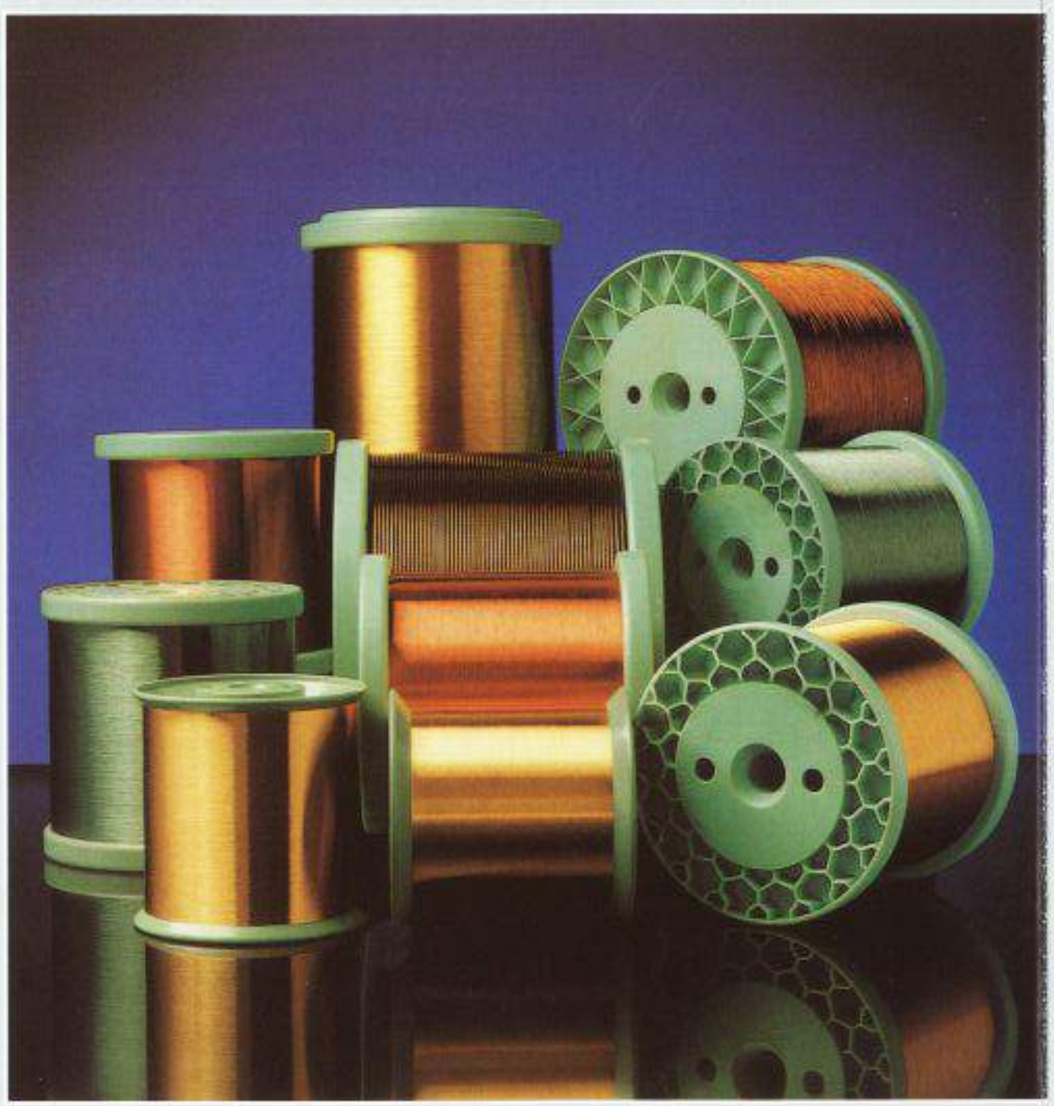
Enamelled copper and aluminium round wires



IRCE is an Italian group with a significant position in the European market, which is engaged in two business activities:
- winding wires;
- electrical cables.

