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Introduction

Copper conductor cables transport the electrical current, they can be made of one rope yarn (a group formed by various wires assembled in spiral in the same direction), or of many, obtaining then the rope (many rope yarns assembled in opposite direction) the wire's diameter will give us the conductor's flexibility.
Copperbraids are electrical conductors interweaved, that allow a lot of flexibility in electrical conditions.
The materials used in our products are:

- Copper: red copper, oxigenless copper, tinned copper, enameled copper.
- Iron: galvanised iron.
- Alloys: alloys for compensation cables and thermocouple extension.
- Other metals to special order.

The theorical section is given by the sum of the wire's sections that form the conductor, it should not be confused with the nominal nor with the apparent section.
We manufacture sections from 0.062 mm2 to 1.000 mm2, with wires of 0.04, 0.05, 0.07, 0.10, ... mm2.
The dimensions are orientative, in the braids the theorical sections are half of those apparent.

Applications: The products that appear in this catalog are orientative, to special order or client's specifications, we can manufacture any variable. Do not doubt to consult with our technical department that will advise you in any question you ask.
Electrical equipment (circuit brakers, section switchs, contactors, lightning conductors, transformer centres, etc.); earthings; protection of electrical equipment; union between distribution rods and vibratory machines; expansion coupling between rod's setting; equipments for welding services; antiparasite braids; electrolysis; earthing settings; cables for brushes; cables for tiristors, relays and condensers; braids for loud-speaker's moving Coils; cables for induction furnaces; cables for feeding of electromagnets; cables for temperature mesure (extension or compensation cables); cables for high-frecuency coils (LITZ wires).

Presentation: Rolls, wooden coils, plastic coils according to DIN 46.399.

Flexible and extra-flexible bare copper conductors also of tinned copper

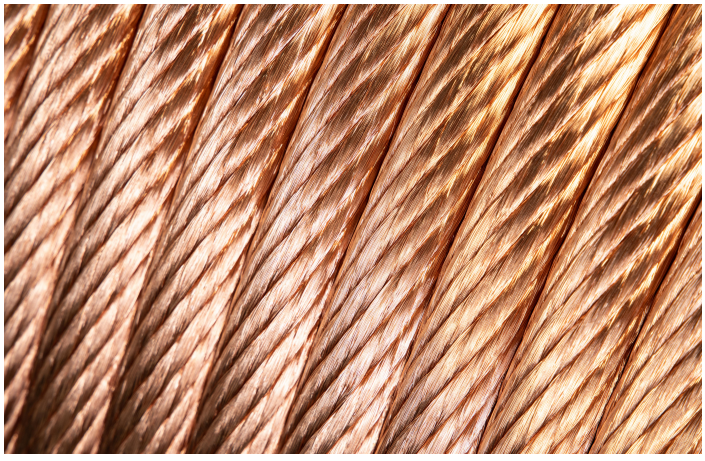
Specifications: Conductors formed by fine, glossy soft electrolytic copper wire. Our conductors may have a circular or square cross-section.
Applications: Connections, manufacture of electrical equipment, protection material and earthing, current taps, lightning conductors, transformer centres, etc.

Flexible and extra-flexible conductors

Conductores con hilos de 0,10 mm de diámetro en cobre rojo
Red copper conductors with wires of 0,10 mm of diameter

Referencia *Reference*	Sección mm² *Section mm²*	Ø mm *Ø mm*	N° total hilos *Total no. of wires*
NF-14N° 1	0,75	1,15	98
NF-14N° 2	1	1,4	126
NF-14N° 3	1,5	1,9	189
NF-14N° 4	2,5	2,3	322
NF-14N° 5	4	3,1	511
NF-14N° 6	6	4	770
NF-14N° 7	10	4,9	1.274
NF-14N° 8	16	6,3	2.044
NF-14N° 9	25	8,25	3.185

Presentation: 50, 100 and 200 meters rolls.
We can manufacture, to special order, conductors according to DIN 46438, in red copper or oxigenless copper.
Approximate weights: It should be 10 grams for each mm² the meter.
For example: 1 mm² = 10 grams the meter
Dimensions: Changing the composition allows to reduce the conductors dimensions as well as the weights¡ because the effective section is bigger than the nominal.
These features are given onlyas a guidance and may be subject to modification.
Applications: Connections, manufacture of electrical equipment, protection material and earthing, current taps, lightning conductors, transformer centres, etc.



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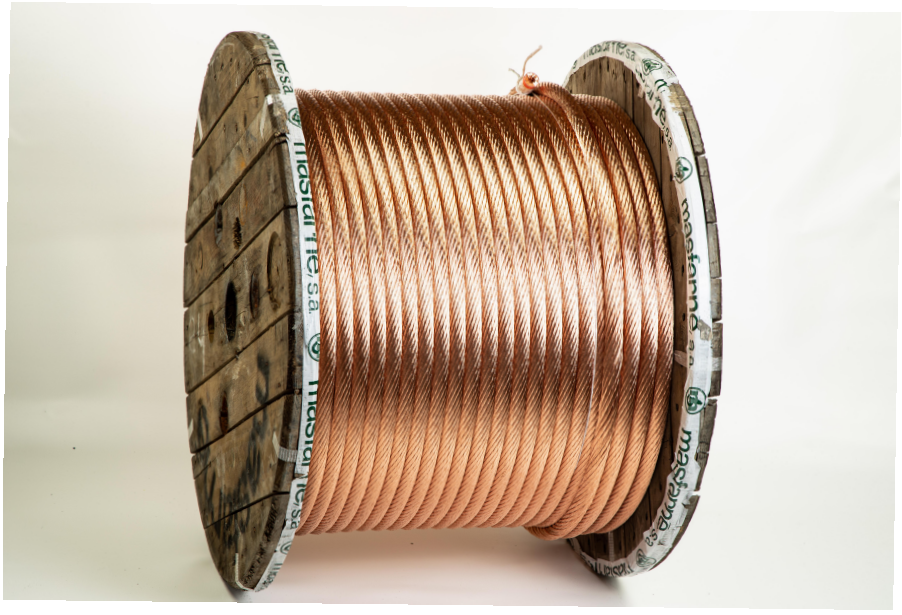
Conductores con hilos de 0,10 mm de diámetro en cobre estañado *Tinned copper conductors with wires of 0,10 mm of diameter*			
Referencia *Reference*	**Sección mm²** *Section mm²*	**Ø mm** *Ø mm*	**N° total hilos** *Total no. of wires*
NF-14N° 1E	0,75	1,15	98
NF-14N° 2E	1	1,4	126
NF-14N° 3E	1,5	1,9	189
NF-14N° 4E	2,5	2,3	322
NF-14N° 5E	4	3,1	511
NF-14N° 6E	6	4	770
NF-14N° 7E	10	4,9	1.274
NF-14N° 8E	16	6,3	2.044
NF-14N° 9E	25	8,25	3.185

Presentation: 50, 100 and 200 meter s rolls.
We can manufacture, to special order, tinned copper conductors according to DIN 46438.
Approximate weights: It should be 10 grams for each mm² the meter.
For example:1mm²=10gms the meter
Dimensions: Changing the composition allows to reduce the conductors dimensions as well as the weights, because the effective section is bigger than the nominal.
These features are given only as a guidance and may be subject to modification.
Applications: Connections, manufacture of electrical equipment, protection material and earthing, current taps, lightning conductors, transformer centres, etc



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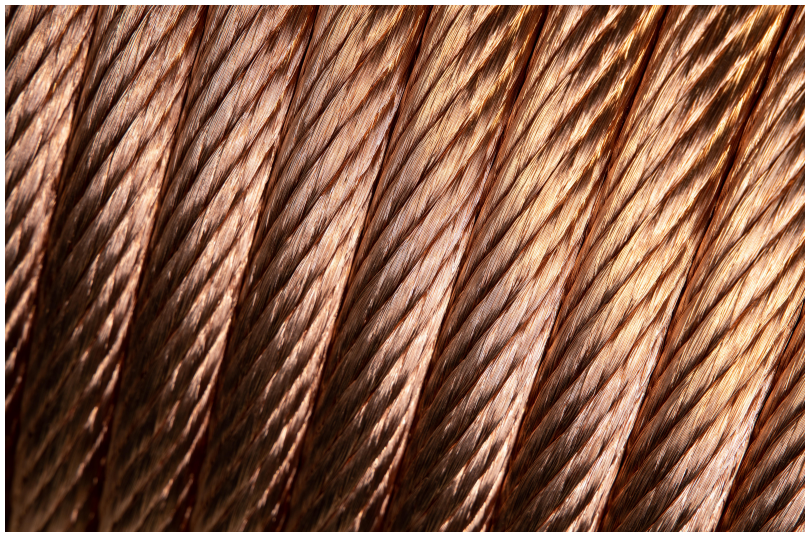
Conductores de cobre rojo con hilos de 0,25 mm de diámetro *Red copper conductors with wires of 0,25 mm of diameter*			
Referencia *Reference*	**Sección mm²** *Section mm²*	**Ø mm** *Ø mm*	**N° total hilos** *Total no. of wires*
NF-15 n° 1	2,5	2,4	49
NF-15 n° 2	4	3,5	84
NF-15 n° 3	6	3,7	126
NF-15 n° 4	10	5	203
NF-15 n° 5	16	5,7	329
NF-15 n° 6	25	8	511
NF-15 n° 7	35	9,4	722
NF-15 n° 8	50	11	1.026
NF-15 n° 9	80	13,5	1.615
NF-15 n° 10	95	16	1.938
NF-15 n° 11	120	18	2.451
NF-15 n° 12	150	19	3.078
NF-15 n° 13	185	21	3.768
NF-15 n° 14	240	23,5	4.902
NF-15 n° 15	300	27	6.118
NF-15 n° 16	400	31	8.113
NF-15 n° 17	500	34,5	10.241

Presentation: 100 meter rolls or in wooden coils, depending on the section.
Approximate weights: It should be 10 grams for each mm² the meter.
For example, one section of 6 mm² = 60 grams/meter; 300 mm² = 3.000 grams/meter.
Dimensions: The given dimensions are orientative, and may be subject to modification in any moment, depending on the rope's composition or the cable's step.
Applications: Connections, manufacture of electrical equipment, protection material and earthing, current taps, lightning conductors, transformer centres, etc.



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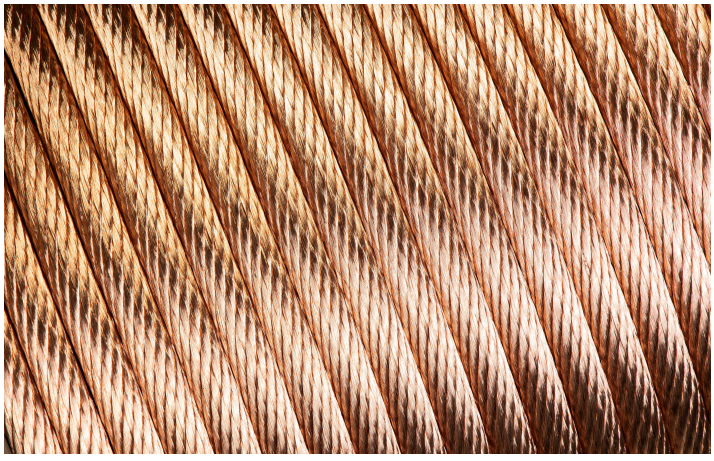
Conductores de cobre estañado con hilos de 0,25 mm de diámetro
Tinned copper conductors with wires of 0,25 mm of diameter

Referencia *Reference*	Sección mm² *Section mm²*	Ø mm *Ø mm*	Nº total hilos *Total no. of wires*
NF-15 nº 1E	2,5	2,4	49
NF-15 nº 2E	4	3,5	84
NF-15 nº 3E	6	3,7	126
NF-15 nº 4E	10	5	203
NF-15 nº 5E	16	5,7	329
NF-15 nº 6E	25	8	511
NF-15 nº 7E	35	9,4	722
NF-15 nº 8E	50	11	1.026
NF-15 nº 9E	80	13,5	1.615
NF-15 nº10E	95	16	1.938
NF-15 nº11E	120	18	2.451
NF-15 nº12E	150	19	3.078
NF-15 nº13E	185	21	3.768
NF-15 nº14E	240	23,5	4.902
NF-15 nº15E	300	27	6.118
NF-15 nº16E	400	31	8.113
NF-15 nº17E	500	34,5	10.241

Presentation: 100 meter rolls or in wooden coils, depending on the section.
Approximate weights: It should be 10 grams for each mm² the meter.
For example, for one section of 6 mm² = 60 grams/meter, as well as 300 mm² = 3.000 grams/meter.
Dimensions: The dimensions are given onlyas a guidance, in any moment they can be modified, depending on the rope's composition or the cable's step.
Applications: Connections, manufacture of electrical equipment, protection material and earthing, current taps, lightning conductors, transformer centres, etc.



