HR30-T)	25 - 64	-	-	58 - 76	-	72 - 80	-	-	-
Phosphor Bronze 92-8 (521) UNS C 52100	Tensile Strength(MPa)	365 - 460	-	-	475 - 580	-	585 - 690	670 - 770	725 - 820	760 - 840
	Tensile Strength(KSI)	53 - 67	-	-	69 - 84	-	85 - 100	97 - 112	105 - 119	110 - 122
	Hardness(HRB)	20 - 70	-	-	69 - 91	-	89 - 97	93 - 100	95 - 102	96 - 103
	Hardness(HRB)	27 - 68	-	-	63 - 78	-	73 - 81	77 - 83	78 - 84	79 - 84

*For the Annealed temper, considering the grain size according to the OS25 standard of the ASTM standard for each alloy.

Values according to ASTM standards B36M, B103M, B121M, B152M and B591.

The hardness test offers a quick and convenient solution for checking general compliance with temper requirements and should not be used as a material rejection criterion.

MANUFACTURING PROPERTIES

PHYSICAL PROPERTIES

	DENSITY AT 20°C (G/CM ³)	MELTING POINT (°C)	AVERAGE COEFFICIENT OF THERMAL EXPANSION (20-300 °C) (µm/m.K)	VOLUMETRIC ELECTRICAL CONDUCTIBILITY AT 20°C (% I.A.C.S.) (1)	THERMAL CONDUCTIBILITY AT 20°C (CAL/CM.S.°C)
COPPER					
Oxygen free copper (OF) – C10200	8,94	1083	17,6	100 (2)	0,93
Oxygen free silver (0,03%) - C10400	8,94	1083	17,6	100	0,93
Electrolytic tough pitch (ETP) – C11000	8,91	1083	17,6	100 (2)	0,93
Deoxidized high phosphorus (DHP) – C12200	8,94	1083	17,6	85	0,81
Gilding, 95 % -C21000	8,86	1065	18,0	56	0,56
Commercial Bronze, 90 % - C22000	8,80	1043	18,4	44	0,45
Jewelry Bronze, 87 1/2 % - C22600	8,77	1035	18,5	40	0,41
Red Brass, 85 % - C23000	8,75	1027	18,7	37	0,38
Cartridge Brass, 70 % - C26000	8,53	954	20,0	28	0,29
Yellow Brass, 66 % - C26800	8,47	932	20,3	27	0,28
Brass 425 UNS C.42500	8,78	1032	18,4 (4)	28 (5)	0,29
LEAD BRASS					
Medium Leaded Brass, 62% UNS C 35000	8,44	915	20,3	26	0,28
BRONZES					
Phosphor Bronze 96 - 4 (511)	8,86	1063	17,8	20	0,20
Phosphor Bronze 95 - 5 (510)	8,86	1049	17,8	15 (6)	0,17
Phosphor Bronze 94 - 6 (519)	8,84	1038	18,0 (4)	14	0,16
Phosphor Bronze 92 - 8 (521)	8,80	1027	18,2	13	0,15

Font: Copper Development Association Inc.

1 - All electrical conductivity values refer to the Annealed material.

2 - As per ASTM B152

3 - Data Termomecanica

4 - All electrical conductivity values refer to Annealed material.

