TECHNICAL DATA FOR **WINDING WIRE**

Ever since the early days of electricity we have been at the heart of electronic development. Today LWW Group is a leading global supplier of winding wire.

LWW WIRE POWER

Whatever your product, rest assured that we can provide you with the right winding wire, made from fully recyclable copper or aluminium. We have been a partner to the electronics industry since the early days of electricity and today you will find our high-quality wire employed in a wide range of applications, from drilling machines and vacuum cleaners to trains and wind turbines. Driven by future-oriented development, adaptability and sustainability, we have grown into a leading global supplier of winding wire. We call this LWW wire power.

GLOBAL

LWW Group is a leading global supplier of copper and aluminium winding wire solutions. Through our business and production units in Sweden, Germany, Poland and China, we offer a complete product range and a wide geographical presence. This makes us a true global partner, with in-depth local knowledge as well as the capability and flexibility to handle complex worldwide orders.

EXPERIENCED

After more than a century in business, we acquired extra-ordinary experience in the production of winding wire. From just a few small independent businesses we have grown into one of the world's largest, most modern manufacturers of winding wire, with a global capacity of around 100,000 tonnes per year.

Along with our sister companies in the Liljedahl Group, we handle everything from raw materials to customer applications. We control all aspects of the production and logistics chain, thereby ensuring punctual delivery and precision quality.

FLEXIBLE

Our production facilities manufacture winding wire of all types – copper or aluminium, round or rectangular – which means we are very flexible. Most of our production is to order and our production system is designed to meet customer needs.

SUSTAINABLE

We are proud to be an industry leader when it comes to minimising our environmental impact. Solvent emissions are significantly below EU directives, copper and aluminium waste is 100 per cent recycled and all packing is reused. We discharge no copper or aluminium into water supplies and any excess energy is used to heat our premises. Our environmental management system is certified in accordance with ISO 14000.

LWW Group is part of the Liljedahl Group – an industrial and commercial group with operations in Europe and China. The Group is organised into seven divisions: Bare Wire, Winding Wire, Steel Wire, Machine Tools, Trucks, Cars and Real Estate. All of the Liljedahl Group companies represent strong brands and occupy market-leading positions. The Group has annual sales of SEK 10 billion and 1,200 employees.

BUILT-IN QUALITY

Quality is not only a question of control – it is something you create and integrate into your everyday work. We are driven by our vision of anticipating our customers' needs and exceeding their expectations – in product quality as well as customer service.

The raw material for both rectangular and round winding wire is rolled copper or aluminium wire. Rectangular wire is made through an extrusion process, in which a wire rod is pressed through a die to acquire its final dimensions. The wire is then enamelled or covered with yarn, foil or other insulating material, or a combination of materials.

Round wire gains its dimensions through one or more stages of cold drawing. The inline manufacturing process means that the final drawing, annealing, enamelling and paraffin waxing are performed by the same machine. Taken together, this dramatically shortens lead times and improves our flexibility and availability.

Our patented paraffin-wax method includes an advanced procedure for melting wax directly onto the wire. This method has influenced an entire industry into exchanging benzine for our more environmentally friendly method of lubrication.

The commonly used Process^{LWW} assures that customers are supplied with the right quality every time. The system includes advanced quality-control systems, full traceability and real-time monitoring of production.

We are certified in accordance with international quality management systems such as ISO 9001, ISO 14001, ISO/TS 16949, OHSAS 18001 and ISO 50001, to mention just a few. For more detailed information, please visit www.lww.se, where you also can download certificates and documents.

DEFINITIONS

STANDARDS

The standards for enamelled and glass-fibre covered winding wire are published by the International Electrotechnical Commission (IEC), an international standardisation body. This internationally established set of specifications covers packaging, test methods, dimensions and product performance and is applied by LWW Group. For tape-insulated special products (DAMIC, DAKAP, etc), internal standards based on established customer requirements are used.

DEFINITIONS OF DIMENSIONS AND GRADES

Round winding wire is defined according to the nominal cross-section diameter, regardless of the insulation thickness. The actual diameter of the insulated product is then limited by the tolerance range:

$Ø_{min}$ = actual conductor diameter + min increase due to insulation; and
$Ø_{max}$ = max overall diameter

Enamelled products are categorised in accordance with the IEC, depending on the grade of the applied insulation, defined as follows:

$$Ø_{Grade1} < Ø_{Grade2} < Ø_{Grade3}$$

Therefore, properties which depend on the thickness of the insulation (e.g. electrical breakdown voltage, resistance to abrasion, springiness, etc) vary from one grade to the next.

TERMINOLOGY FOR RESISTANCE, RESISTIVITY AND AREA

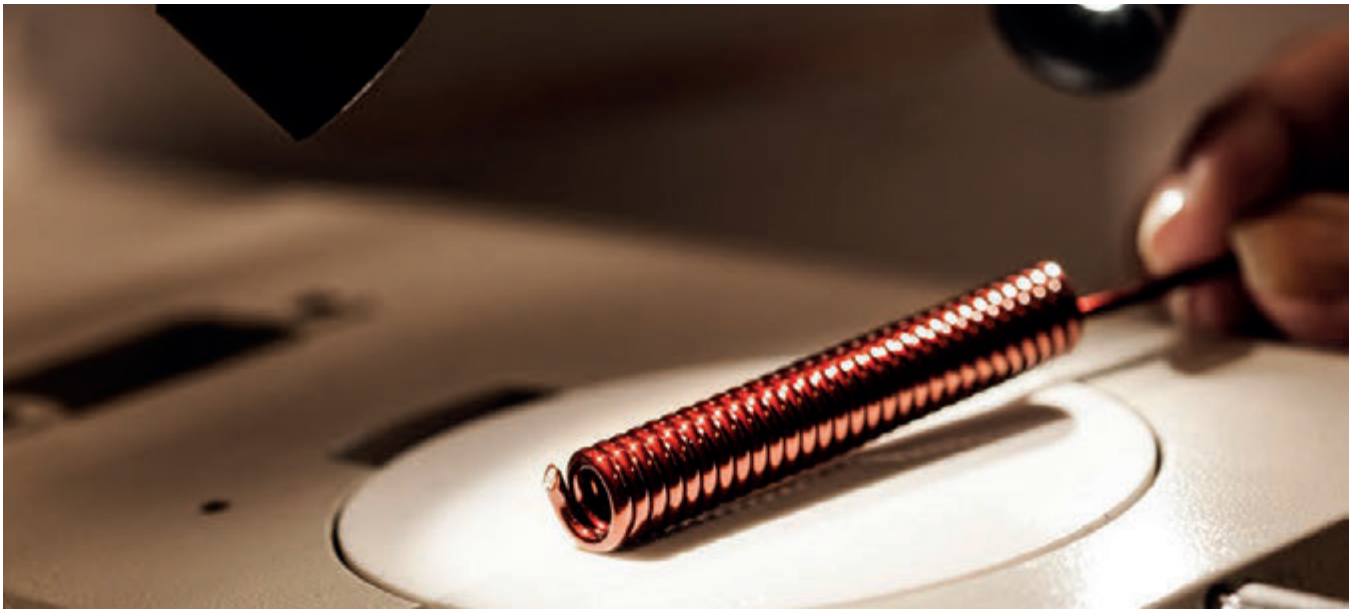
The resistance of a wire-shaped conductor is:

$$\mathbf{R} = \rho \frac{l}{A}$$

where:
l = length of conductor in metres
A = cross-section of conductor in m^2
ρ = resistivity of conductor material in Ωm

The square metre is not a practical unit of measure for conductor area; therefore, in this brochure, A is always stated in mm^2. Applying this unit in the equation above gives ρ expressed in μΩm or, more clearly, $Ωmm^2/m$, which is the unit used in this document. The resistivity is temperature dependent. A temperature of 20°C applies to all of the resistivity-dependent data in the following pages.