The Group is a leading global player in the winding wire market, with a production capacity over 100,000 tons per year, and manufacturing sites in Italy, Netherlands, UK, Germany, Brazil and India. IRCE offers a complete range of products: round and rectangular conductors of any dimensions in copper or aluminium, using all existing types of insulating materials.

IRCE was established in Imola (BO) Italy in 1947, where its Head Office is still located, and quickly conquered its space, in the beginning, in the winding wire market, then also in the electrical cable market.

The Group went public in 1996 and, since 2001, it is listed on the Star segment of the Italian Stock Exchange; the segment of the market where only medium-size companies with high potential are listed.

The Group is acknowledged for the high quality of its products and for its customer service, for the innovative and modern production systems, for its high technologies and advanced automatic control systems, for the highly qualified and competent employees.

IRCE is compliant with the standards of the certifications of ISO 9001, ISO TS 16949 and ISO 14001, and operates in full respect of all existing health, safety and environmental regulations.

IRCE

IQNet CSQ AUTO CSQ eco

MEASURES TABLE: COPPER (IEC 60317-0-1) ALUMINIUM (IEC 60317-0-3)

Nominal diameter conductor	Tolerance conductor ±	GRADE 1		GRADE 2		Minimum increase bonding layer	GRADE 1B	GRADE 1B	Nominal linear resistance at 20°C		Suggeted winding tension	
		Minimum increase	Maximum overall diameter	Minimum increase	Maximum overall diameter		Maximum overall diameter	Maximum overall diameter	Cu Ohm/m	Al Ohm/m	Cu pN	Al pN
mm	mm	mm	mm	mm	mm	mm	mm	mm				
0,018	(2)	0,002	0,022	0,004	0,024				67,17517			
0,020		0,002	0,024	0,004	0,027	0,002	0,026	0,029	54,41189		0,005	
0,022		0,002	0,027	0,005	0,030	0,002	0,030	0,033	44,96850		0,006	
0,025		0,003	0,031	0,005	0,034	0,002	0,034	0,037	34,82361		0,007	
0,032		0,003	0,039	0,007	0,043	0,003	0,044	0,048	21,25464		0,012	
0,036		0,004	0,044	0,008	0,049	0,003	0,050	0,055	16,79379		0,014	
0,040		0,004	0,049	0,008	0,054	0,003	0,055	0,060	13,60297		0,017	
0,045		0,005	0,055	0,009	0,061	0,003	0,062	0,068	10,74803		0,021	
0,050		0,005	0,060	0,010	0,066	0,003	0,068	0,074	8,70590		0,024	
0,056		0,006	0,067	0,011	0,074	0,003	0,075	0,082	6,94029		0,030	
0,063	↓	0,006	0,076	0,012	0,083	0,005	0,085	0,092	5,48369		0,036	
0,071	0,003	0,007	0,084	0,012	0,091	0,005	0,094	0,101	4,31755		0,043	
0,080	0,003	0,007	0,094	0,014	0,101	0,005	0,105	0,112	3,40074		0,052	
0,090	0,003	0,008	0,105	0,015	0,113	0,005	0,117	0,125	2,68701		0,064	
0,100	0,003	0,008	0,117	0,016	0,125	0,005	0,129	0,137	2,17648		0,077	
0,112	0,003	0,009	0,130	0,017	0,139	0,008	0,143	0,152	1,73507		0,095	