5 - According to ASTM B152

6 - Data Termomecanica

CHEMICAL COMPOSITIONS

CHEMICAL COMPOSITIONS									
	Cu (%)	Zn (%)	Sn (%)	Pb (%)	O (p.p.m)	P (%)	Ag (%)	Te (%)	Fe (%)
COPPER									
Oxygen free copper (OF) UNS C 10200	99,95 min				10 máx				
Oxygen free silver (0,03%) UNS C 10400	99,95 min				10 máx		0,027 mín		
Electrolytic tough pitch (ETP) UNS C11000	99,90 min								
Deoxidized high phosphorus (DHP) UNS C 12200	99,90 min					0,015 a 0,040			
BRASS									
Gilding, 95 % UNS C 21000	94,00 a 96,00	Remain		0,05 máx					0,05 máx
Commercial Bronze, 90 % UNS C 22000	89,00 a 91,00	Remain		0,05 máx					0,05 máx
Jewelry Bronze, 871/2 % UNS C 22600	86,00 a 89,00	Remain		0,05 máx					0,05 máx
Red Brass, 85 % UNS C 23000	84,00 a 86,00	Remain		0,05 máx					0,05 máx
Cartridge Brass, 70 % UNS C 26000	68,50 a 71,50	Remain		0,07 máx					0,05 máx
Yellow Brass, 66 % UNS C 26800	64,00 a 68,50	Remain		0,09 máx					0,05 máx
Brass 425 UNS C 42500	87,00 a 90,00	Remain	1,50 a 3,00	0,05 máx		0,35 máx			0,05 máx
LEAD BRASS									
Medium Leaded Brass, 62% UNS C 35000	60,00 a 63,00	Remain		0,80 a 2,00					0,10 máx
BRONZES									
Phosphor Bronze 511 UNS C 51100	Remain	0,30 máx	3,50 a 4,90	0,05 máx		0,03 a 0,35			0,10 máx
Phosphor Bronze 510 UNS C 51000	Remain	0,30 máx	4,20 a 5,80	0,05 máx		0,03 a 0,35			0,10 máx
Phosphor Bronze 519 UNS C 51900	Remain	0,30 máx	5,00 a 7,00	0,05 máx		0,03 a 0,35			0,10 máx
Phosphor Bronze 521 UNS C 52100	Remain	0,20 máx	7,00 a 9,00	0,05 máx		0,03 a 0,35			0,10 máx

DIMENSIONS



Tomback Brass (210, 220, 226, 230)															
	0.590"(15mm)	1.181"(30mm)	1.968"(50mm)	3.937"(100mm)	5.905"(150mm)	7.874"(200mm)	9.842"(250mm)	11.023"(280mm)	11.811"(300mm)	13.779"(350mm)	15.748"(400mm)	17.716"(450mm)	19.685"(500mm)	21.653"(550mm)	23.622"(600mm)
0.001"(0,04mm)															
0.001"(0,05mm)															
0.002"(0,07mm)															
0.003"(0,08mm)															
0.003"(0,10mm)															
0.004"(0,12mm)															
0.005"(0,15mm)															
0.007"(0,20mm)															
0.009"(0,25mm)															
0.011"(0,30mm)															
0.015"(0,40mm)															
0.019"(0,50mm)															
0.039"(1,0mm)															
0.059"(1,5mm)															
0.078"(2,0mm)															
0.098"(2,5mm)															
0.124"(3,17mm)															
0.157"(4,0mm)															
0.177"(4,5mm)															
0.196"(5,0mm)															
0.216"(5,5mm)															
0.236"(6,0mm)															
0.255"(6,5mm)															

Binary Brass (260, 268)															
	0.590"(15mm)	1.181"(30mm)	1.968"(50mm)	3.937"(100mm)	5.905"(150mm)	7.874"(200mm)	9.842"(250mm)	11.023"(280mm)	11.811"(300mm)	13.779"(350mm)	15.748"(400mm)	17.716"(450mm)	19.685"(500mm)	21.653"(550mm)	23.622"(600mm)
0.001"(0,04mm)															
0.001"(0,05mm)															
0.002"(0,07mm)															
0.003"(0,08mm)															
0.003"(0,10mm)															
0.004"(0,12mm)															
0.005"(0,15mm)															
0.007"(0,20mm)															
0.009"(0,25mm)															
0.011"(0,30mm)															
0.015"(0,40mm)															
0.019"(0,50mm)															
0.039"(1,0mm)															
0.059"(1,5mm)															
0.078"(2,0mm)															
0.098"(2,5mm)															
0.124"(3,17mm)															
0.157"(4,0mm)															
0.177"(4,5mm)															
0.196"(5,0mm)															
0.216"(5,5mm)															
0.236"(6,0mm)															
0.255"(6,5mm)															

Brass Key (350)															
	0.590"(15mm)	1.181"(30mm)	1.968"(50mm)	3.937"(100mm)	5.905"(150mm)	7.874"(200mm)	9.842"(250mm)	11.023"(280mm)	11.811"(300mm)	13.779"(350mm)	15.748"(400mm)	17.716"(450mm)	19.685"(500mm)	21.653"(550mm)	23.622"(600mm)
0.019"(0,50mm)															
0.039"(1,0mm)															
0.059"(1,5mm)															
0.078"(2,0mm)															
0.098"(2,5mm)															
0.124"(3,17mm)															
0.157"(4,0mm)															
0.177"(4,5mm)															
0.196"(5,0mm)															

*Other dimensions on request
 ** Thicknesses below 0.20mm, only on consultation with Alloy, Temper and Width.
 *** We reserve the right to make changes without prior notice.
 **** Dimensional tolerances must follow the standard as per ASTM B248