Subject to modification.
For more detailed information see our product datasheets.



GENERAL TECHNICAL INFORMATION

CORRELATIONS

Proportions of aluminium and copper under identical conditions of resistance:

Dimension: $_{Al} = 1.27\ _{Cu}$
Area: $A_{Al} = 1.63\ A_{Cu}$
Weight: $m_{Al} = 0.50\ m_{Cu}$

COPPER

Quality standard:	ASTM B 49; EN1977 ETP/ETP1
Resistivity (ρ_{Cu}):	0.01709 Ωmm²/m
Specific heat (cp_{Cu}):	0.368 J/(g K)
Temperature coefficient of resistance (α_{Cu}):	3.93 ‰
Coefficient of longitudinal expansion (a_{Cu}):	18.5 .10^{-6}/K
Specific gravity:	8.96 g/cm³
Thermal conductivity (λ_{Cu}):	370 – 400 W/(m K)

ALUMINIUM

Quality standard:	EN 573-3 (EAl 99.7)
Resistivity (ρ_{Al}):	0.02789 Ωmm²/m
Specific heat (cp_{Al}):	0.207 J/(g K)
Temperature coefficient of resistance (α_{Al}):	4.30 ‰
Coefficient of longitudinal expansion (a_{Al}):	23.8 .10^{-6}/K
Specific gravity:	2.70 g/cm³
Thermal conductivity (λ_{Al}):	200 W/(m K)

TEMPERATURE DEPENDENCE OF RESISTANCE

If resistance R_T is measured at a temperature $T \neq 20$ °C, then resistance R_{20} can be calculated as follows:

$$R_{20} = \frac{R_T}{1 + \alpha\,(T - 20)}$$

where:
T = the actual temperature in °C at the time of measurement
α = the temperature coefficient (see the sections above on copper and aluminium)

The temperature coefficients above only apply within the range $15 \geq T \geq 25$ (°C).

Winding wire is a core element in everyday products and modern infrastructure. We offer a complete range of copper and aluminium wire for all types of applications.

PRODUCT RANGE
ROUND ENAMELLED COPPER WIRE




	DAMID 180	DAMID 200	DAMID 220	DAMID 240
Class	180	200	220	240
Standard	IEC 60317-8	IEC 60317-13	IEC 60317-57	IEC 60317-46
Insulation	THEIC-modified esterimide	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide	Polyamide-imide	Aromatic polyimid
UL approval	E106565 (Isodraht)	E101843 (Dahréntråd) E106565 (Isodraht) E206884 (Slaska)	Not approved	Not approved
Dimension range				
Grade 1	0.090 - 6.00	0.090 - 6.00	0.250 - 2.00	0.500 - 2.00
Grade 2	0.090 - 6.00	0.090 - 6.00	0.250 - 2.00	0.500 - 2.00
Grade 3	-	0.355 - 4.00	-	-
Properties	Suitable for winding in high speed machines. Very good resistance to transformer oils. Very good resistance to typical solvent. Freon resistant. Excellent resistance to mechanical stress.	High heat resistance. Suitable for winding in high speed machines. Very good resistance to transformer oils. Very good resistance to typical solvent. Freon resistant. Excellent resistance to mechanical stress.	Very good abrasion resistance. Excellent heat resistance. Suitable for winding in high speed machines.	Very high cut-trough temperature. Excellent heat resistance. Very good mechanical resistance.
Temperatue index	≥ 180 °C	≥ 200 °C	≥ 220 °C	≥ 240 °C
Heat shock	≥ 200 °C	≥ 220 °C	≥ 240 °C	≥ 260 °C
Solder temperature	-	-	-	-
Cut-through	≥ 320 °C	≥ 320 °C	≥ 350 °C	≥ 450 °C
Reels and packaging	www.lww.se			

PRODUCT RANGE
ROUND ENAMELLED COPPER WIRE




	DASOL 155	DASOL 180	DAMIDSOL 180	DAMID SL 200
Class	155	180	180	200
Standard	IEC 60317-20	IEC 60317-51	IEC 60317-23	IEC 60317-13
Insulation	Polyurethane	Polyurethane	Modified esterimide	THEIC-modified polyester or polyesterimide, over-coated with polyamide-imide (selflubricated)
UL approval	E206884 (Slaska)	E101843 (Dahréntråd) E106565 (Isodraht) E206884 (Slaska)	E106565 (Isodraht)	Not approved
Dimension range				
Grade 1	0.180 - 0.750	0.200 - 2.00	0.150 - 1.50	0.150 - 2.50
Grade 2	0.180 - 0.750	0.200 - 2.00	0.150 - 1.50	0.150 - 2.50
Grade 3	-	-	-	-
Properties	Very good mechanical resistance. Suitable in high speed winding machines. Directly solderable.	Suitable in high speed winding machines. Directly solderable. Very short soldertime. Excellent mechanical resistance.	Very good hairline crack avoidance. Solderable at 470 °C.	High heat resistance. Suitable for winding in high speed machines. Very good resistance to transformer oils. Very good resistance to typical solvent. Freon resistant. Excellent resistance to mechanical stress.
Temperatue index	≥ 155 °C	≥ 180 °C	≥ 180 °C	≥ 200 °C
Heat shock	≥ 175 °C	≥ 200 °C	≥ 200 °C	≥ 220 °C
Solder temperature	≥ 375 °C	≥ 375 °C	≥ 470 °C	-
Cut-through	≥ 200 °C	≥ 230 °C	≥ 265 °C	≥ 320 °C
Reels and packaging	www.lww.se			

PRODUCT RANGE
ROUND ENAMELLED COPPER WIRE



	DAMID CR 200	DAPREST 200	DAMIDBOND 200
Class	200	200	200
Standard	IEC 60317-13	IEC 60317-13 + internal LWW	IEC 60317-38
Insulation	THEIC-modified polyesterimide, overcoated with polyamide-imide	THEIC-modified polyesterimide, overcoated with polyamide-imide	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, with a bonding layer
UL approval	E101843 (Dahréntråd) E206884 (Slaska)	Not approved	E101843 (Dahréntråd) E106565 (Isodraht)
Dimension range			
Grade 1	0.315 - 2.00	0.630 - 2.00	0.200 - 1.50
Grade 2	0.315 - 2.00	0.630 - 2.00	0.200 - 1.50
Grade 3	0.315 - 2.00	-	-
Properties	Excellent corona effect resistance. High cut-through temperature. Very good heat resistance. Very good mechanical resistance.	Excellent corona effect resistance. Very good heat resistance. High cut-through temperature.	High heat resistance. Suitable for winding in high speed machines. Very good resistance to transformer oils. Very good resistance to typical solvent. Freon resistant. Excellent resistance to mechanical stress. Bondable at 180°C-220°C. High re-softening temperature.
Temperatue index	≥ 200 °C	≥ 200 °C	≥ 200 °C
Heat shock	≥ 220 °C	≥ 220 °C	≥ 220 °C
Solder temperature	-	-	-
Cut-through	≥ 320 °C	≥ 340 °C	≥ 320 °C
Reels and packaging	www.lww.se		