0,125	0,003	0,010	0,144	0,019	0,154	0,009	0,158	0,168	1,39294		0,114	
0,140	0,003	0,011	0,160	0,021	0,171	0,010	0,175	0,186	1,11045		0,140	
0,160	0,003	0,012	0,182	0,023	0,194	0,010	0,197	0,209	0,85019	1,387	0,178	0,081
0,180	0,003	0,013	0,204	0,025	0,217	0,010	0,220	0,233	0,67175	1,096	0,221	0,100
0,200	0,003	0,014	0,226	0,027	0,239	0,011	0,243	0,256	0,54412	0,888	0,267	0,121
0,224	0,003	0,015	0,252	0,029	0,266	0,012	0,270	0,284	0,43377	0,708	0,329	0,150
0,250	0,004	0,017	0,281	0,032	0,297	0,013	0,300	0,316	0,34824	0,568	0,401	0,182
0,280	0,004	0,018	0,312	0,033	0,329	0,013	0,331	0,348	0,27761	0,453	0,492	0,224
0,315	0,004	0,019	0,349	0,035	0,367	0,014	0,369	0,387	0,21935	0,358	0,608	0,276
0,355	0,004	0,020	0,392	0,038	0,411	0,015	0,413	0,432	0,17270	0,282	0,752	0,342
0,400	0,005	0,021	0,439	0,040	0,459	0,016	0,461	0,481	0,13603	0,222	0,924	0,420
0,450	0,005	0,022	0,491	0,042	0,513	0,016	0,514	0,536	0,10748	0,175	1,139	0,518
0,500	0,005	0,024	0,544	0,045	0,566	0,017	0,568	0,590	0,08706	0,142	1,367	0,621
0,560	0,006	0,025	0,606	0,047	0,630	0,017	0,630	0,654	0,06940	0,113	1,679	0,763
0,630	0,006	0,027	0,679	0,050	0,704	0,018	0,704	0,729	0,05484	0,089	2,063	0,938
0,710	0,007	0,028	0,762	0,053	0,789	0,019	0,788	0,815	0,04318	0,070	2,532	1,151
0,800	0,008	0,030	0,855	0,056	0,884	0,020	0,882	0,911	0,03401	0,055	3,106	1,412
0,900	0,009	0,032	0,959	0,060	0,989	0,020	0,987	1,017	0,02687	0,044	3,806	1,730
1,000	0,010	0,034	1,062	0,063	1,094	0,021	1,091	1,123	0,02176	0,036	4,634	2,106
1,120	0,011	0,034	1,184	0,065	1,217	0,022	1,214	1,247	0,01735	0,028	5,527	2,512
1,250	0,013	0,035	1,316	0,067	1,349	0,022	1,346	1,379	0,01393	0,023	6,679	3,036
1,400	0,014	0,036	1,468	0,069	1,502	0,023	1,499	1,533	0,01110	0,018	8,047	3,658
1,600	0,016	0,038	1,670	0,071	1,706	0,023	1,702	1,738	0,008502	0,014	9,917	4,508
1,800	0,018	0,039	1,872	0,073	1,909				0,006718	0,011	12,104	5,502
2,000	0,020	0,040	2,074	0,075	2,112				0,005441	0,009	14,765	6,711
2,240	0,022	0,041	2,316	0,077	2,355				0,004338	0,007	17,507	7,958
2,500	0,025	0,042	2,578	0,079	2,618				0,003482	0,006	20,941	9,519
2,800	0,028	0,043	2,880	0,081	2,922				0,002776	0,005	25,060	11,391
3,150	0,032	0,045	3,233	0,084	3,276				0,002193	0,004	30,541	13,882
3,550	0,036	0,046	3,635	0,086	3,679				0,001727	0,003	38,751	17,614
4,000	0,040	0,047	4,088	0,089	4,133				0,001360	0,002	49,099	22,318
4,500	0,045	0,049	4,591	0,092	4,637				0,001075	0,002	62,079	28,218
5,000	0,050	0,050	5,093	0,094	5,141				0,000871	0,001	76,564	34,802

(I) On the table are not mentioned the intermediate diameters belonging to the R40 serie, these diameters are manufatured only on request
(2) For these tolerances are not fixed the relevant figures, for the acceptance only the linear resistance value required