Tubular or laminated copper braids al so **of tinned copper**

Specifications: Made from fine, glossy 50ft electrolytic copper wire. Highly flexible and low bending radius.
Applications: Earthing, vibratory machines, connection bridges to transformers, manufacture of electrical equipment, etc.

Flexible conductor braids

Flat, square, square insulated with clear pvc, round conductors with copperbraid coatings, braids to screen, special braids small sections, round braids, round braids with clear pvc.

Trenzas con hilo de 0,15 y 0,20 mm de diámetro en cobre rojo
Red copper braids with wires of 0,15 and 0,20 mm of diameter

Referencia *Reference*	Sección mm² *Section mm²*	Dimensiones *Dimensions*	Nº total hilos *Total no. of wires*	Composición *Composition*
NF-16Nº 1	2,5	5 × 1	144	16 × 9
NF-16Nº 2	5	8 × 1,1	288	24 × 12
NF-16Nº 3	8	8 × 1,5	456	24 × 19
NF-16Nº 4	10	10 × 1,5	576	24 × 24
NF-16Nº 5	16	15 × 2	896	32 × 28
NF-16Nº 6	20	20 × 2	1120	32 × 35
NF-16Nº 7	25	25 × 2	1408	32 × 44
NF-16Nº 8	30	25 × 2,5	1696	32 × 53
NF-16Nº 9	40	25 × 3	2240	32 × 70
NF-16Nº10	50	30 × 3,5	2816	32 × 88
NF-16Nº11	60	30 × 4	3392	32 × 107
NF-16Nº12	75	30 × 5	4224	32 × 132
NF-16Nº13	90	35 × 5	5088	32 × 159
NF-16Nº14	100	40 × 5	5632	32 × 176
NF-16Nº15*	120	50 × 5	3840	48 × 80
NF-16Nº16*	150	60 × 5	4800	48 × 100
NF-16Nº17*	200	65 × 5	6336	48 × 132
NF-16Nº18*	250	70 × 8	7872	48 × 164
NF-16Nº19*	300	70 × 10	9600	48 × 200
NF-16Nº20*	400	80 × 10	12768	48 × 266
NF-16Nº21*	500	100 × 10	15936	48 × 332

* Estas trenzas están fabricadas con hilos de 0,20 mm de diámetro. * *These braids are manufactured with wires of 0,20 mm of diameter*

Presentation: Rolls of 6, 10, 15, 20, 25, 50, 100 and 200 meters.
Approximate weights: It should be 10 grams for each mm² the meter.
For example: 5 mm² = 50 grams the meter
Dimensions: To special order, and if the braid allows it, we can modify them. To special order, we can manufacture braids with clear PVC
These features are given only as a guidance and may be subject to modification.
Applications: Earthing connections, vibratory machines, connection bridges to transformers, manufacture of electrical equipment, etc.

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Trenzas con hilo de 0,15 y 0,20 mm de diámetro en cobre estañado
Tinned copper braids with wires of 0,15 and 0,20 mm of diameter

Referencia *Reference*	Sección mm² *Section mm²*	Dimensiones *Dimensions*	Nº total hilos *Total no. of wires*	Composición *Composition*
NF-16Nº 1E	2,5	5 × 1	144	16 × 9
NF-16Nº 2E	5	8 × 1,1	288	24 × 12
NF-16Nº 3E	8	8 × 1,5	456	24 × 19
NF-16Nº 4E	10	10 × 1,5	576	24 × 24
NF-16Nº 5E	16	15 × 2	896	32 × 28
NF-16Nº 6E	20	20 × 2	1120	32 × 35
NF-16Nº 7E	25	25 × 2	1408	32 × 44
NF-16Nº 8E	30	25 × 2,5	1696	32 × 53
NF-16Nº 9E	40	25 × 3	2240	32 × 70
NF-16Nº10E	50	30 × 3,5	2816	32 × 88
NF-16Nº11E	60	30 × 4	3392	32 × 107
NF-16Nº12E	75	30 × 5	4224	32 × 132
NF-16Nº13E	90	35 × 5	5088	32 × 159
NF-16Nº14E	100	40 × 5	5632	32 × 176
NF-16Nº15*E	120	50 × 5	3840	48 × 80
NF-16Nº16*E	150	60 × 5	4800	48 × 100
NF-16Nº17*E	200	65 × 5	6336	48 × 132
NF-16Nº18*E	250	70 × 8	7872	48 × 164
NF-16Nº19*E	300	70 × 10	9600	48 × 200
NF-16Nº20*E	400	80 × 10	12768	48 × 266
NF-16Nº21*E	500	100 × 10	15936	48 × 332

* Estas trenzas están fabricadas con hilos de 0,20 mm de diámetro

* *These braids are manufactured with wires of 0,20 mm of diameter*

Presentation: Rolls of 6, 10, 15, 20, 25, 50, 100 and 200 meters.
Approximate weights: It should be 10 grams for each mm² the meter.
For example: 5 mm2 = 50 grams the meter
Dimensions: To special order, and if the braid allows it, we can modify them. To special order, we can manufacture braids with clear PVC.
These features are given only as a guidance and may be subject to modification.
Applications: Earthing connections, vibratory machines, connection bridges to transformers, manufacture of electrical equipment, etc.

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Trenzas cuadradas de cobre rojo
Square red copper braids

Referencia *Reference*	Sección mm² *Section mm²*	Dimensiones *Dimensions*	Ø hilo *Ø wire*	N° total hilos *Total no. of wires*
NF-20N° 1	1	1,2 × 1,2	0,15	56
NF-20N° 2	1,5	1,5 × 1,5	0,15	88
NF-20N° 3	2,5	2,1 × 2,1	0,15	144
NF-20N° 4	4	2,8 × 2,8	0,15	224
NF-20N° 5	6	3,3 × 3,3	0,15	344
NF-20N° 6	10	4,3 × 4,3	0,15	568
NF-20N° 7	16	5,4 × 5,4	0,15	912
NF-20N° 8	25	7 × 7	0,15	1.416
NF-20N° 9	35	8 × 8	0,15	1.980
NF-20N°10	50	10 × 10	0,20	1.584
NF-20N°11	75	12 × 12	0,25	1.524
NF-20N°12	95	14 × 14	0,25	1.932

They are made of wires of 0.05, 0.07 and 0.10 mm of diameter.
To special order, we can manufacture them with other sections and tinned copper.
Presentation: 50 and 100 meters rolls, plastic coils accordins to DIN 46 399 or wooden coil.
Approximate weights: It should be 10 grams for each mm² the meter.
For example: 35 mm² = 350 grams the meter
Dimensions: These features are siven only as a guidance and may be subject to modification.
Applications: Weldins services and union of the contact line with the catenary in high-speed trains.

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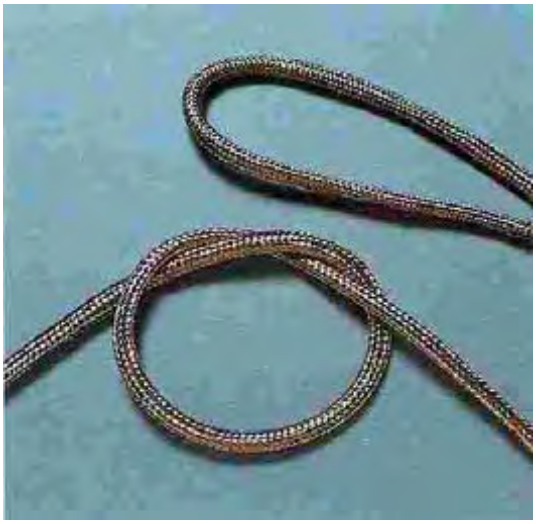
Conductores redondos con cubierta de trenza de cobre S/DIN 46440 en cobre rojo
Round conductors with copperbraid coatings S/DIN 46440 in red copper

Referencia *Reference*	Sección nominal *Nominal section* mm^2	Sección efectiva *Effective section* Ø mm	Dimensiones exteriores *External dimensions*	Nº hilos conduc. *No. wires of conduc.*	Ø hilo mm *Ø wire mm*	Nº hilos cubierta *No. wires of coating*	Ø hilo mm *Ø wire mm*
CT-0,5-05/01	0,5	0,5	1,1	130	0,05	32	0,1
CT-0,75-05/01	0,75	0,75	1,4	266	0,05	32	0,1
CT-1-0,5/01	1	1	1,5	266	0,05	64	0,1
CT-1,5-05/01	1,5	1,5	2	525	0,05	64	0,1
CT-2,5-07/01	2,5	3	2,9	651	0,07	64	0,1
CT-4-07/01	4	4,5	3,6	1.036	0,07	64	0,1
CT-6-07/01	6	6,8	4,5	1.575	0,07	96	0,1
CT-10-07/01	10	11	5,5	2.562	0,07	128	0,1
CT-16-07/01	16	17,5	7	4.116	0,07	192	0,1
CT-25-01/01	25	27	8,9	3.234	0,1	192	0,1
CT-35-01/01	35	37	10,5	4.508	0,1	240	0,1
CT-50-01/01	50	53,5	12,5	6.468	0,1	360	0,1
CT-70-01/01	70	73	14,7	8.967	0,1	360	0,1

Presentation: Coils according to DIN 46399 in rolls or wooden coils depending on the section.
Approximate weights: We will take +/- 12% of the effective section up to 16 mm², +/- 8% from 25 mm² up to 50 mm² and +/-6% above 70 mm².
Dimensions: These features are given only as a guidance and may be subject to modification in any moment.
To special order, we can manufacture them with tinned copper.
Applications: Electric welding services and electric furnaces.



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Trenzas en cobre rojo para apantallar
Red copper braids to screen
Tresses de cuivre rouge pour blindage
Abschirmgeflecht in Rotkupfer

Referencia *Reference* Référence *Bestell-Nr.*	**Ø interior** *Internal Ø* Ø intérieur *Innerer Ø*	**Nº hilos** *No. wires* Nbre de fils *Anzahl Drähte*	**Nº husos** *No. braids* Nbre de fuseaux *Anzahl Adern*	**Total Nº hilos** *Total No. wires* Nbre Total de fils *Gesamtanzahl Drähte*	**Ø hilo** *Ø wire* Ø fil *Ø Draht*
TA-2	2	3	24	72	0,1
TA-4	4	4	24	96	0,15
TA-8	8	7	32	224	0,15
TA-12	12	9	32	288	0,15
TA-16	16	8	32	256	0,20
TA-20	20	10	32	320	0,20
TA-25	25	11	32	352	0,20
TA-30	30	10	32	320	0,30
TA-40	40	12	32	384	0,30
TA-50	50	9	32	288	0,50
TA-60	60	7	48	336	0,50

To special order, we can manufacture other diameters.
Presentation: Rolls or coils according to DIN 46399, depending on the diameter.
Dimensions: These features are given only as a guidance and may be subject to modification in any moment
Applications: Antiparasite, earthing and shield.