TECHNICAL DATA, COPPER WIRE
DAMID, DASOL, DAMID SL, DAMID CR, DAPREST, DAMIDSOL

ACCORDING TO IEC 60317-0-1

		Grade 1		Grade 2		Grade 3					Area	Resistance
Nominal conductor diameter	Conductor tolerance +/-	min increase	max overall diameter	min increase	max overall diameter	min increase	max overall diameter	Length (m/kg) Grade 1	Grade 2	Grade 3	mm² Nominal	20°C Ω/m Nominal
0.090	0.003	0.008	0.105	0.015	0.113	0.022	0.120	16628	16121	15675	0.00636	2.6870
0.100	0.003	0.008	0.117	0.016	0.125	0.023	0.132	13453	13084	12759	0.00785	2.1765
0.112	0.003	0.009	0.130	0.017	0.139	0.026	0.147	10759	10463	10199	0.00985	1.7351
0.125	0.003	0.010	0.144	0.019	0.154	0.028	0.163	8663	8427	8213	0.01227	1.3929
0.140	0.003	0.011	0.160	0.021	0.171	0.030	0.181	6927	6743	6574	0.01539	1.1104
0.150	0.003	0.012	0.171	0.023	0.182	0.033	0.193	6040	5890	5739	0.01767	0.9673
0.160	0.003	0.012	0.182	0.023	0.194	0.033	0.205	5313	5179	5054	0.02011	0.8502
0.180	0.003	0.013	0.204	0.025	0.217	0.036	0.229	4204	4102	4006	0.02545	0.6718
0.200	0.003	0.014	0.226	0.027	0.239	0.039	0.252	3409	3335	3259	0.03142	0.5441
0.212	0.003	0.015	0.240	0.029	0.254	0.043	0.268	3032	2965	2897	0.03530	0.4843
0.224	0.003	0.015	0.252	0.029	0.266	0.043	0.280	2722	2665	2608	0.03941	0.4338
0.236	0.004	0.017	0.267	0.032	0.283	0.048	0.298	2447	2391	2339	0.04374	0.3908
0.250	0.004	0.017	0.281	0.032	0.297	0.048	0.312	2186	2139	2095	0.04909	0.3482
0.265	0.004	0.018	0.297	0.033	0.314	0.050	0.330	1948	1906	1866	0.05515	0.3099
0.280	0.004	0.018	0.312	0.033	0.329	0.050	0.345	1748	1713	1679	0.06158	0.2776
0.300	0.004	0.019	0.334	0.035	0.352	0.053	0.36	1524	1493	1479	0.07069	0.2418
0.315	0.004	0.019	0.349	0.035	0.367	0.053	0.384	1384	1358	1333	0.07793	0.2193
0.335	0.004	0.020	0.372	0.038	0.391	0.057	0.408	1223	1200	1179	0.08814	0.1939
0.355	0.004	0.020	0.392	0.038	0.411	0.057	0.428	1091	1072	1054	0.09898	0.1727
0.375	0.005	0.021	0.414	0.040	0.434	0.060	0.453	978	961	944	0.1104	0.1548
0.400	0.005	0.021	0.439	0.040	0.459	0.060	0.478	861	847	834	0.1257	0.1360
0.425	0.005	0.022	0.466	0.042	0.488	0.064	0.508	763	750	738	0.1419	0.1205
0.450	0.005	0.022	0.491	0.042	0.513	0.064	0.533	682	671	661	0.1590	0.1075
0.475	0.005	0.024	0.519	0.045	0.541	0.067	0.562	612	603	594	0.1772	0.09646
0.500	0.005	0.024	0.544	0.045	0.566	0.067	0.587	553	545	537	0.1963	0.08706
0.530	0.006	0.025	0.576	0.047	0.600	0.071	0.623	492	485	478	0.2206	0.07748
0.560	0.006	0.025	0.606	0.047	0.630	0.071	0.653	442	436	430	0.2463	0.06940
0.600	0.006	0.027	0.649	0.050	0.674	0.075	0.698	385	380	375	0.2827	0.06046
0.630	0.006	0.027	0.679	0.050	0.704	0.075	0.728	350	345	341	0.3117	0.05484
0.650	0.007	0.028	0.702	0.053	0.729	0.080	0.751	328	324	320	0.3318	0.05151
0.670	0.007	0.028	0.722	0.053	0.749	0.080	0.774	309	305	301	0.3526	0.04848
0.710	0.007	0.028	0.762	0.053	0.789	0.080	0.814	276	272	269	0.3959	0.04318
0.750	0.008	0.030	0.805	0.056	0.834	0.085	0.861	247	244	241	0.4418	0.03869
0.800	0.008	0.030	0.855	0.056	0.884	0.085	0.911	217	215	212	0.5027	0.03401
0.850	0.009	0.032	0.909	0.060	0.939	0.090	0.968	193	190	188	0.5675	0.03012
0.900	0.009	0.032	0.959	0.060	0.989	0.090	1.018	172	170	168	0.6362	0.02687
0.950	0.010	0.034	1.012	0.063	1.044	0.095	1.074	154	153	151	0.7088	0.02412
1.000	0.010	0.034	1.062	0.063	1.094	0.095	1.124	139	138	137	0.7854	0.02176
1.060	0.011	0.034	1.124	0.065	1.157	0.098	1.188	124	123	122	0.8825	0.01937
1.120	0.011	0.034	1.184	0.065	1.217	0.098	1.248	111	110	109	0.9852	0.01735
1.180	0.012	0.035	1.246	0.067	1.279	0.100	1.311	100	99	99	1.094	0.01563
1.250	0.013	0.035	1.316	0.067	1.349	0.100	1.381	89	89	88	1.227	0.01393
1.320	0.013	0.036	1.388	0.069	1.422	0.103	1.455	80	80	79	1.368	0.01249
1.400	0.014	0.036	1.468	0.069	1.502	0.103	1.535	71	71	70	1.539	0.01110
1.500	0.015	0.038	1.570	0.071	1.606	0.107	1.640	62	62	61	1.767	0.009673
1.600	0.016	0.038	1.670	0.071	1.706	0.107	1.740	55	54	54	2.011	0.008502
1.700	0.017	0.039	1.772	0.073	1.809	0.110	1.844	49	48	48	2.270	0.007531
1.800	0.018	0.039	1.872	0.073	1.909	0.110	1.944	43	43	43	2.545	0.006718
1.900	0.019	0.040	1.974	0.075	2.012	0.113	2.048	39	39	38	2.835	0.006029
2.000	0.020	0.040	2.074	0.075	2.112	0.113	2.148	35	35	35	3.142	0.005441
2.120	0.021	0.041	2.196	0.077	2.235	0.116	2.272	31	31	31	3.530	0.004843
2.240	0.022	0.041	2.316	0.077	2.355	0.116	2.392	28	28	28	3.941	0.004338
2.360	0.024	0.042	2.438	0.079	2.478	0.119	2.516	25	25	25	4.374	0.003908
2.500	0.025	0.042	2.578	0.079	2.618	0.119	2.656	23	22	22	4.909	0.003482
2.650	0.027	0.043	2.730	0.081	2.772	0.123	2.811	20	20	20	5.515	0.003099
2.800	0.028	0.043	2.880	0.081	2.922	0.123	2.961	18.0	17.9	17.8	6.158	0.002776
3.000	0.030	0.045	3.083	0.084	3.126	0.127	3.166	15.7	15.6	15.5	7.069	0.002418
3.150	0.032	0.045	3.233	0.084	3.276	0.127	3.316	14.2	14.2	14.1	7.793	0.002193
3.350	0.034	0.046	3.435	0.086	3.479	0.130	3.521	12.6	12.5	12.5	8.814	0.001939
3.550	0.036	0.046	3.635	0.086	3.679	0.130	3.721	11.2	11.2	11.1	9.898	0.001727
3.750	0.038	0.047	3.838	0.089	3.883	0.134	3.926	10.0	10.0	10.0	11.04	0.001548
4.000	0.040	0.047	4.088	0.089	4.133	0.134	4.176	8.8	8.8	8.8	12.57	0.001360
4.250	0.043	0.049	4.341	0.092	4.387	0.138	4.431	7.8	7.8	7.8	14.19	0.001205
4.500	0.045	0.049	4.591	0.092	4.637	0.138	4.681	7.0	7.0	6.9	15.90	0.001075
4.750	0.048	0.050	4.843	0.094	4.891	0.142	4.936	6.3	6.2	6.2	17.72	0.0009646
5.000	0.050	0.050	5.093	0.094	5.141	0.142	5.186	5.7	5.6	5.6	19.63	0.0008706