Imola - Italy

Joinville - Brazil

Nijmegen - The Netherlands

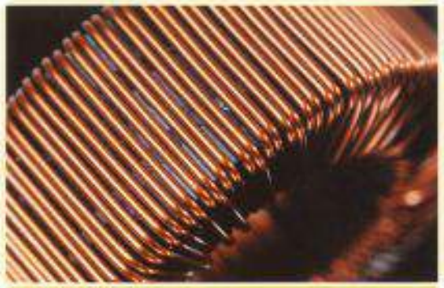
Blackburn - UK

Umbertide - Italy

Cochin - India

Kierspe - Germany

Main Enamelled Round Wires

Characteristics \ Denomination		Salflex 180		Poliflex 180	Poliflex 200		Poliflex C
Conductor Material		*Copper*	*Aluminium*	*Copper*	*Copper*	*Aluminium*	*Copper*
Thermal class (Copper/Aluminium) (temperature index)		Cu: H (180 °C)	Al: H (180 °C)	H (180 °C)	Cu: H (>200 °C)	Al: H (>220 °C)	H (>240 °C)
Chemical composition: **- Base resins** **- Overcoat** **- Bonding coat**		Modified polyurethanes - -		Polyesterimide - -	Polyesterimide THEIC Amide-Imide -		Polyimide - -
Reference to the International Standards		*Copper* IEC 60317-51 NEMA MW 1000 spec. MW 82-C	*Aluminium* Irce Internal Standard	*Copper* IEC 60317-23 NEMA MW 1000 spec. MW 77-C	*Copper* IEC 60317-13 NEMA MW 1000 spec. MW 35-C/MW 73-C	*Aluminium* IEC 60317-25 NEMA MW 1000 spec. MW 35-A/MW 73-A	*Copper* IEC 60317-7 NEMA MW 1000 spec. MW 16-C
UL - approval		File E 60641			File E 60641		
Diameters range (mm)	**grade 1 (L)** **grade 2 (2L)**	*Copper* ø 0,018 to 2,24 ø 0,050 to 1,80	*Aluminium* ø 0,150 to 0,630 ø 0,150 to 0,630	*Copper* ø 0,030 to 1,000 ø 0,050 to 1,000	*Copper* ø 0,080 to 2,500 ø 0,011 to 6,000	*Aluminium* ø 0,150 to 5,000 ø 0,150 to 5,000	*Copper* ø 0,200 to 0,800 ø 0,200 to 0,800
Cut-through temperature	**ø 0,050 mm** **ø 0,500 mm**	Higher than 240 °C Higher than 260 °C		300 ÷ 310 °C 310 ÷ 320 °C	- Higher than 340 °C		- Higher than 450 °C
Heat Shock to IEC standard	**ø 0,300 mm** **ø 0,500 mm**	230 ÷ 240 °C 220 ÷ 230 °C		230 ÷ 250 °C 220 ÷ 250 °C	Higher than 300 °C Higher than 300 °C		Higher than 400°C Higher than 400°C
Significant properties		○ Directly solderable without any prior mechanical stripping of the enamel at the temperature: ø 0,050 mm at 370 ÷ 390 °C in 1"; ø 0,500 mm at 380 ÷ 400 °C in 2". ○ Due to a good surface smoothness and copper softness is excellent for fine wire windings requiring high filling factor. ○ Good thermal resistance (180 °C). ○ Good mechanical resistance. ○ Excellent resistance to sizing of epoxied and polyamide resins.		○ Good mechanical resistance. ○ High thermal resistance (180 °C), Self-solderable wire: ø 0,050 mm at 450 ÷ 470 °C in 2"; ø 0,280 mm at 480 ÷ 500 °C in 2". ○ Low percentage of extraction with perchloroethylene and chloride solvents in general. ○ High resistance to solvents.	○ Excellent winding characteristics due to the high resistance to abrasions and to the good surface smoothness. ○ Excellent thermal resistance (>200 °C). ○ Very high resistance to impregnating varnishes and to humidity. ○ Very low precentage of extraction with perchloroethylene with Danfoss method. ○ Excellent resistance to transformers oil.		○ Highest thermal class > 220 °C. ○ Excellent electrical chemical and thermal characteristics superior to any other enamelled wire.
							
Applications		△ Is especially suitable for applications requiring automated soldering systems: small transformers, small motors, measuring equipments, impregnated and unimpregnated coils operating at a max temperature of 180 °C.		△ Motors, transformers, electromagnetic coils and in general electrical assemblies working at high temperatures up to a maximum of 180 °C.	△ Motors, hermetic compressors motors, oil filled transformers, ballasts and in general electric assemblies operating at very high temperature up to 200 °C.		△ This wire is the most suitable for special windings exposed to extreme mechanical and thermal stress as in nuclear and space fields.