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Trenzas en cobre estañado para apantallar
Tinned copper braids to screen
Tresses de cuivre étamé pour blindage
Abschirmgeflecht in verzinntem Kupfer

Referencia *Reference* Référence *Bestell-Nr.*	Ø interior *Internal Ø* Ø intérieur *Innerer Ø*	N° hilos *No. wires* Nbre de fils *Anzahl Drähte*	N° husos *No. braids* Nbre de fuseaux *Anzahl Adern*	Total N° hilos *Total No. wires* Nbre Total de fils *Gesamtanzahl Drähte*	Ø hilo *Ø wire* Ø fil *Ø Draht*
TA-2	2	3	24	72	0,1
TA-4	4	4	24	96	0,15
TA-8	8	7	32	224	0,15
TA-12	12	9	32	288	0,15
TA-16	16	8	32	256	0,20
TA-20	20	10	32	320	0,20
TA-25	25	11	32	352	0,20
TA-30	30	10	32	320	0,30
TA-40	40	12	32	384	0,30
TA-50	50	9	32	288	0,50
TA-60	60	7	48	336	0,50

To special order, we can manufacture other diameters.
Presentation: Rolls or coils according to DIN 46399, depending on the diameter.
Dimensions: These features are given onLy as a guidance and may be subject to modification in any moment.
Applications: Antiparasite, earthing and armouring.

Round braids of bare copper wire insulated with clear pvc

They are manufactured according to standard UNE 20.707. These features are given only as a guidance and may be subject to modification. They can be made of tinned copper and other sections to special order.
Applications: Earthing device and in short-circuit for high-tension.

Sección mm² *Section mm²* Section mm² *Querschnitt mm²*	N° hilos *Number wire* Nombre de fils *Anzahl Drähte*	Ø hilos mm *Ø wires mm* Ø des fils mm *Ø Drähte in mm*	Ø sobre cobre *Ø with copper* Ø sur cuivre nu *Ø nur Kupfer*	Ø sobre aislamiento *Ø with isolation* Ø sur isolant mm *Ø mit Isolierung*
16	504	0,20	6	8
25	792	0,20	7	9
35	720	0,25	9	11,8
50	1.008	0,25	10	12,8
70	1.416	0,25	12	15,6
95	1.932	0,25	14	18
120	2.448	0,25	16	21

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Trencillas extraflexibles con hilos de 0,10 mm de diámetro
Extraflexible small braids with wires of 0,10 mm of diameter
Tresses extra-souples avec fil de 0,10 mm de diamètre
Hochflexible Geflechte aus Drähten von 0,10 mm Durchmesser

Referencia *Reference* Référence *Bestell-Nr.*	Tipo cobre *Copper type* Type de cuivre *Kupferart*	Sección mm² *Section mm²* Section mm² *Querschnitt mm²*	Dimensiones *Dimensions* Dimensions *Abmessungen*	N° total hilos *Total no. of wires* Nbre total de fils *Gesamtanzahl Drähte*
F-7 AC	rojo/red/rouge/rot	0,5	2 mm ancho/width/large/breit	64
F-7 AE	estañado/tinned/étamé/verzinnt	0,5	2 mm ancho/width/large/breit	64
F-7 C	rojo/red/rouge/rot	1	3 mm ancho/width/large/breit	120
F-7 E	estañado/tinned/étamé/verzinnt	1	3mm ancho/width/large/breit	120
F-8 C	rojo/red/rouge/rot	2	4 mm ancho/width/large/breit	240
F-8 E	estañado/tinned/étamé/verzinnt	2	4mm ancho/width/large/breit	240

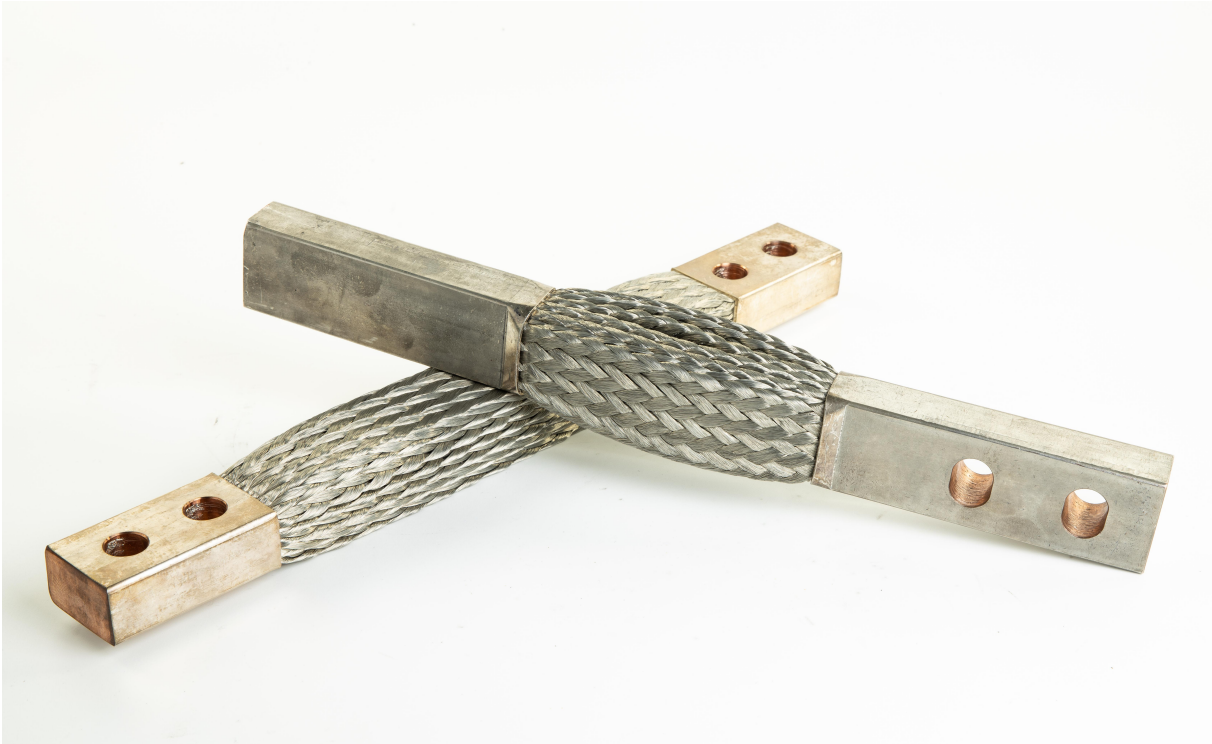
Trencillas extraflexibles con hilos de 0,05 mm de diámetro
Extraflexible small braids with wires of 0,05 mm of diameter
Tresses extra-souples avec fil de 0,05 mm de diamètre
Hochflexible Geflechte aus Drähten von 0,05 mm Durchmesser

Referencia *Reference* Référence *Bestell-Nr.*	Tipo cobre *Copper type* Type de cuivre *Kupferart*	Sección mm² *Section mm²* Section mm² *Querschnitt mm²*	N° total hilos *Total no. of wires* Nbre total de fils *Gesamtanzahl Drähte*
F-9 B	rojo/red/rouge/rot	0,13	64
F-9 D	rojo/red/rouge/rot	0,20	96

To special order, we can manufacture other sections according to standard DIN 46444.
Presentation: 100, 200 or 500 meters coiLs according to DIN 46399, depending on the section.
Approximate weights: It should be 10 grams for each millimeter² the meter. For example: 0,12 mm² = 1,2 grams the meter.
Dimensions: these features are given only as a guidance and may be subject to modification in any moment
Applications: High-speaker moving coils, screening of cores of small diameter, earthing connections, screen or TV's tubes earthing.

braid connections or red copper conductors also of tinned

specifications: These connections are made with braid or conductor of specifications identical to those given in the corresponding paragraphs.
To special order, we can manufacture any type of lenght, section terminals, connection, etc.



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Connections

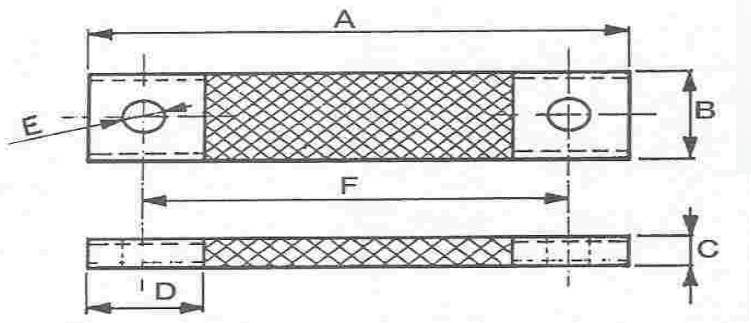
- **Specially flexible connections**
- **Point resístanse**
- **Koper sheets**
- **Nomalized earthing connections**

Applications: Electrical connections between bars and transformers.
Electrical connections between bars and contactors, circuit breakers, etc.
Manufacture of electrical quipment.
Motor earthing connections, etc.

In view of their degree of flexibility they are very suitable for the transmission of vibrations and expansion strains in electrical connections.
Allow errors made in rigidly assembled appliances to be corrected.

Enclose following details with your order:

Sección Section	A	B	C	D	E	F

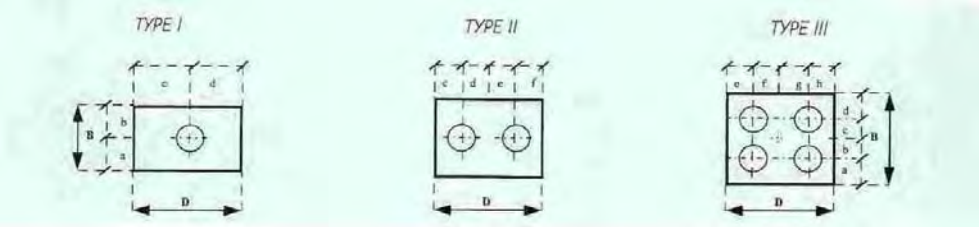


Note: State whether braid or conductor connections is wanted, as well as copper or tinned copper.
Our Technical Department will study any need you may have.