The technical data included is up to date at the time of printing.
LWW reserve the right to make any amendments deemed necessary.

TECHNICAL DATA, COPPER WIRE
DAMIDBOND
ACCORDING TO IEC 60317-0-1

			Grade 1B		Grade 2B		Length (m/kg)		Area mm²	Resistance, 20°C, Ω/m
Nominal conductor diameter	Conductor tolerance +/-	min increase bonding	min increase	max overall diameter	min increase	max overall diameter	Grade 1B	Grade 2B	Nominal	Nominal
0.200	0.003	0.011	0.014	0.243	0.027	0.256	3311	3236	0.031	0.544
0.212	0.003	0.012	0.015	0.258	0.029	0.272	2945	2877	0.035	0.484
0.224	0.003	0.012	0.015	0.270	0.029	0.284	2649	2591	0.039	0.434
0.236	0.004	0.013	0.017	0.286	0.032	0.302	2381	2324	0.044	0.391
0.250	0.004	0.013	0.017	0.300	0.032	0.316	2130	2083	0.049	0.348
0.265	0.004	0.013	0.018	0.316	0.033	0.333	1901	1859	0.055	0.310
0.280	0.004	0.013	0.018	0.331	0.033	0.348	1709	1673	0.062	0.278
0.300	0.004	0.014	0.019	0.354	0.035	0.372	1490	1459	0.071	0.242
0.315	0.004	0.014	0.019	0.369	0.035	0.387	1355	1329	0.078	0.219
0.335	0.004	0.015	0.020	0.393	0.038	0.412	1197	1174	0.088	0.194
0.355	0.004	0.015	0.020	0.413	0.038	0.432	1070	1050	0.099	0.173
0.375	0.005	0.016	0.021	0.436	0.040	0.456	959	942	0.110	0.155
0.400	0.005	0.016	0.021	0.461	0.040	0.481	846	831	0.126	0.136
0.425	0.005	0.016	0.022	0.489	0.042	0.511	750	737	0.142	0.120
0.450	0.005	0.016	0.022	0.514	0.042	0.536	671	660	0.159	0.107
0.475	0.005	0.017	0.024	0.543	0.045	0.565	602	592	0.177	0.096
0.500	0.005	0.017	0.024	0.568	0.045	0.590	544	536	0.196	0.087
0.530	0.006	0.017	0.025	0.600	0.047	0.624	485	478	0.221	0.077
0.560	0.006	0.017	0.025	0.630	0.047	0.654	436	429	0.246	0.069
0.600	0.006	0.018	0.027	0.674	0.050	0.699	380	374	0.283	0.060
0.630	0.006	0.018	0.027	0.704	0.050	0.729	345	340	0.312	0.055
0.650	0.007	0.018	0.028	0.728	0.053	0.755	324	319	0.332	0.052
0.670	0.007	0.019	0.028	0.748	0.053	0.775	305	301	0.353	0.048
0.710	0.007	0.019	0.028	0.788	0.053	0.815	272	269	0.396	0.043
0.750	0.008	0.020	0.030	0.832	0.056	0.861	244	241	0.442	0.039
0.800	0.008	0.020	0.030	0.882	0.056	0.911	215	212	0.503	0.034
0.850	0.009	0.020	0.032	0.937	0.060	0.967	190	188	0.567	0.030
0.900	0.009	0.020	0.032	0.987	0.060	1.017	170	168	0.636	0.027
0.950	0.010	0.021	0.034	1.041	0.063	1.073	153	151	0.709	0.024
1.000	0.010	0.021	0.034	1.091	0.063	1.123	138	137	0.785	0.022
1.060	0.011	0.022	0.034	1.154	0.065	1.187	123	122	0.882	0.019
1.120	0.011	0.022	0.034	1.214	0.065	1.247	110	109	0.985	0.017
1.180	0.012	0.022	0.035	1.276	0.067	1.309	100	99	1.094	0.016
1.250	0.013	0.022	0.035	1.346	0.067	1.379	89	88	1.227	0.014
1.320	0.013	0.023	0.036	1.419	0.069	1.453	80	79	1.368	0.012
1.400	0.014	0.023	0.036	1.499	0.069	1.533	71	70	1.539	0.011
1.500	0.015	0.023	0.038	1.602	0.071	1.638	62	61	1.767	0.010

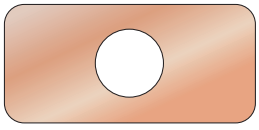
The technical data included is up to date at the time of printing.
LWW reserve the right to make any amendments deemed necessary.

PRODUCT RANGE
SPECIAL PRODUCTS

	DALITZ	DAMID 200 TUBE	DAMID 200 TUBE	TUBE (various insulations)
Class	180	200	200	Depend on type of insulation
Conductor material	Cu-ETP1	Cu-DHP (capillary tubes)	Cu-OF, Cu-OFE and CuAg (OF) (hollow conductors)	Cu-OF, Cu-OFE and CuAg(OF) (hollow conductors)
Standard	DIN 46 436-1	IEC 60317-13	Customer requirement	Customer requirement
Insulation	Polyamid-paper and/or Polyester-tape*	Basecoat: THEIC-modified polyester imide Overcoat: Polyamid-imide	Basecoat: THEIC modified polyester or polyesterimide Overcoat: Polyamid-imide	Enamel, Kapton foil, Mica tape, PET film, glassfibre yarn, glassfibre polyester yarn (combinations possible)
UL approval	E106565 (Isodraht)	E106565, MW 35	E 101843	Not approved
Dimension range	Round: 6.00 ≤ Ø ≤ 20.00 mm Rectangular: 10 - 220mm²	1,00 ≤ Ø ≤2,50 mm With different capillary sizes Dimensions on request	Dimensions on request (shapes see below)	Dimensions on request (shapes see below)
Properties	High flexibility	Very good abrasion resistance Very good impregnation resistance Very good hydrolysis resistance	High heat resistance, very good resistance to transformer oils, very good resistance to typical solvent, Freon resistant. Excellent resistance to mechanical stress	Depend on type of insulation
Temperatue index	≥180°C	≥ 200 °C	≥ 200 °C	Depend on type of insulation
Heat shock		≥ 220 °C	≥ 220 °C	Depend on type of insulation
Reels and packaging	www.lww.se			