No contractual document. Above mentioned data are for information only

Cemenflex 155

Copper	*Aluminium*
Cu: F (155 °C)	Al: F (155 °C)
Modified polyurethanes with polyesters – Polyamide	
Copper	*Aluminium*
IEC 60317-35	Irce Internal Standard
Copper	*Aluminium*
ø 0,020 to 1,400 ø 0,100 to 1,400	ø 0,200 to 1,500 ø 0,200 to 1,500
– 215 ÷ 235 °C	
230 ÷ 240 °C 220 ÷ 230 °C	

- Directly solderable.
- Self-bonding takes place under thermal or solvent action.

▲ Suitable for self-supporting TV deflection coils, small motors, loudspeakers coils.

Cemenflex 200

Copper	*Aluminium*
Cu: H (200 °C)	Al: H (200 °C)
Polyesterimide THEIC Polyamide-imide Aromatic Polyamide	
Copper	*Aluminium*
IEC 60317-38	Irce Internal Standard
File E 60641	
Copper	*Aluminium*
ø 0,132 to 1,500 ø 0,132 to 1,500	ø 0,200 to 1,500 ø 0,200 to 1,500
– Higher than 330 °C	
Higher than 300 °C Higher than 300 °C	

- Improved chemical and mechanical stability due to Amide-Imide overcoat.
- Resistance to increased temperatures, humidity and refrigerants.

▲ Top quality thermosetting wire of triple layer construction, particularly suitable for one-phase, three phase and universal motors, magnetic spools up to and including thermal Class H-200°C.

Other types

Salflex 155
UL approval: File E 60641

Base resin: modified Polyurethane
Thermal class F (155 °C)
IEC 60317-20 NEMA MW 79-C
Directly solderable, without previous removal of the enamel:
ø 0,05 mm at 350 ÷ 370 °C in 1";
ø 0,50 mm at 370 ÷ 380 °C in 2".
(Aluminium version available)

Poliflex 180 ST
UL approval: File E 60641

Base resin: Polyesterimide
Thermal class H (180 °C)
IEC 60317-23 NEMA MW 77-C
Heat resisting winding wire which at inscreased temperature of the tinning bath can be tinned without previous removal of the enamel coating.
(For soldering temperature and time: see POLIFLEX 180)

Poliflex H
UL approval: File E 60641

Base resin: Polyester-Amide-Imide
Thermal class H (180 °C)
IEC 60317-8 NEMA MW 74
Special winding wire with improved thermal, mechanical and chemical properties for the construction of motors and transformers.

Cemenflex 180
UL approval: File E 60641

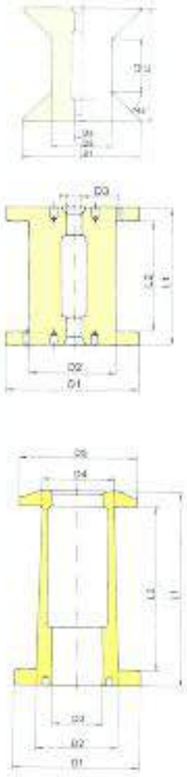
Base resin: Polyesterimide THEIC
Bonding coat: Polyamide
Thermal class H (180 °C)
IEC 60317-37
Increased resistance due to the base coat Polyesterimide THEIC.
High thermal resistance.
Suitable for applications requiring self-bonding properties at high temperature and when the traditional impregnating process wish to be avoided.

Thermoflex

Base resin: Modified Polyvinil Acetate
IEC 60317-12
Thermal class B (120 °C)
High mechanical and solvents resistance. Due to excellent resistance to the oils it is advisable for transformers.

Special products and customer made wires

The continuous improvement of the industrial products performance requires the development of new materials and technological process.
IRCE produces enamelled wires according to special customer specifications.