Terminals

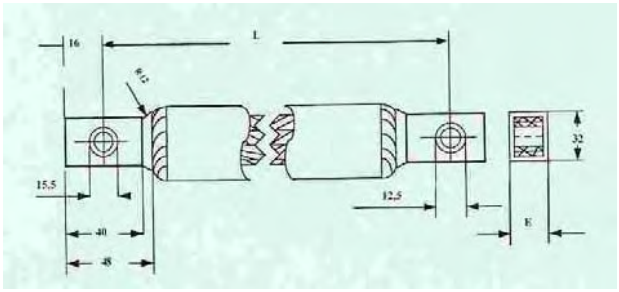
Criterions to consider for the terminals of the connection.
The connection serves to establish a union between conductors. Before doing it, you must know the following points:
Preparation of contact surfaces: elimination of the oxide screen or any other foreign coat that is not a good conductor and prevents its reconstitution. This can be done mechanical!y with abrasives. This film is generally very fine and fragile. Avoidance of its formation due to oxidation, by using a neutral and impermeable product -such as grease- which does not damage the contact, or by depositing a coat of another metal in the oxide's place which is less sensitive to atmospherical agents.
Pressing effort: this deals with bettering the contact, by multiplying the number of contact points and increasing its surface effectiveness. It is necessary to exercise a sufficient pressing effort. As there is an ideal pressure effort, it would be better to tighten all contacts with a dynamometric key, to allow exact measurement of the pressing effort.
Surface contact: it is important to have sufficient surface contact, because contact temperature is not enough criterion to determine its quality. This depends on the intensity by which it crosses, its geometric dimensions and the tension fall due to contact. The contact temperature could be superior to the conductor's without meaning that the contact is electrically bad, that is to say without having an abnormal fall in tension.
It is indispensable that the fall in tension and the joining temperature vary only slightly whatever be the functioning time.
A correctly effected contact is conserved indefinitely, must conserve the initial conditions of each tension and relative temperature, even after many years of function.
If joining is formed by metals of different dilatation coefficients -such as copper bars and steel pressing screwswith the current of electricity different dilatations can be developed in the contact elements, the screw dilates less than the copper bar. Whilst the screw or the bar do not exceed their elastic limit the initial pressure of the cold contact stays constant after each stop. The elastic limit of the elements should never be exceeded, not at the beginning nor during the service, or the pressing effort will be modified and so destroy the joining.
All pressure modification changes the tension fall and the temperature.
Any intention to repress proves that an element of the group has broken under the current's effect.
The carrying out of any contact, if you do not dispose of a calculation element, demands the following fundamental regulations:
1- Brushing with a metalically toothed brush coated with neutral grease. The brush can be substituted by any other abrasive.
2- To make the pressing effort with screws of greatest possible diameter, using as many as possible.
3- Screw tightly with a key of normal dimensions, preferibly using a tubular key. If not, a flat one.

Some examples of terminals:



Notes:

- Indicate in each case, the diameter of the drills.
- Other variants can be manufactured, regarding the number of drills, position according to axles, etc.
- Indicate whether the terminals should be tinned, silver plated, etc.
- Indicate if the terminal should be reamed in the contact zone with the conductor.



Execution: In all our connections, terminals made of electrolytic copper tubes are used, high-pressure pressed.
To special order, they can be tin-covered or silverplated.

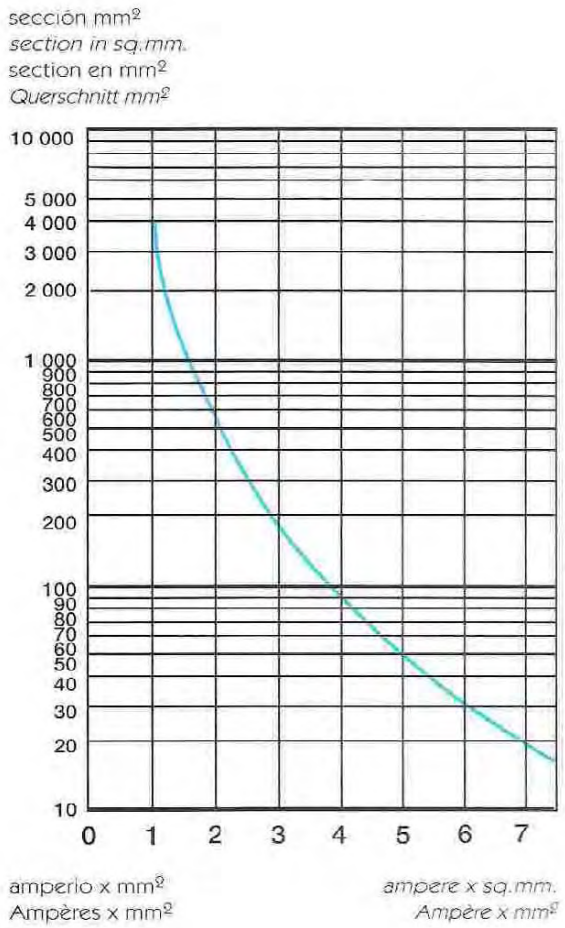
Terminales
Terminals
Plages de raccordement
Anschluss-Flansche

Sección/*Section* *Section/Querschnitt* *E* *L*	Ø hilos/*wires/fils/der Drähte* 0,25 *300 mm* *17* *Ref./Bestell-Nr.*	*400 mm* *19* *Ref./Bestell-Nr.*	*500 mm²* *23* *Ref./Bestell-Nr.*
200	NF-25 300 200	NF-25 400 200	NF-25 500 200
225	NF-25 300 225	NF-25 400 225	NF-25 500 225
250	NF-25 300 250	NF-25 400 250	NF-25 500 250
275	NF-25 300 275	NF-25 400 275	NF-25 500 275
300	NF-25 300 300	NF-25 400 300	NF-25 500 300
325	NF-25 300 325	NF-25 400 325	NF-25 500 325
350	NF-25 300 350	NF-25 400 350	NF-25 500 350
375	NF-25 300 375	NF-25 400 375	NF-25 500 375
400	NF-25 300 400	NF-25 400 400	NF-25 500 400
425	NF-25 300 425	NF-25 400 425	NF-25 500 425
450	NF-25 300 450	NF-25 400 450	NF-25 500 450
475	NF-25 300 475	NF-25 400 475	NF-25 500 475
500	NF-25 300 500	NF-25 400 500	NF-25 500 500
525	NF-25 300 525	NF-25 400 525	NF-25 500 525
550	NF-25 300 550	NF-25 400 550	NF-25 500 550
575	NF-25 300 575	NF-25 400 575	NF-25 500 575
600	NF-25 300 600	NF-25 400 600	NF-25 500 600

Tolerance: L = +5, D= +-2 Y E = +-1, the cuotes are given in millimeters.
To special order, they can be manufactured according to standard DIN 44. 760.

flexible connections in copper sheet

table for determining the current density according to the cross- section in sq.mm.



Sección mm² *Section in sq.mm.* *Section mm²* *Querschnitt mm²*	Intensidad admisible *Admissible current* Intensité admissible *zulässige Stromstärke*
16,5	122
26,5	157
37	202
50	250
73	310
90	349
100	372
125	431
150	480
200	599
250	673
300	780
400	950
500	1.100
625	1.300
800	1.500
1.000	1.800
1.500	2.200
2.000	2.400
3.000	3.000

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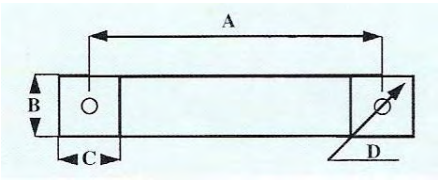
Regulated earthing connections



Sección *Section* Section *Querschnitt*	A	B	C	D

Cuotes are given in mm

Con trenza de cobre estañado y terminales de tubo de cobre estañado
With tinned copperbraid and terminals with tinned copper tube
Tresse en cuivre étamé et plages de raccordement en cuivre étamé
Mit verzinntem Kupfergeflecht und Anschluss-Flanschen aus verzinntem Kupferrohr

Referencia Reference Référence *Bestell-Nr.*	**Sección mm²** Section mm² Section mm² *Querschnitt mm²*	A	B	C	D	**Intensidad (Amp.)** Intensity (Amperes) Intensité (Amp.) *Stromstärke (Amp.)*
FT-17 16x150	*16*	*250*	*17*	*17*	*6*	*120*
FT-17 16x250	*16*	*250*	*17*	*17*	*6*	*120*
FT-17 25x150	*25*	*150*	*26*	*26*	*8*	*150*
FT-17 25x250	*25*	*250*	*26*	*26*	*8*	*150*
FT-17 25x300	*25*	*300*	*26*	*26*	*8*	*150*
FT-17 40x250	*40*	*250*	*26*	*30*	*10*	*215*
FT-17 40x300	*40*	*300*	*26*	*30*	*10*	*215*
FT-17 50x250	*50*	*250*	*33*	*33*	*10*	*250*
FT-17 50x300	*50*	*300*	*33*	*33*	*10*	*250*

Con trenza de cobre estañado y terminales estañados
With tinned copperbraid and tinned terminals
Tresse en cuivre étamé et plages de raccordement massivées à l'étain
Mit verzinntem Kupfergeflecht und verzinnten Anschluss-Flanschen

F-17 16x150	*16*	*150*	*15*	*6*	*120*
F-17 16x250	*16*	*250*	*15*	*6*	*120*
F-17 25x150	*25*	*150*	*25*	*8*	*150*
F-17 25x250	*25*	*250*	*25*	*8*	*150*
F-17 25x300	*25*	*300*	*25*	*8*	*150*
F-17 40x250	*40*	*250*	*25*	*10*	*215*
F-17 40x300	*40*	*300*	*25*	*10*	*215*
F-17 50x250	*50*	*250*	*30*	*10*	*250*
F-17 50x300	*50*	*300*	*33*	*10*	*250*

Presentation: Package of 10 units. If less are required, contact our nearest distributor and request the oneconnection blister.

Water-cooled braided cables for welding service

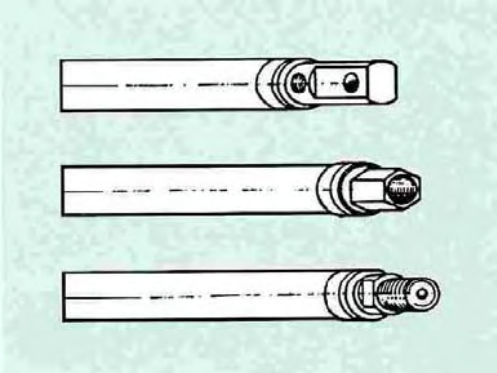
specifications: These cables are formed by a copper spring core coated with a copper braid using 0.5, 0.20 and 0.25 mm diameter wires, allowing for some very low bending radii and consequently great ease of handling. Nevertheless, the main feature is the elimination of heat caused by the high current flowing when welding, by the water flowing through inside of the cable.
This cable is coated on the outside with a neoprene tube.
Terminals suiting the needs of each application are welded at the ends of the required length of cable.

Applications: The main applications of the water-cooled cables are:
Electrochemistry; welding; induction furnaces; electrothermics; feeding of electromagnets; etc.

Datos técnicos / *Specifications* / Spécifications / *Technische Daten*

Referencia *Reference* Référence *Bestell-Nr.*	**Sección mm²** *Section mm²* Section mm² *Querschnitt mm²*	**Alma en mm.** *Core in mm.* Âme Ø mm *Seele in mm*	**Hilo muelle Ø en mm.** *Spring wire in mm.* Ressort Ø mm *Federdraht*	**Composición trenzado** *Braided composition* Composition tresse *Zusammensetzung Kupfergeflecht*
FRA - 40	*40*	*4,5*	*1*	*165 — 0,15 x 12*
FRA - 50	*50*	*4,5*	*1*	*71 — 0,15 x 3 x 12*
FRA - 80	*80*	*7,5*	*1,5*	*62 — 0,20 x 3 x 12*
FRA - 100	*100*	*7,5*	*1,5*	*78 — 0,20 x 3 x 12*
FRA - 150	*150*	*7,5*	*1,5*	*80 — 0,25 x 3 x 12*
FRA - 200	*200*	*7,5*	*1,5*	*54 — 0,25 x 3 x 12*
				54 — 0,25 x 3 x 12
FRA - 250	*250*	*7,5*	*1,5*	*68 — 0,25 x 3 x 12*
				68 — 0,25 x 3 x 12
FRA - 300	*300*	*7,5*	*1,5*	*82 — 0,25 x 3 x 12*
				82 — 0,25 x 3 x 12

To special order, we can study any other section comprissed between the standard ones.
The cable lengths and the terminals are made to special order.