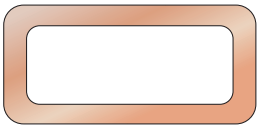
*Fore more information regarding other insulations and materials please contact us

Conductor shapes:

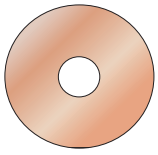


Rectangular with round hole

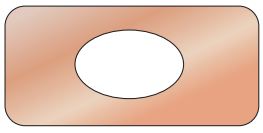
Square with square hole



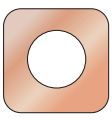
Rectangular with uniform wall thickness



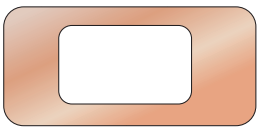
Round with round hole



Rectangular with oval hole

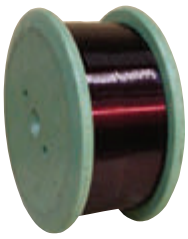


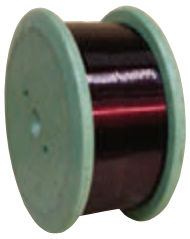
Square with round hole



Rectangular with non uniform wall thickness

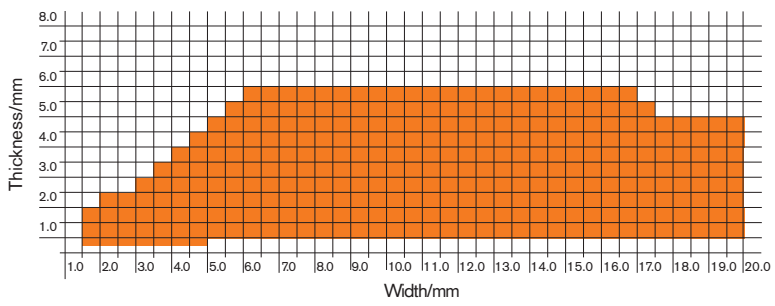
PRODUCT RANGE
RECTANGULAR ENAMELLED COPPER WIRE



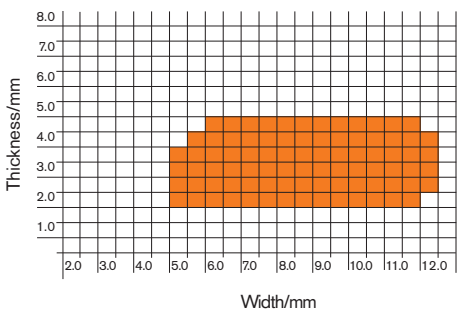


	DAMID 200	DAMIDBOND 200
Class	200	200
Standard	IEC 60317-29	IEC 60317-29 + internal LWW standard
Insulation	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, with a bonding layer
UL approval	E101843 (Dahréntråd) E106565 (Isodraht)	E101843 (Dahréntråd)
Dimension range	See below	See below
Properties	High heat resistance. Very good resistance to transformer oils. Very good resistance to typical solvent. Freon resistant. Excellent resistance to mechanical stress.	High heat resistance. Very good resistance to transformer oils. Very good resistance to typical solvent. Bondable at 180°C-220°C. High re-softening temperature.
Temperature index/°C	≥ 200 °C	≥ 200 °C
Heat shock/°C	≥ 220 °C	≥ 220 °C
Reels and packaging	www.lww.se	

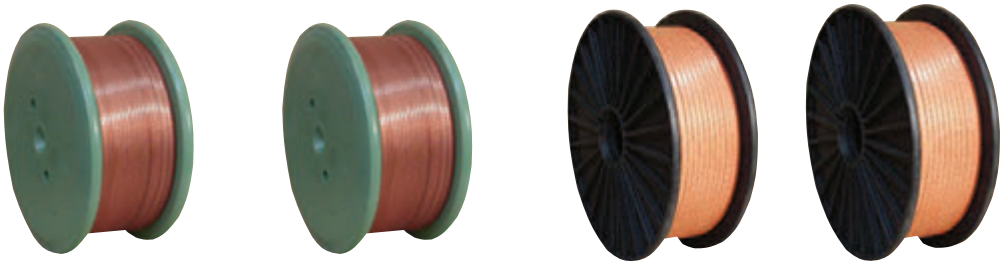
DAMID



DAMIDBOND

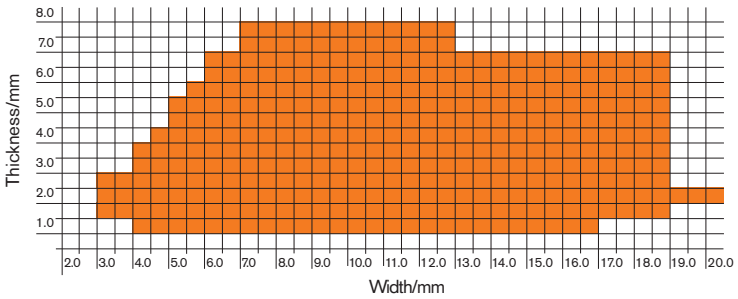


PRODUCT RANGE
RECTANGULAR COVERED COPPER WIRE



	DAFIBRE 155	DAFIBRE 180	DAFIBRE EP 155	DAFIBRE EP 180
Class	155	180	155	180
Standard	IEC 60317-32	IEC 60317-31	IEC 60317-32 + Internal LWW standard	IEC 60317-31 + Internal LWW standard
Insulation	1-3 layers of glassfibre yarn, impregnated with polyurethane varnish	1-3 layers of glassfibre yarn, impregnated with polyester-imide varnish	1-2 layers of glassfibre yarn, impregnated with polyurethane varnish, coated with a layer of semi-cured epoxy	1-2 layers of glassfibre yarn, impregnated with polyester-imide varnish, coated with a layer of semi-cured epoxy
UL approval	Not approved	Not approved	Not approved	Not approved
Dimension range	See below	See below	See below	See below
Properties	Excellent resistance to mechanical stress.	Excellent resistance to mechanical stress.	Excellent resistance to mechanical stress. B-stage cured epoxy layer allows pre-pressing of windings.	Excellent resistance to mechanical stress. B-stage cured epoxy layer allows pre-pressing of windings.
Temperatue index	≥ 155 °C	≥ 180 °C	≥ 155 °C	≥ 180 °C
Heat shock	≥ 175 °C	≥ 200 °C	≥ 175 °C	≥ 200 °C
Reels and packaging	www.lww.se			