Conductors materials

IRCE produces enamelled wires in varius metals:

- COPPER — Quality: Cu-ETP according to EN 1977 Purity: Cu+Ag > 99,90
- ALUMINIUM — Quality: E-Al according to EN 573-3 Purity: Al > 99,50
- COPPER-CLAD ALUMINIUM — CCA wire is a bimetallic wire with a copper claddind concentrically covering an aluminium core, which combines the properties of both metals in a single composite material.
  We can have two kinds of copper percentage in volume: 10% and 15%

PHYSICAL PROPERTIES		COPPER	ALUMINIUM	CCA 15% *
density	kg/dm³	8,92	2,70	3,63
melting point	°C	1084,6	660,3	1084,6÷660,32
specific heat	J/(kg·K)	385,1	896,9	623,7
coefficient of linear expansion	µm·m⁻¹·K⁻¹	17,0	23,0	22,0
thermal conductivity	W·m⁻¹·K⁻¹	393,5	237,0	247,0
electrical resitivity	nΩ·m	17,24	28,20	25,73
tensile strengh	N/mm²	220 ÷ 270	100 ÷ 160	138 ÷ 220
COMPARISON		**COPPER**	**ALUMINIUM**	**CCA 15% ***
conductivity IACS (annealed)	-	100	61,1	67,0
elongation	-	≥ 20	≥ 8	≥ 10
lenght with same weight and diameter	-	1	3,30	2,46
diameter for the same tensile load	-	1	1,88	1,37
for the same DC resistance	diameter	1	1,28	1,22
"	area	1	1,64	1,49
"	weight	1	0,50	0,61
windability	-	very good	good	good
weight	-	bad	very good	good
solderability	-	very good	bad	very good
conductivity	-	very good	good	good

All data are referred at 20° C
*CCA - Copper Clad Aluminium: 15% is ratio of sectional area to copper; 38,8% is ratio of mass to copper

Delivery packing program

Reels characteristics and dimensions

Reel type	Reels dimensions in mm							Recommended for wire size (mm)				Wire Weight KG/reel	
	D1	D2	D3	L1	L2	D4	D5	Copper		Aluminium		CU	AL
Biconical reels													
BK76	63,5	44,4	16	86	60	-	-	0,018	0,025	-	-	0,3	-
BK100	100	56	16	100	49	-	-	0,025	0,036	-	-	1,0	-
BK125	125	71	16	125	65	-	-	0,032	0,050	-	-	2,3	-
BK125 L	125	71	22	200	140			0,036	0,050	-	-	4,5	-
BK160	160	90	22	160	85	-	-	0,045	0,090	-	-	6	-
BK200	200	112	22	200	106	-	-	0,050	0,125	-	-	11	-
BK200 L	200	112	22	315	221	-	-	0,050	0,125	-	-	20	
BK250	250	140	22	250	133	-	-	0,063	0,125	-	-	22	-
Cylindrical reels													
80	80	50	16	80	64	-	-	0,025	0,036	-	-	0,6	-
100	100	63	16	100	80	-	-	0,036	0,05	-	-	1,1	-
125	125	80	16	125	100	-	-	0,036	0,05	-	-	2,3	-
160	160	100	22	160	128	-	-	0,05	0,20	-	-	5,8	-
200	200	125	22	200	160	-	-	0,14	0,56	-	-	14	-
250	250	160	22	200	160	-	-	0,56	2,00	-	-	22	-
355	355	224	36	200	160	-	-	1,50	5,00	1,32	5,00	52	16
500	500	315	36	250	160	-	-	2,00	5,00	1,32	5,00	110	35
630	630	315	127	230	180	-	-	-	-	1,50	5,00	180	60
Conical reels													
A200 (200/315)	200	125	100	315	265	112	190	0,10	0,14			18	-
A250 (250/400)	250	160	100	400	335	140	236	0,10	2,00	0,15	0,25	45	15
A315 (315/500)	315	200	100	500	425	180	300	0,18	1,50	0,28	0,50	90	27
A400 (400/630)	400	250	100	630	530	224	375	0,25	2,24	0,45	3,15	180	56
A500 (500/800)	500	315	100	800	670	280	475	0,355	2,24	0,80	3,15	370	115
A630 (630/1000)	630	400	100	935	850	355	600	0,450	2,24	0,80	3,15	750	230