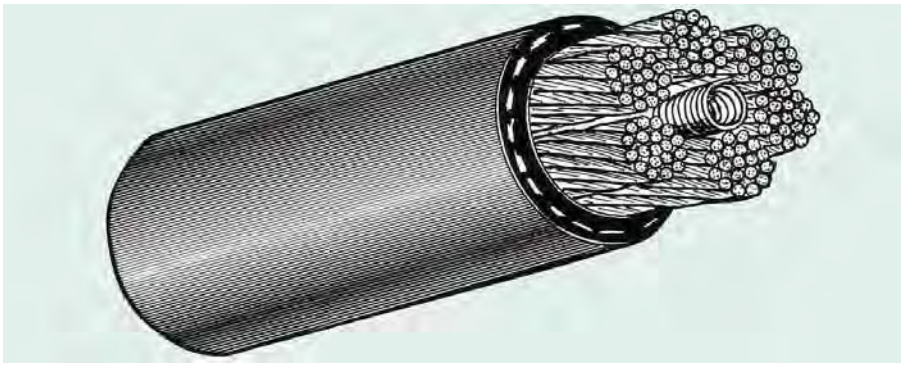


Water-cooled helical cables

These cables are used for the same working conditions of the braided cables, but for sections above 400 mm2. The same comments are valid for terminals, lengths, etc., as given for the braided cables.

Referencia *Reference* Référence *Bestell-Nr.*	Sección mm *Section mm* Section mm² *Querschnitt mm*	Ø Alma en mm. *Ø Core in mm.* Âme Ø mm *Ø Seele in mm*	Hilo muelle Ø en mm. *Spring wire Ø in mm.* Ressort Ø mm *Federdraht Ø in mm*	Cable en mm. *Cable in mm.* Câble Ø mm *Kabel in mm*	Composición *Composition* Composition *Zusammensetzung*	
					N°. hilo/Toron *No. of wires/rope* Nbre fils/toron *Anzahl Drähte/Ader*	N°. Torones *No. of ropes* Nbre torons *Anzahl Adern*
FHA - 400	*400*	*11*	*1,5*	*39*	*1326*	*6*
FHA - 550	*550*	*11*	*1,5*	*42*	*1836*	*6*
FHA - 700	*700*	*11*	*1,5*	*50*	*704*	*7 + 13*
FHA - 850	*850*	*11*	*1,5*	*53*	*857*	*7 + 13*

To special order, we can study any other section comprissed between the standard ones.



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Compensation or extension cables

CÓDIGO DE COLORES
COLOUR CODE
CODE DE COULEURS
FARBENCODE

Letra Material	+ / −	DIN IEC 584	DIN 43710/ 43713/43714	ANSI MC 96.1	BS 4937	NF C 42-324
K	+ Ni Cr − Ni	KX −25° ÷ +200°C	NiCr-Ni 0° ÷ +200°C	KX 0° ÷ +200°C	KX 0° ÷ +200°C	KX −25° ÷ +200°C
	+ Ni Cr − Ni	KCA 0° ÷ +150°C	ScNiCr-ScNi WX 0° ÷ +200°C			WC 0° ÷ +150°C
	+ Ni Cr − Ni	KCB 0° ÷ +100°C			VX 0° ÷ +100°C	VC 0° ÷ +100°C

When the conductors and the thermocouple's wires are of the same nature, it is called extension cable, and when the conductors are of a different nature to that of the thermocouple's wires, a compensation cable.

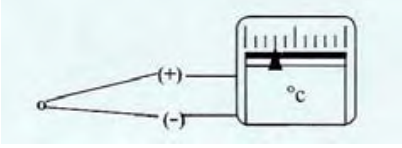
The pyrometer is based on two effects:
PELTIER effect: if we establish an electrical contact between two wires of dissimilar metals, an electromotive force (EMF) is created at their junction point.
THOMSON effect: if there is a different temperature at each of the two ends of a conductor wire of uniform composition, an EMF is created.
The algebraic sum of the EMF of the above two effects creates a resultant EMF, called the SEEBECK effect, which is what it is measured.
The ideal thing would be for the cable concerned to be of the same material as the thermocouple (extension cable) but since the thermocouple is usually made of costly materials, another law of thermoelectricity is used to allow incorporation of a third metal into the circuit without causing the EMF to vary, as long as such a metal maintains the same temperature throughout its length.
Other cables are used with the particularity of giving in the same temperature zone of use, the same temperature-EMF (compensation cables) as the thermocouple.

Compensation cables should have the following qualities:
- Homogeneous conductors
- High isolation resistance between the conductors and between them and the screen, if there is one
- Best watertightness possible
- Protection that best responds to conditions of use such as temperature, chemical action, mechanic resistance, etc.
- Rapid response speed

Here below is a list of the mistakes that would cause a variation of tenths of grades and would inutilise the pyrometer:
- Substitution of the compensation cable for an ordinary copper one
- Use of a type of compensation cable destinated to a different couple
- Inversion of polarity
- It is necessary to know and maintain constant the temperature of the comparison point in order to determine the temperature of the measurement point.

When you order a compensation cable you must remember the following:
- Thermocouple class
- Maximum and minimum ambient temperature
- Working conditions (humidity, carbohydrates, etc.)
- Cable's working conditions (traction, abrasion, mobile equipment, etc.)
- The scale of temperature needs to be measured to know if they correspond to the EMF-temperature lineality.

TYPE K: Scale of temperatures from -17°C to + 1400ºC
Advantages:
- Appropriate in oxidizins atmosphere.
Disadvantages:
- Specially vulnerable in reducins atmospheres, required protection if used.



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Litz cables

Litz cables are used principally for: energy conversion, high frequency emission and reception, potency electronics, inductive proximity detector s, electronic tags, multiple telephonic transmission equipment, flexible junctions for relays, coils, transformers, motors, etc.
Litz cables can be made in different ways, according to the designer. Casa Masfarné, S.A. manufacture them round, with wires assembled in the same direction, with a cabling step of less than 60mm.
To special order, we can satisfy our client's needs by forming square or rectangular rope shapes for a better coiling volume.
In the manufacture of Litz cables we use products that allow direct welding, without the need of any mechanical procedure.
Before welding, the cable has to be submerged in a rust-removing agent and after in a bath of tin (60%) and lead (40%) at a temperature between 375°C and 400°C.
The immersion time will depend on the wire's number and its diameter.

Coil losses
These are due to the following:
- Conductor losses: - JOULE effect
  - FOUCAUL T currents
- Losses due to capacity
- Losses due to the nucleus (hysteresis)

The first two appear in all the coils and the third in the ones that have an ironmagnetic nucleus.
Here, we will analyze the first two to justify the use of the Litz cable.

Conductor losses
JOULE effect: we all know that electrical conductors heat by electricity, causing the conductor to increase its ohmic resistance, causing a decrease of amperes in the same section.
Apparently, we could increase the diameter of the section to diminish the effect, but this would increase the losses due to Foucault currents. Once we have defined the section, its modification is not a solution.
We can do as follows: once determined the ideal conductor section, to avoid the pellicular effect, we can achieve the calculated section with the reunion of isolated enameled cables; this way we will achieve a section which will be maintained during almost all the working cycle of the coil.
The thinner the wires, the greater the use, due to the pellicular effect. However, this solution would be expensive. We then recommend the ideal calculation for the section, which should be studied individually by the technician.
To calculate the pellicular current, we should use the following formula, which will give the current's depth

$$e = 503\frac{\rho}{\sqrt{\mu \cdot \mathrm{f}}}$$

e = thickness to calculate
p = conductor resistivity
u = conductor's material permeability
f = current's frequency

for a copper conductor, of interest in our case, the formula would be as follows:

$$e = \frac{66}{\sqrt{\mathrm{f}}}$$

the value would be given in mm.

The conductor's resistance in alternating current would be given by

$$R = \frac{198 \cdot 10^{-5} \sqrt{\rho \cdot f}}{l} \Omega / m$$

I beins equal to the perimeter of the conductor's section in mm.

For Koper, the formula would be:

$$R = \frac{260.10^{-6} \sqrt{f}}{l} \Omega / m$$

FOUCAULT currents: when an ironmagnetic material is introduced inside an alternating masnetic field, in addition to magnetization, an induced tension is created; this produces n induced current that depends on the material's resistance.
This current induced in the material is consumed in the form of heat (JOULE effect) and is given by the following formula:

$$P = \frac{4 \cdot K}{\rho} B \cdot c^2 \cdot f^2 \cdot V^2$$

where P is the dissipated potency by Foucault currents; K is the constant; p is the copper's resistivity; B is the maximum induction that passes through the material;c is the tickness of the ironmasnetic material; f is the frequency and V is the volume of ironmagnetic material.

Losses due to capacity

Two conductors with different potentials store electric enersy at the same time, the wires used to form the coils have this particularity, thus, in a coil, we can talk of a sum of capacities distributed between the different spirals.
The coils studied are exposed to alternating high frequency tension, close to resonance frequency, which will sive us an elevated impedance, beins as they are parallel with the ohmic resistance of the coil and the self-induction coefficient of the coil.
These concepts conclude that the capacity of the coil itself in Pf is 0.55 times the coil's diameter in cm.
We can modify the coil's capacity, by: desisnins its dimensions, seekins the best windins, distributins the currents in the coil and isolation of the conductors.

The capacity between two conductor wires is:

$$C = \frac{0,0241.\xi}{lg\, D/d} \mu F / Km$$

Where ξ , is the dielectric constant of the isolation; D is the diameter of the conductor's isolated wire and d is the diameter of the conductor's wire without isolation.

Once isolation has been decided -which has to have a very low dielectric constant and must respond to our objectives- we have to analyze the relation D/d. When lower, the sreater the capacity; the technician has to decide on the best solution dependins on the maximum current that has to pass throush each wire and the tension to be supported by the wires.
An adequate cablins between the wires that form the Litz cable will sive us the uniformity necessary in the capacitive distribution throuShout the en tire cablins in the Litz cable, so increasins the coi/'s quality.

Placins a spiral of natural silk, poliester or any other fiber that responds to our requirements, as a support of the cablins of enameled wires, allows no in crease of D, and the spiral's step of the fiber has to be the ideal so that the Litz cable is not very rigid, and permits sood coilinS, without increasins the apparent inductance created between the spirals.

It is paradoxical that in the cables the relation lgd/d is a multiplier in inductance, for which it has to be as small as possible, and is a dividend in the capacity for which it has to be as big as possible.
It is the technician that calculates the coil that has to decide which are the parameters to consider in the study of the circuit: ohmic resistance, total induction and total capacity. The final result has to be a coil ready for use in the circuit, with the greater performance, less volume and good quality together with a lower loss resistance.

As a result, with the Litz cable, we will obtain the following:
- decrease of losses due to the Joule effect
- decrease of losses due to the Foucault currents
- smaller magnetic nucleus
- capacity in smaller coils
- greater quality
- to work with wires of easy handling during coiling
  being as theyare attached.
- extra flexible cables that allow the coiling of nucleus
  with a very small curving radius.

Manufacturing regulations
Masfarné manufacture according to the DIN 46447 regulation and designate the cables according to: number of wires for the wire's diameter and in continuation the type of coating in the same amount as the cable's layers.
The enameled copper wires must be tinned directly. The exterior diameter and others properties of the enameled copper wire will be up to the manufacturer if the client does not indicate specifically.
The exterior diameters without wire coating serve as a base for the calculation of the exterior diameters of the coated cables: these are not valid for reception control.

High frequency cabling cables (Litz cables) are defined by:
- thickness of each wire
- total number of wires and its reunion in groups
- cabling's step length
- coating

In the DIN 46447, the types of the calculated cables' cabling are indicated for each of the 4 concepts.
Any question about the preestablished total section of a conductor (effective section) are answered as follows:
Preestablished effective section: 0.70 mm'2,
Individual wire diameter: 0.10 mm; its section is 0.007854 mm2.
Number of wires that correspond: 0.70/0.007854 = 89.13 theoric wires. 90 wires would be taken. For which the cable studied will give us the following composition: 90 x 0. 10 mm.