DAFIBRE, DAFIBRE EP

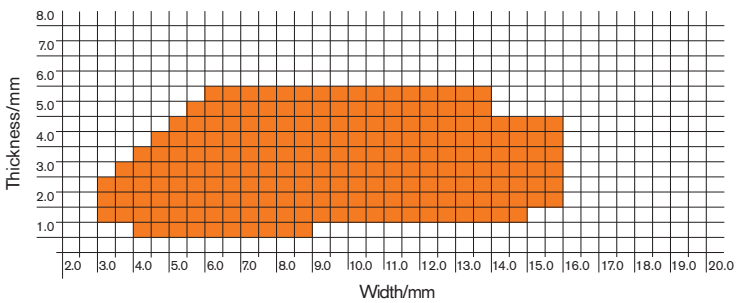


PRODUCT RANGE
RECTANGULAR COVERED COPPER WIRE

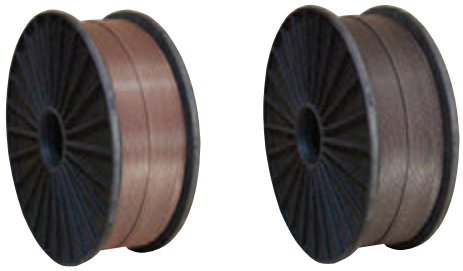



	DAMIDFIBRE 155	DAMIDFIBRE 180	DAMIDFIBRE EP 155	DAMIDFIBRE EP 180
Class	155	180	155	180
Standard	IEC 60317-32	IEC 60317-31	IEC 60317-32 + Internal LWW standard	IEC 60317-31 + Internal LWW standard
Insulation	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyurethane varnish	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyester-imide varnish	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyurethane varnish, coated with a layer of semi-cured epoxy	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyester-imide varnish, coated with a layer of semi-cured epoxy
UL approval	Not approved	Not approved	Not approved	Not approved
Dimension range	See below	See below	See below	See below
Properties	Excellent resistance to mechanical stress. Heat resistant.	Excellent resistance to mechanical stress. Heat resistant.	Excellent resistance to mechanical stress. B-stage cured epoxy layer allows pre-pressing of windings.	Excellent resistance to mechanical stress. B-stage cured epoxy layer allows pre-pressing of windings.
Temperatue index	≥ 155 °C	≥ 180 °C	≥ 155 °C	≥ 180 °C
Heat shock	≥ 175 °C	≥ 200 °C	≥ 175 °C	≥ 200 °C
Reels and packaging	www.lww.se			

DAMIDFIBRE, DAMIDFIBRE EP

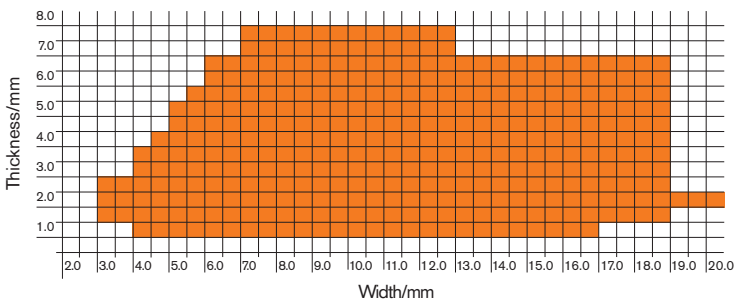


PRODUCT RANGE
RECTANGULAR COVERED COPPER WIRE

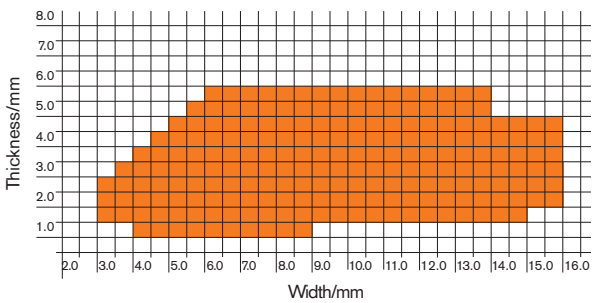


	DAROGLAS 155	DAMIDOGLAS 155
Class	155	155
Standard	IEC 60317-60	IEC 60317-60
Insulation	1-2 layers of polyester-glassfibre yarn	THEIC-modified polyester or polyesterimide, over-coated with polyamide-imide, covered with 1-2 layers of polyester-glassfibre yarn
UL approval	Not approved	Not approved
Dimension range	See below	See below
Properties	Excellent resistance to mechanical stress. Very good adhesion to conductor.	Excellent resistance to mechanical stress. Very good adhesion to conductor.
Temperatue index	≥ 155 °C	≥ 155 °C
Heat shock	≥ 155 °C	≥ 155 °C
Reels and packaging	www.lww.se	

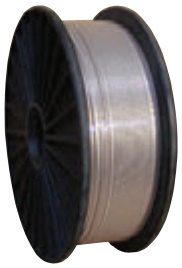
DAROGLAS



DAMIDOGLAS

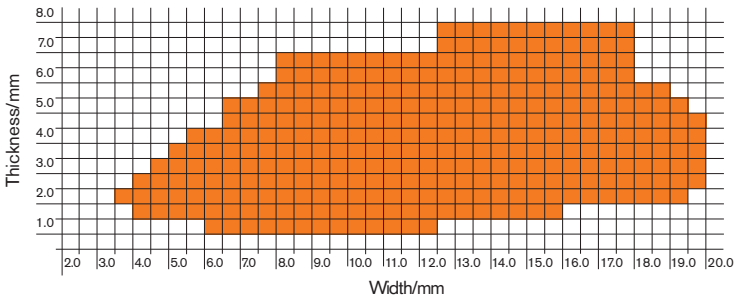


PRODUCT RANGE
RECTANGULAR COVERED COPPER WIRE

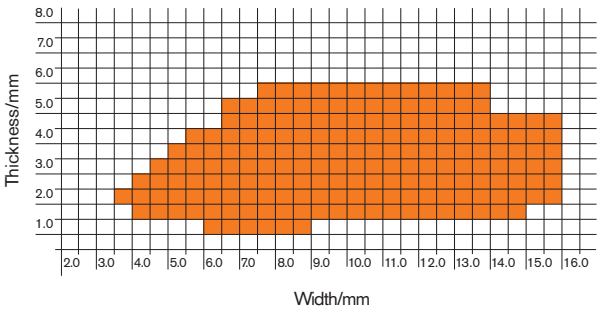



	DAMIC	DAMIDOMIC	DAKAP	DAKAP CR
Class	155	155	240	240
Standard	Internal LWW standard	Internal LWW standard	Internal LWW standard	Internal LWW standard
Insulation	Wrapped with 1-4 layers of mica tape. (Calcined muscovite on PET-carrier impregnated with epoxy)	THEIC-modified poly-ester or polyesterimide, overcoated with polyamide-imide Wrapped with 1-4 layers of mica tape. (Calcined muscovite on PET-carrier impregnated with epoxy)	Wrapped with 1-2 layers of teflon coated polyimide foil (Kapton®). Bonded to conductor by sintering of Teflon coat	Wrapped with 1layer of teflon coated polyimide foil (Kapton CR®). Bonded to conductor by sintering of Teflon coat
UL approval	Not approved	Not approved	Not approved	Not approved
Dimension range	See below	See below	See below	See below
Properties	Very good resistance to partial discharges.	Very good resistance to partial discharges.	Excellent thermal resistance. Excellent resistance to humidity.	Outstanding thermal resistance. Excellent resistance to humidity. Very good resistance to partial discharges.
Temperatue index	≥ 155 °C	≥ 155 °C	≥ 240 °C	≥ 240 °C
Heat shock	≥ 155 °C	≥ 155 °C	≥ 260 °C	≥ 260 °C
Reels and packaging	www.lww.se			

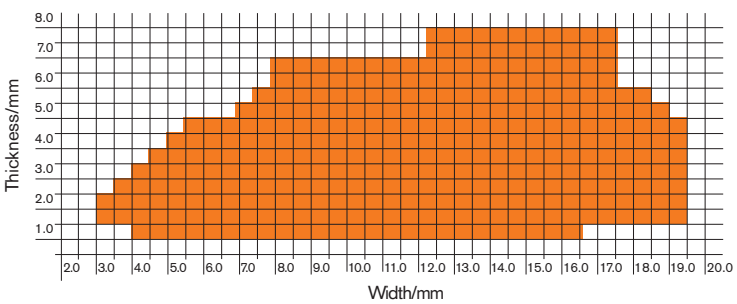
DAMIC

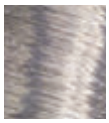


DAMIDOMIC



DAKAP, DAKAP CR





PRODUCT RANGE
ROUND ENAMELLED ALUMINIUM WIRE

	DAMID 200 AL
Class	200
Standard	IEC 60317-25
Insulation	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide
UL approval	E101843 (Dahréntråd) E106565 (Isodraht) E206884 (Slaska)
Dimension range/mm **Grade 1** **Grade 2** **Grade 3**	 0.375 - 5.60 0.375 - 5.60 -
Properties	High heat resistance. Suitable in lightweight designs Very good resistance to transformer oils. Very good resistance to typical solvent. Freon resistant.
Temperature index	≥ 200 °C
Heat shock	≥ 220 °C
Cut-through	≥ 320 °C
Reels and packaging	www.lww.se

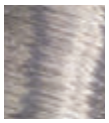
TECHNICAL DATA, ALUMINIUM WIRE
DAMID AL

ACCORDING TO IEC 60317-0-3

		Grade 1		Grade 2		Length (m/kg)		Area	Resistance
Nominal conductor diameter	Conductor tolerance +/-	min increase	max overall diameter	min increase	max overall diameter	Grade 1	Grade 2	mm² Nominal	20°C Ω/m Nominal
0.375	0.005	-	-	0.040	0.434	-	2859	0.1104	0.2526
0.400	0.005	-	-	0.040	0.459	-	2538	0.1257	0.2220
0.425	0.005	-	-	0.042	0.488	-	2246	0.1419	0.1966
0.450	0.005	-	-	0.042	0.513	-	2021	0.1590	0.1754
0.475	0.005	-	-	0.045	0.541	-	1815	0.1772	0.1574
0.500	0.005	-	-	0.045	0.566	-	1650	0.1963	0.1421
0.530	0.006	-	-	0.047	0.600	-	1468	0.2206	0.1264
0.560	0.006	-	-	0.047	0.630	-	1325	0.2463	0.1133
0.600	0.006	-	-	0.050	0.674	-	1156	0.2827	0.09865
0.630	0.006	-	-	0.050	0.704	-	1055	0.3117	0.08948
0.650	0.007	-	-	0.053	0.729	-	987	0.3318	0.08406
0.670	0.007	-	-	0.053	0.749	-	932	0.3526	0.07912
0.710	0.007	-	-	0.053	0.789	-	836	0.3959	0.07045
0.750	0.008	-	-	0.056	0.834	-	748	0.4418	0.06314
0.800	0.008	-	-	0.056	0.884	-	662	0.5027	0.05549
0.850	0.009	-	-	0.060	0.939	-	587	0.5675	0.04916
0.900	0.009	-	-	0.060	0.989	-	527	0.6362	0.04385
0.950	0.010	-	-	0.063	1.044	-	473	0.7088	0.03935
1.000	0.010	-	-	0.063	1.094	-	429	0.7854	0.03552
1.060	0.011	-	-	0.065	1.157	-	382	0.8825	0.03161
1.120	0.011	-	-	0.065	1.217	-	344	0.9852	0.02831
1.180	0.012	-	-	0.067	1.279	-	311	1.094	0.02551
1.250	0.013	-	-	0.067	1.349	-	279	1.227	0.02273
1.320	0.013	-	-	0.069	1.422	-	250	1.368	0.02038
1.400	0.014	-	-	0.069	1.502	-	223	1.539	0.01812
1.500	0.015	-	-	0.071	1.606	-	195	1.767	0.01578
1.600	0.016	-	-	0.071	1.706	-	172	2.011	0.01387
1.700	0.017	-	-	0.073	1.809	-	153	2.270	0.01229
1.800	0.018	-	-	0.073	1.909	-	137	2.545	0.01096
1.900	0.019	-	-	0.075	2.012	-	123	2.835	0.009838
2.000	0.020	-	-	0.075	2.112	-	111	3.142	0.008879
2.120	0.021	-	-	0.077	2.235	-	99	3.530	0.007902
2.240	0.022	-	-	0.077	2.355	-	89	3.941	0.007078
2.360	0.024	-	-	0.079	2.478	-	80	4.374	0.006377
2.500	0.025	-	-	0.079	2.618	-	72	4.909	0.005683
2.650	0.027	-	-	0.081	2.772	-	64	5.515	0.005057
2.800	0.028	-	-	0.081	2.922	-	58	6.158	0.004530
3.000	0.030	0.045	3.083	0.084	3.126	51	50	7.069	0.003946
3.150	0.032	0.045	3.233	0.084	3.276	46	46	7.793	0.003579
3.350	0.034	0.046	3.435	0.086	3.479	41	40	8.814	0.003165
3.550	0.036	0.046	3.635	0.086	3.679	37	36	9.898	0.002818
3.750	0.038	0.047	3.838	0.089	3.883	33	32	11.04	0.002526
4.000	0.040	0.047	4.088	0.089	4.133	29	29	12.57	0.002220
4.250	0.043	0.049	4.341	0.092	4.387	26	25	14.19	0.001966
4.500	0.045	0.049	4.591	0.092	4.637	23	23	15.90	0.001754
4.750	0.048	0.050	4.843	0.094	4.891	20	20	17.72	0.001574
5.000	0.050	0.050	5.093	0.094	5.141	19	18	19.63	0.001421
5.250*	0.053	0.053	5.346	0.096	5.395	17	17	21.65	0.001288
5.300*	0.053	0.053	5.393	0.096	5.443	16	16	22.06	0.001264
5.500*	0.055	0.053	5.600	0.096	5.645	15	15	23.76	0.001174
5.600*	0.056	0.056	5.703	0.098	5.748	15	15	24.63	0.001133

* Not IEC standard

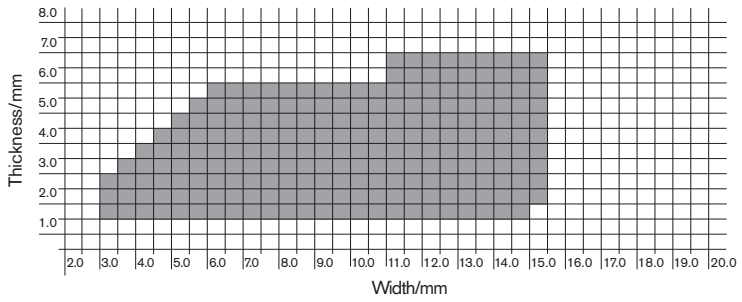
The technical data included is up to date at the time of printing.
LWW reserve the right to make any amendments deemed necessary.