Do not hesitate to call us for any question; our technical department will advise you and resolve any doubt you may have, for choosing the wire required.

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Tinned copper wires for electronic components

Conditioning: in coils according to standard 46399 of 4 and 8 kilograms.

Hilos estañados por immersión, especialmente diseñados para utilizar en electrónica
Immerged tinned wires, specially designed for electronic use
Fils étamés par immersion, spécialement étudié pour des utilisations électroniques
Tauchverzinnte Drähte, speziell für die Anwendung in der Elektronik entwickelt

Diámetro hilo mm *Diameter of wire in mm* Diamètre du fil mm *Drahtdurchmesser in mm*
0,20
0,25
0,30
0,40
0,50
0,60
0,70
0,80
1
1,20
1,50

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“FLEX·LINE" anti-inductive conductor

The "FLEX-LINE" is an extra-flexible electric anti-inductive conductor developed for high-current installations.

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Consultative tables

Características del cobre ***Copper specifications*** **Caractéristiques du cuivre** ***Eigenschaften des Kupfers***	
Símbolo químico/*Chemical symbol* Symbole chimique/*Chemisches Zeichen*	*Cu*
Número atómico/*Atomic number* Numéro atomique/*Anzahl Atome*	29
Peso atómico/*Atomic weight* Poids atomique/*Atomgewicht*	63,546
Estados de oxidación más comunes/*oxidation states more usual* État d'oxydation usuel/*Häufigste Oxydations-Zustände*	Cu^{+}, Cu^{2+}
Punto de fusión/*Fusion point* Point de fusion/*Schmelzpunkt*	1083 °C
Punto de ebullición/*Boiling point* Point d'ébullition/*Siedepunkt*	2567 °C
Densidad del cobre industrial a 20 °C *Density of industrial copper at 20 °C* Densité du cuivre industriel à 20°C *Dichtigkeit des Industriekupfers bei 20 °C*	8,9 g/cm^3
Calor específico entre 1 y 100 °C/*Specific heat between 1 and 100°C* Chaleur spécifique entre 1 et 100°C/*Spezifische Wärme zwischen 1 und 100 °C*	0,092 cal/°C.g
Calor específico a 2000 °K/*Specific heat at 2000 °K* Chaleur spécifique à 2.000°K/*Spezifische Wärme bei 2000 °K*	0,118 cal/°C.g
Conductibilidad térmica/*Thermic conductibility* Conductibilité thermique/*Wärmeleitfähigkeit*	0,93 (cal/cm2/cm) °C
Termo conductividad/*Thermic conductivity* Conductivité thermique/*Thermoleitwert*	3,98 w/cm.°C
Coeficiente de dilatación lineal a 25 °C *Coefficient of linear expansion at 25 °C* Coefficient de dilatation linéaire à 25°C *Linearer Dilatationskoeffizient bei 25 °C*	16,6 x 10^{-6}
Coeficiente de aumento de resistencia por grado a 20 °C *Increasing coefficient of resistance per grade at 20 °C* Coefficient d'augmentation de la résistance par degré à 20°C *Koeffizient der Erhöhung des Widerstands pro Grad bei 20 °C*	0,00393
Conductividad en estado de recocido a 20 °C *Conductivity in soft state at 20 °C* Résistivité à l'état recuit à 20°C *Leitfähigkeit in geglühtem Zustand bei 20 °C*	58 m/Ohm. mm^2
Resistividad en estado de recocido a 20 °C *Resistivity in soft state at 20 °C* Conductivité à l'état recuit à 20°C *Widerstand in geglühtem Zustand bei 20 °C*	0,071241 Ohm. mm^2/m
Resistividad másica/*Mass resistivity* Résistivité de masse/*Masse-Widerstand*	0,15328 Ohm. g/m^2
IACS recocido a 20 °C/IACS soft at 20 °C IACS recuit à 20°C/*IACS geglüht bei 20 °C*	*100%*
IACS alambre duro/ IACS hard wire (according to diameters) IACS fil dur *(suivant diamètres)/IACS Hartdraht (je nach Durchmesser)*	*96,5 a 98% (según diámetros)*
Resistencia a la tracción/Resistance to traction Résistance à la traction/*Zugfestigkeit*	*200 a 450 N/mm^2* (según estado de tratamiento) *(according to treatment state)* (suivant l'état de traitement) *(je nach Bearbeitungszustand)*

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Factor de corrección de la resistencia obtenida a t °C, para referirla a la temperatura normalizada, de 20 °C
Correcting factor of the resistance at t °C, to refer to regulated temperature, of 20 °C
Correction du facteur de la résistance à t°C, en référence à la température normalisée de 20°C
Korrektur-Faktor für den Widerstand bei t °C, bezogen auf die Standard-Temperatur von 20 °C

Temperatura del conductor durante la medición t °C *Conductor's temp. during measuring* Température de conducteur durant la mesure t°C *Temperatur des Leiters bei der Messung t °C*	Factor de corrección de los conductores de cobre (1) *Correcting factor of copper conductors (1)* Facteur de correction des conducteurs de cuivre(1) *Korrektur-Faktor der Kupfer-Leiter (1)*	Temperatura del conductor durante la medición t °C *Conductor's temp. during measuring* Température du conducteur durant la mesure t°C *Temperatur des Leiters bei der Messung t °C*	Factor de corrección de los conductores de cobre (1) *Correcting factor copper conductors (1)* Facteur de correction des conducteurs de cuivre(1) *Korrektur-Faktor der Kupfer-Leiter (1)*
5	1,06263	18	1,00792
5,5	1,06042	18,5	1,00593
6	1,05821	19	1,00394
6,5	1,05602	19,5	1,00197
7	1,05383	20	1,00000
7,5	1,05165	20,5	0,99804
8	1,04948	21	0,99609
8,5	1,04733	21,5	0,99414
9	1,04517	22	0,99220
9,5	1,04303	22,5	0,99027
10	1,04090	23	0,98835
10,5	1,03878	23,5	0,98643
11	1,03666	24	0,98453
11,5	1,03455	24,5	0,98262
12	1,03245	25	0,98073
12,5	1,03036	25,5	0,97885
13	1,02828	26	0,97697
13,5	1,02621	26,5	0,97510
14	1,02414	27	0,97323
14,5	1,02209	27,5	0,97137
15	1,02004	28	0,96952
15,5	1,01800	28,5	0,96768
16	1,01597	29	0,96584
16,5	1,01394	29,5	0,96402
17	1,01193	30	0,96219
17,5	1,00992		

(1) Correcting factors based in the coefficient 0.00393, per grade °C at 20 °C, of resistance's variation with the temperature, specified in standard UNE 20003.

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Amperios admisibles *Permissible load* Intensité admissible *Zulässige Ampère-Zahlen*			
Sección nominal *Nominal section* Section nominale *Nominalquerschnitt*	**Amperios admisibles aproximadamente** *Permissible load approx.* Intensité admissible approx. Amp. *Zulässige Ampère (ungefähr)*	**Sección nominal** *Nominal section* Section nominale *Nominalquerschnitt*	**Amperios admisibles aproximadamente** *Permissible load approx.* Intensité admissible approx. Amp. *Zulässige Ampère (ungefähr)*
0,1	5	35	195
0,14	6	50	250
0,2	7	70	300
0,25	9	95	360
0,35	10	120	420
0,5	12,5	150	480
0,75	15	185	570
1	18	240	670
1,5	21	300	780
2,5	30	400	950
4	40	500	1100
5,25	44	625	1300
6	55	800	1500
8	70	1000	1800
10	85	1500	2200
16	120	2000	2400
25	150	3000	3000

Calculated at a room temperature of 35°C and a maximum permissible temperature of the conductor of 70°C.

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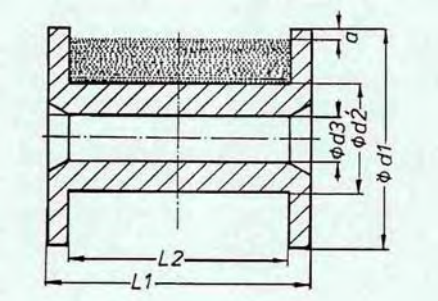
Tabla de carretes
Table of coils
Tableau des bobines
Spulen-Tabelle

Tipo de bobina *Type of coil* Type de bobine *Spulen-Type*	**d 1 mm** *d 1 mm* d_1 mm *d 1 mm*	**d 2 mm** *d 2 mm* d_2 mm *d 2 mm*	**d 3 mm** *d 3 mm* d_3 mm *d 3 mm*	**L 1 mm** *L 1 mm* L_1 mm *L 1 mm*	**L 2 mm** *L 2 mm* L_2 mm *L 2 mm*	**Tara kgs** *Tare kgs* Poids Kg *Tara kg*	**Volumen bobinado cm³** *Coiling volume cm³* Volume du bobinage cm³ *Volumen Wicklung cm³*
125	*125*	*80*	*16*	*125*	*100*	*0,20*	*450*
160	*160*	*100*	*22*	*160*	*128*	*0,35*	*970*
200	*200*	*125*	*22*	*200*	*160*	*0,60*	*2110*
250	*250*	*160*	*22*	*200*	*160*	*1,05*	*3430*
355	*355*	*225*	*36*	*200*	*160*	*3,20*	*7380*
500	*500*	*250*	*127*	*300*	*260*	*15,8*	*15890*



*Calculation of a **full** coil's content: multiply the volume per 8,9 gr/cm³, which is the copper's density.*
Example:
Coil 160
Volume = 970 cm³

$$\text{Weight} = 970\ \cancel{cm^3} \times 8{,}9\ \frac{\cancel{gr}}{\cancel{cm^3}} \times \frac{1\ kg}{1000\ \cancel{gr}} = 8{,}63\ kg$$

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Cables Litz de alta frecuencia S/DIN 46447
High frequency Litz cables S/DIN 46447
Câbles de Litz de haute fréquence s/DIN 46.447
Hochfrequenz-Litzenleiter nach DIN 46477

Estructura Hilos cobre esmaltados / *Structure of enameled copper wires* / Structure de fil de cuivre émaillé / *Struktur lackisolierte Kupferdrähte*		Form. de haces / *Size of rope* / Taille du toron / *Adern*	Diám. ext. sin recubrimiento / *Exterior Ø without coating* / Ø ext. sans isolant / *Aussendurchmesser ohne Ummantelung*		Diam. ext. con recubrimiento de seda sencillo (1 capa) doble (2 capas) / *Exterior Ø with silk coating simple (1 layer) double (2 layers)* / Ø ext. avec isolant de soie Unique (1 couche) Double (2couches) / *Aussendurchmesser mit Seidenummantelung einfach (1 Schicht) doppelt (2 Schichten)*				Secc. total / *Total section* / Section totale / *Querschnitt total*	Resistencia en cc a 20 °C en Ohm./km. / *Resistance in c.c. at 20°C in Ohm/Km* / Résistance C.C. 20°C en W/Km / *Widerstand in cc bei 20° C in Ohm/km.*		
N°	Ø NOM. mm		min. mm	máx. mm	min. mm	máx. mm	min. mm	máx. mm	mm²	NOM.	min.	máx.
10		1x10	0,153	0,183	0,185	0,218	0,216	0,253	0,01257	1420	1240	1610
12		1x12	0,175	0,208	0,207	0,243	0,238	0,278	0,01508	1190	1030	1340
15		1x15	0,191	0,228	0,227	0,268	0,254	0,298	0,01885	950	830	1070
20		1x20	0,218	0,260	0,254	0,300	0,281	0,330	0,02513	710	620	800
25		1x25	0,252	0,300	0,288	0,340	0,315	0,370	0,03142	570	500	640
30		1x30	0,270	0,321	0,306	0,361	0,333	0,391	0,03770	475	413	537
35		1x35	0,294	0,350	0,330	0,390	0,357	0,420	0,04398	407	354	460
45		1x45	0,336	0,400	0,372	0,440	0,399	0,470	0,05655	316	275	358
60	0,04	3x20	0,399	0,475	0,435	0,515	0,462	0,545	0,07540	237	207	268
75		3x25	0,461	0,550	0,497	0,590	0,533	0,630	0,09425	190	165	215
90		3x30	0,495	0,590	0,531	0,630	0,567	0,670	0,1131	158	138	179
105		3x35	0,538	0,640	0,574	0,680	0,610	0,720	0,1319	136	118	153
120		3x40	0,580	0,690	0,616	0,730	0,652	0,770	0,1508	119	103	134
135		3x45	0,617	0,735	0,653	0,775	0,689	0,815	0,1696	105	92	118
180		3x3x20	0,756	0,900	0,801	0,950	0,846	1,000	0,2262	79	69	89
225		3x3x25	0,869	1,035	0,914	1,085	0,959	1,135	0,2827	63	55	71
270		3x3x30	0,932	1,110	0,977	1,160	0,922	1,210	0,3393	52,7	45,9	59,6
6		1x6	0,156	0,186	0,188	0,221	0,219	0,256	0,01178	1520	1370	1670
8		1x8	0,172	0,205	0,204	0,240	0,235	0,275	0,01571	1150	1030	1250
10		1x10	0,190	0,226	0,226	0,266	0,253	0,296	0,01964	910	820	1000
12		1x12	0,216	0,258	0,252	0,298	0,279	0,328	0,02356	760	680	840
15		1x15	0,237	0,282	0,273	0,322	0,300	0,352	0,02945	610	550	670
20		1x20	0,270	0,322	0,306	0,362	0,333	0,392	0,03927	456	410	501
25		1x25	0,312	0,372	0,348	0,412	0,375	0,442	0,04909	365	328	401
30		1x30	0,334	0,398	0,370	0,438	0,397	0,468	0,05891	304	273	334
35		1x35	0,364	0,434	0,400	0,478	0,427	0,504	0,06872	260	234	286
45	0,05	1x45	0,416	0,496	0,452	0,536	0,479	0,566	0,08836	203	182	223
60		3x20	0,494	0,588	0,530	0,628	0,566	0,668	0,1178	152	137	167
75		3x25	0,572	0,682	0,608	0,722	0,644	0,762	0,1473	122	109	134
90		3x30	0,613	0,732	0,649	0,772	0,685	0,812	0,1767	101	91	111
105		3x35	0,665	0,794	0,701	0,834	0,737	0,874	0,2062	87	78	95
120		3x40	0,718	0,856	0,763	0,906	0,808	0,956	0,2356	76	68	84
135		3x45	0,765	0,911	0,810	0,961	0,855	1,011	0,2651	68	61	74
180		3x3x20	0,936	1,116	0,981	1,166	1,026	1,216	0,3534	50,6	45,6	57,6
225		3x3x25	1,076	1,283	1,121	1,333	1,166	1,373	0,4418	40,5	36,5	44,6
270		3x3x30	1,154	1,376	1,199	1,426	1,244	1,476	0,5301	33,8	30,4	37,1

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Estructura Hilos cobre esmaltados / *Structure of enameled copper wires* / Structure de fil de cuivre émaillé / *Struktur lackisolierte Kupferdrähte*		Form. de haces / *Size of rope* / Taille du toron / *Adern*	Diám. ext. sin recubrimiento / *Exterior Ø without coating* / Ø ext. sans isolant / *Aussendurchmesser ohne Ummantelung*		Diam. ext. con recubrimiento de seda sencillo (1 capa) doble (2 capas) / *Exterior Ø with silk coating simple (1 layer) double (2 layers)* / Ø ext. avec isolant de soie Unique (1 couche) Double (2couches) / *Aussendurchmesser mit Seidenummantelung einfach (1 Schicht) doppelt (2 Schichten)*				Secc. total / *Total section* / Section totale / *Querschnitt total*	Resistencia en cc a 20 °C en Ohm./km. / *Resistance in c.c. at 20°C in Ohm/Km* / Résistance C.C. 20°C en W/Km / *Widerstand in cc bei 20° C in Ohm/km.*		
N°	Ø NOM. mm		min. mm	máx. mm	min. mm	máx. mm	min. mm	máx. mm	mm²	NOM.	min.	máx.
3		1x3	0,158	0,184	0,190	0,219	0,221	0,254	0,01155	1550	1460	1640
5		1x5	0,197	0,230	0,233	0,270	0,260	0,300	0,01924	930	870	990
6		1x6	0,219	0,255	0,255	0,295	0,282	0,325	0,02309	780	730	820
8		1x8	0,242	0,282	0,278	0,322	0,305	0,352	0,03079	580	550	620
10		1x10	0,266	0,310	0,302	0,350	0,329	0,380	0,03848	465	437	493
12		1x12	0,304	0,354	0,340	0,394	0,367	0,424	0,04618	387	364	411
15		1x15	0,332	0,387	0,368	0,427	0,395	0,457	0,05773	310	231	329
20		1x20	0,380	0,442	0,416	0,482	0,443	0,512	0,07697	232	219	246
25		1x25	0,438	0,510	0,474	0,550	0,501	0,580	0,09621	186	175	197
30		1x30	0,468	0,546	0,540	0,586	0,540	0,626	0,11558	155	146	164
35		1x35	0,511	0,595	0,547	0,635	0,582	0,675	0,1347	133	125	141
45	0,07	1x45	0,583	0,680	0,619	0,720	0,655	0,760	0,1732	103	97	110
60		3x20	0,693	0,807	0,729	0,874	0,765	0,887	0,23098	78	73	82
75		3x25	0,803	0,935	0,848	0,985	0,893	1,035	0,2886	62	58	66
90		3x30	0,861	1,005	0,906	1,055	0,951	1,105	0,3464	51,7	48,6	54,8
105		3x35	0,935	1,090	0,980	1,140	1,025	1,190	0,4041	44,3	41,6	46,9
120		3x40	1,007	1,173	1,052	1,223	1,097	1,263	0,4618	38,8	36,4	41,1
135		3x45	1,075	1,250	1,120	1,300	1,165	1,350	0,5195	34,4	32,4	36,5
180		3x3x20	1,315	1,530	1,360	1,580	1,405	1,630	0,6927	25,8	24,3	27,4
225		3x3x25	1,510	1,760	1,555	1,810	1,600	1,860	1,8659	20,7	19,4	21,9
270		3x3x30	1,620	1,890	1,665	1,940	1,710	1,990	1,039	17,2	16,2	18,3
315		3x3x35	1,765	2,060	1,810	2,110	1,860	2,160	1,212	14,8	13,9	15,6
405		3x3x45	2,015	2,350	2,060	2,400	2,105	2,450	1,559	11,5	10,8	12,2
10		1x10	0,380	0,431	0,416	0,471	0,443	0,501	0,07854	228	214	242
12		1x12	0,433	0,491	0,469	0,531	0,496	0,561	0,09425	190	179	201
15		1x15	0,473	0,537	0,509	0,577	0,545	0,617	0,01178	152	143	161
20		1x20	0,541	0,613	0,577	0,653	0,613	0,693	0,15714	114	107	121
25		1x25	0,624	0,708	0,660	0,748	0,696	0,788	0,19634	91	86	97
30		1x30	0,668	0,757	0,704	0,797	0,740	0,837	0,2356	76	71	81
35	0,10	1x35	0,728	0,826	0,764	0,866	0,800	0,906	0,2749	65	61	69
45		1x45	0,832	0,944	0,877	0,994	0,922	1,044	0,3534	50,6	47,6	53,7
60		3x20	0,988	1,120	1,033	1,170	1,078	1,220	0,4712	38,0	35,7	40,3
75		3x25	1,145	1,300	1,190	1,350	1,235	1,400	0,5890	30,4	28,6	32,2
90		3x30	1,228	1,395	1,273	1,445	1,318	1,495	0,7069	25,3	22,8	26,8
105		3x35	1,330	1,510	1,375	1,560	1,420	1,610	0,8247	21,7	20,4	23,0
120		3x40	1,435	1,626	1,480	1,678	1,523	1,718	0,9425	19,0	17,8	20,1
135		3x45	1,530	1,735	1,575	1,785	1,620	1,835	1,060	16,9	15,9	17,9

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Tabla de galgas
Table of gages
Tableau des freins de moyeux
Lehren-Tabelle

Galga nº / *Gage no.* / Frein Nº / *Lehre Nr.*	Imperial standard Pulg. / *Imperial standard Inch*	mm / *mm*	Alambres Birmingham Pulg. / *Birmingham Wire and Stubs Inch*	mm / *mm*	Chapas y flejes Birmingham Pulg. / *Birmingham Sheet and Hoop Inch*	mm / *mm*
	Standard Impérial Pouce / *Imperial Standard Zoll*	mm / *mm*	Fil de fer Birmingham Pouce / *Birmingham Drähte Zoll*	mm / *mm*	Plaques & feuillard Birmingham Pouce / *Birmingham Bleche und Bänder Zoll*	mm / *mm*
0000	0,400	10,160	0,454	11,530	–	–
000	0,372	9,448	0,425	10,795	0,500	12,700
00	0,348	8,839	0,380	9,652	0,4452	11,308
0	0,324	8,229	0,340	8,636	0,3964	10,068
1	0,300	7,620	0,300	7,620	0,3532	8,971
2	0,276	7,010	0,284	7,213	0,3147	7,993
3	0,252	6,400	0,259	6,578	0,2804	7,122
4	0,232	5,892	0,238	6,045	0,2500	6,350
5	0,212	5,384	0,220	5,588	0,2225	5,651
6	0,192	4,876	0,203	5,156	0,1981	5,031
7	0,176	4,470	0,180	4,572	0,1764	4,480
8	0,160	4,064	0,165	4,190	0,1570	3,987
9	0,144	3,657	0,148	3,759	0,1398	3,550
10	0,128	3,251	0,134	3,403	0,1250	3,175
11	0,116	2,946	0,120	3,048	0,1113	2,827
12	0,104	2,640	0,109	2,768	0,0991	2,517
13	0,092	2,336	0,095	2,413	0,0882	2,240
14	0,080	2,032	0,083	2,108	0,0785	1,993
15	0,072	1,828	0,072	1,828	0,0699	1,775
16	0,064	1,625	0,065	1,651	0,0625	1,587
17	0,056	1,422	0,058	1,473	0,0556	1,412
18	0,048	1,219	0,049	1,244	0,0495	1,257
19	0,040	1,016	0,042	1,066	0,0440	1,117
20	0,036	0,914	0,035	0,889	0,0392	0,995
21	0,032	0,812	0,032	0,812	0,0349	0,886
22	0,028	0,711	0,028	0,711	0,03125	0,793
23	0,024	0,609	0,025	0,635	0,02782	0,706
24	0,022	0,558	0,022	0,558	0,02476	0,628
25	0,020	0,508	0,020	0,508	0,02204	0,559
26	0,018	0,457	0,018	0,457	0,01961	0,498
27	0,0164	0,416	0,016	0,406	0,01745	0,443
28	0,0148	0,375	0,014	0,355	0,01264	0,396
29	0,0136	0,345	0,013	0,330	0,01390	0,353
30	0,0124	0,314	0,012	0,304	0,01230	0,312
31	0,0116	0,294	0,010	0,254	0,01100	0,279
32	0,0108	0,274	0,009	0,228	0,00980	0,248
33	0,0100	0,254	0,008	0,203	0,00870	0,220
34	0,0092	0,233	0,007	0,177	0,00770	0,195
35	0,0084	0,213	0,005	0,127	0,00690	0,175
36	0,0076	0,193	0,004	0,101	0,00610	0,154
37	0,0068	0,172	–	–	0,00540	0,137
38	0,0060	0,152	–	–	0,00480	0,121
39	0,0052	0,132	–	–	0,00430	0,109
40	0,0048	0,121	–	–	0,00386	0,098
41	0,0044	0,111	–	–	0,00343	0,087
42	0,0040	0,101	–	–	0,00306	0,077
43	0,0036	0,091	–	–	0,00272	0,069
44	0,0032	0,081	–	–	0,00242	0,061
45	0,0028	0,071	–	–	0,00215	0,054
46	0,0024	0,060	–	–	0,00192	0,048
47	0,0020	0,050	–	–	0,00170	0,043
48	0,0016	0,040	–	–	0,00152	0,038

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Tabla de galgas «AWG»
Table of gages «AWG»
Tableau des freins de moyeux "AWG"
"AWG"-Lehren-Tabelle

AWG (B&S) números *AWG (B &S) numbers* N° AWG *AWG (B&S) Anzahl*	Diámetro nominal (mm) *Nominal diameter mm* Diamètre nominal mm *Durchmesser nominal (mm)*	Sección nominal (mm^2) *Nominal section mm^2* Section nominale mm^2 *Querschnitt nominal (mm^2)*	Peso nominal (Kg/Km) *Nominal weight (Kg/Km)* Poids nominal Kg/Km *Nominalgewicht (kg/km)*	Resistencia a 20 °C (Ohms/Km) *Resistance at 20 °C (Ohms/Km)* Résistance à 20°C Ohms/Km *Widerstand bei 20 °C (Ohm/km)*
4/0	*11,68*	*107,2*	*953,19*	*0,1608*
3/0	*10,40*	*85,03*	*755,86*	*0,2028*
2/0	*9,266*	*67,43*	*599,46*	*0,2556*
1/0	*8,252*	*53,48*	*475,50*	*0,3225*
1	*7,348*	*42,41*	*376,96*	*0,4065*
2	*6,544*	*33,63*	*299,00*	*0,5128*
3	*5,827*	*26,67*	*237,07*	*0,6463*
4	*5,189*	*21,15*	*188,11*	*0,8153*
5	*4,621*	*16,77*	*149,13*	*1,028*
6	*4,115*	*13,30*	*118,27*	*1,296*
7	*3,665*	*10,55*	*93,775*	*1,634*
8	*3,264*	*8,366*	*74,383*	*2,061*
9	*2,906*	*6,632*	*58,965*	*2,599*
10	*2,588*	*5,261*	*46,789*	*3,256*
11	*2,305*	*4,172*	*37,093*	*4,134*
12	*2,053*	*3,309*	*29,426*	*5,210*
13	*1,828*	*2,624*	*23,335*	*6,571*
15	*1,450*	*1,650*	*14,668*	*10,45*
16	*1,291*	*1,309*	*11,232*	*13,18*
17	*1,150*	*1,038*	*9,2281*	*16,61*
18	*1,024*	*0,8232*	*8,5171*	*20,95*
19	*0,9116*	*0,6527*	*5,803*	*26,39*
20	*0,8118*	*0,5176*	*4,602*	*33,30*
21	*0,7229*	*0,4105*	*3,649*	*41,99*
22	*0,6439*	*0,3255*	*2,895*	*52,95*
23	*0,5733*	*0,2582*	*2,295*	*66,80*
24	*0,5105*	*0,2047*	*1,820*	*84,22*
25	*0,4547*	*0,1624*	*1,444*	*106,20*
26	*0,4049*	*0,1288*	*1,145*	*133,9*
27	*0,3607*	*0,1021*	*0,9079*	*168,9*
28	*0,3211*	*0,0809*	*0,7199*	*212,9*
29	*0,2859*	*0,0642*	*0,5708*	*268,6*
30	*0,2547*	*0,0509*	*0,4527*	*338,6*
31	*0,2268*	*0,0404*	*0,3591*	*426,6*
32	*0,2019*	*0,0320*	*0,2847*	*538,4*
33	*0,1798*	*0,0254*	*0,2258*	*678,8*
34	*0,1601*	*0,0211*	*0,1790*	*856*
35	*0,1426*	*0,0160*	*0,1420*	*1.079*
36	*0,1270*	*0,0127*	*0,1127*	*1.360*
37	*0,1131*	*0,0100*	*0,0893*	*1.716*
38	*0,1007*	*0,0080*	*0,0708*	*2.164*
39	*0,0897*	*0,0063*	*0,0561*	*2.729*
40	*0,0799*	*0,0050*	*0,0445*	*3.442*
41	*0,0711*	*0,0040*	*0,0353*	*4.310*
42	*0,0632*	*0,0032*	*0,0279*	*5.454*
43	*0,0564*	*0,0025*	*0,0222*	*6.852*
44	*0,0503*	*0,0020*	*0,0177*	*8.621*
45	*0,0447*	*0,0015*	*0,0139*	*11.135*

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Prefijos para las unidades
Unities prefixes
Préfixes des Unités
Vorzeichen

Factor por el que debe multiplicarse la unidad *Factor to multiply the unit* Facteur multipliant l'unité *Multiplikations-Faktor pro Einheit*	Prefijo *Prefixe* Préfixe *Vorzeichen*	Símbolo *Symbol* Symbole *Symbol*
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	mili	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Relación entre las unidades de trabajo y potencia
Relation between the working and potency unities
Relation entre les Unités de travail et de puissance
Verhältnis zwischen Arbeitseinheit und Potenz

(1) Trabajo/*Work* (1) Travail/*Arbeit*	kgm	CVh	kWh	kcal	BTU
1 kgm	*1*	$3.7.10^{-6}$	$2.72.10^{-6}$	$2.34.10^{-3}$	$9.3.10^{-3}$
1 CVh	$2.27.10^{6}$	*1*	*0.736*	*632*	*2509*
1kWh	$0.37.10^{6}$	*1.36*	*1*	*860*	*3417*
1 kcal	*427*	$1.58.10^{-3}$	$1.16.10^{-3}$	*1*	*3,97*
1 BTU	*107.65*	$0.399.10^{-3}$	$0.29.10^{-3}$	*0.252*	*1*
(2) Potencia/*Potency* **(2) Puissance/*Potenz***	**kgm/s**	**CV**	**kW**	**kcal/s**	**BTU/s**
1 kgm/s	*1*	$13.3.10^{-3}$	$9.81.10^{-3}$	$2.34.10^{-3}$	$9.3.10^{-3}$
1 CV	*75*	*1*	*0.736*	*0.176*	*0.702*
1 kW	*102*	*1.36*	*1*	*0.239*	*0.953*
1 kcal/s	*427*	*5.69*	*4.19*	*1*	*3,97*
1 BTU/s	*107.65*	*1.43*	*1.05*	*0.252*	*1*

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Principales unidades eléctricas
Principal electric unities
Principales Unités électriques
Die wichtigsten elektrischen Einheiten

Magnitud *Magnitude* Valeur *Grösse*	**Unidad** *Unity* Unité *Einheit*	**Símbolo** *Symbol* Symbole *Symbol*
Tensión/*Tension*/Tension/*Spannung*	Voltio/Volt	V
Intensidad de corriente/*Current intensity* Intensité de courant/*Stromstärke*	Amperio Ampère	A
Resistencia/*Resistance*/Résistance/*Widerstand*	Ohmio/Ohm	Ω
Resistividad/*Resistivity*/Résistivité/*Spezifischer Widerstand*	Ohm x mm² / m	Ωmm²/m
Conductividad/*Conductivity*/Conductivité/*Leitfähigkeit*	Siemens	S = 1/Ω
Capacidad/*Capacity*/Capacité/*Kapazität*	Faradio/Farad	F
Intensidad del campo eléctrico/*Electric field's intensity* Intensité de champs électrique/*Feldstärke*	Voltio/cm Volt / cm	V/cm
Inductancia/*Inductance*/Inductance/*Induktivität*	Henrio/Henry	H
Intensidad del campo magnético/*Magnetic field intensity* Intensité de champs magnétique/*Magnetfeldstärke*	Amperio/cm Ampère / cm	Av/cm
Inducción magnética/*Magnetic induction* Induction magnétique/*Magnetflussdichte*	Gauss	G
Cantidad de electricidad/*Amount of electricity* Quantité d'électricité/*Elektrizitätsmenge*	Culombio Coulomb	C
Densidad de corriente/*Current density* Densité de courant/*Stromdichte*	Amp / cm²	A/mm²
Frecuencia/*Frequency*/Fréquence/*Frequenz*	Herzio/Herz	Hz
Trabajo/*Work*/Travail/*Leistung*	Kilovatio hora/*hour*/heure	kWh
Potencia aparente/*Apparent potency* Puissance apparente/*Scheinleistung*	Kilovoltiamperio Kilovoltampère	kVA
Potencia activa/*Active potency*/Puissance active/*Wirkleistung*	Kilovatio/Kilowatt	kW
Potencia reactiva/*Reactive potency*/Puissance réactive/*Blindleistung*	Kilovar	kVar

Relación entre escalas de temperatura
Relation between temperature scales
Relation entre les échelles de température
Verhältnis zwischen den Temperaturskalen

Denominación *Denomination* Dénomination *Bezeichnung*	**Abreviaturas** *Abridgment* Symbole *Abkürzung*	**Conversión en grados centígrados** *Conversion in °C* Conversion en degré Celsius *Umwandlung in Grad Celsius*
Grado Fahrenheit	°F	5/9 (F-32°)
Grado Centígrado	°C	1
Grado Kelvin	°K	K-273,16°

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Tabla de medida sección y peso de alambres y barras
Measuring table section and weight of wires and bars
Tableau de mesure de sections et poids des fils et barres
Masstabelle der Querschnitte und Gewichte von Drähten und Schienen

mm	mm²	gr/m	mm	mm²	gr/m
0,15	0,0176715	0,157	1,40	1,53938	13,70
0,16	0,0201062	0,179	1,60	2,01062	17,89
0,17	0,0226980	0,202	1,80	2,54469	22,65
0,18	0,0254469	0,226	2,00	3,14159	27,96
0,19	0,0283529	0,252	2,20	3,80133	33,83
0,20	0,0314159	0,280	2,25	3,97608	35,39
0,21	0,0346361	0,308	2,50	4,90874	43,69
0,22	0,0380133	0,338	2,80	6,15752	54,80
0,23	0,0415476	0,370	3,00	7,06858	62,91
0,24	0,0452389	0,403	3,80	9,62113	85,63
0,25	0,0490874	0,437	4,00	12,5664	118,8
0,28	0,0615752	0,548	4,50	15,9043	141,5
0,32	0,0804248	0,716	5,00	19,6350	174,8
0,35	0,0962113	0,856	5,80	23,7583	211,5
0,40	0,125664	1,118	6,00	28,2743	251,6
0,45	0,159043	1,415	6,50	33,1831	295,3
0,50	0,196350	1,748	7,00	38,4845	342,5
0,55	0,237583	2,114	8,00	50,2655	447,4
0,60	0,282743	2,516	9,00	63,6173	566,2
0,65	0,331831	2,953	10,00	78,5398	699,0
0,80	0,502655	4,474	12,00	113,097	1006
0,85	0,567450	5,050	15,00	176,715	1573
0,90	0,636173	5,662	18,00	254,469	2265
0,95	0,708822	6,309	20,00	314,159	2796
1,00	0,785398	6,990	25,00	490,874	4369
1,10	0,950332	8,458	30,00	706,858	6291
1,20	1,13097	10,07	35,00	968,113	8616