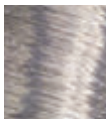


PRODUCT RANGE
RECTANGULAR ENAMELLED ALUMINIUM WIRE

	DAMID 200 AL
Class	200
Standard	Corresponds to IEC 60317-29
Insulation	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide
UL approval	E101843 (Dahréntråd)
Dimension range	See below
Properties	High heat resistance. Allows lightweight designs. Very good resistance to transformer oil. Very good resistance to typical solvent. Freon resistant.
Temperature index/°C	≥ 200 °C
Heat shock/°C	≥ 220 °C
Reels and packaging	www.lww.se

DAMID AL

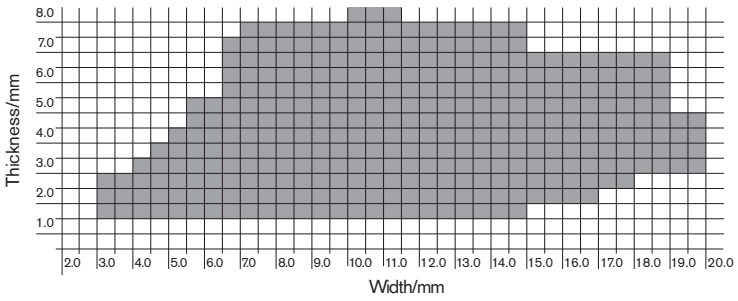


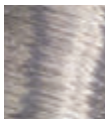


PRODUCT RANGE
RECTANGULAR COVERED ALUMINIUM WIRE

	DAFIBRE 155 AL	DAFIBRE 180 AL	DAFIBRE EP 155 AL	DAFIBRE EP 180 AL
Class	155	180	155	180
Standard	Internal LWW standard	Internal LWW standard	Internal LWW standard	Internal LWW standard
Insulation	1-3 layers of glassfibre yarn, impregnated with polyurethane varnish	1-3 layers of glassfibre yarn, impregnated with polyester-imide varnish	1-2 layers of glassfibre yarn, impregnated with polyurethane varnish, coated with a layer of semi-cured epoxy	1-2 layers of glassfibre yarn, impregnated with polyester-imide varnish, coated with a layer of semi-cured epoxy
UL approval	Not approved	Not approved	Not approved	Not approved
Dimension range	See below	See below	See below	See below
Properties	Excellent resistance to mechanical stress. Suitable in lightweight designs.	Excellent resistance to mechanical stress. Suitable in lightweight designs.	Excellent resistance to mechanical stress. Suitable in lightweight designs.	Excellent resistance to mechanical stress. Suitable in lightweight designs.
Temperatue index	≥ 155 °C	≥ 180 °C	≥ 155 °C	≥ 180 °C
Heat shock	≥ 175 °C	≥ 200 °C	≥ 175 °C	≥ 200 °C
Reels and packaging	www.lww.se			

DAFIBRE AL, DAFIBRE EP AL



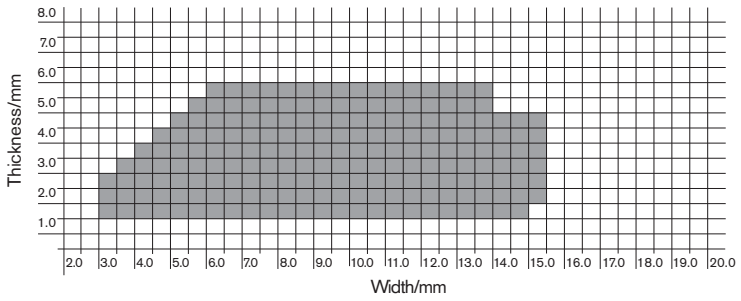


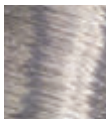
PRODUCT RANGE
RECTANGULAR COVERED ALUMINIUM WIRE




	DAMIDFIBRE 155 AL	DAMIDFIBRE 180 AL	DAMIDFIBRE EP 155 AL	DAMIDFIBRE EP 180 AL
Class	155	180	155	180
Standard	Internal LWW standard	Internal LWW standard	Internal LWW standard	Internal LWW standard
Insulation	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyurethane varnish	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyester-imide varnish	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyurethane varnish, coated with a layer of semi-cured epoxy	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of glassfibre yarn, impregnated with polyester-imide varnish, coated with a layer of semi-cured epoxy
UL approval	Not approved	Not approved	Not approved	Not approved
Dimension range	See below	See below	See below	See below
Properties	Excellent resistance to mechanical stress. Heat resistant.	Excellent resistance to mechanical stress. Heat resistant.	Excellent resistance to mechanical stress. Suitable in lightweight designs.	Excellent resistance to mechanical stress. Suitable in lightweight designs.
Temperatue index	≥ 155 °C	≥ 180 °C	≥ 155 °C	≥ 180 °C
Heat shock	≥ 175 °C	≥ 200 °C	≥ 175 °C	≥ 200 °C
Reels and packaging	www.lww.se			

DAMIDFIBRE AL, DAMIDFIBRE EP AL

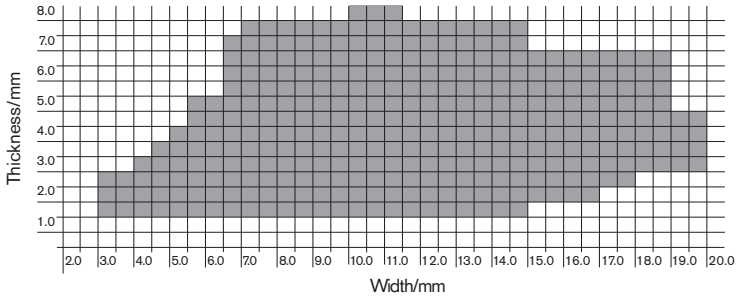




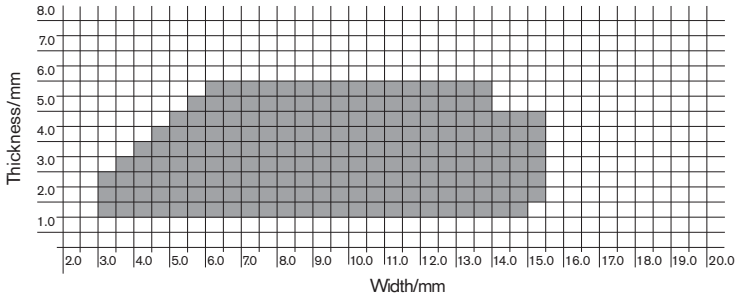
PRODUCT RANGE
RECTANGULAR COVERED ALUMINIUM WIRE

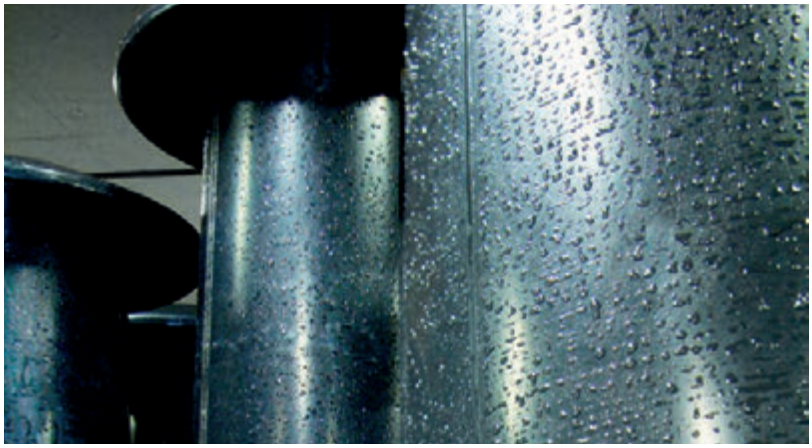
	DAROGLAS 155 AL	DAMIDOGLAS 155 AL
Class	155	155
Standard	Internal LWW standard	Internal LWW standard
Insulation	1-2 layers of polyester-glassfibre yarn	THEIC-modified polyester or polyesterimide, overcoated with polyamide-imide, covered with 1-2 layers of polyester-glassfibre yarn
UL approval	Not approved	Not approved
Dimension range	See below	See below
Properties	Excellent resistance to mechanical stress. Very good adhesion to conductor.	Excellent resistance to mechanical stress. Very good adhesion to conductor.
Temperatue index	≥ 155 °C	≥ 155 °C
Heat shock	≥ 175 °C	≥ 175 °C
Reels and packaging	www.lww.se	

DAROGLAS AL



DAMIDOGLAS AL



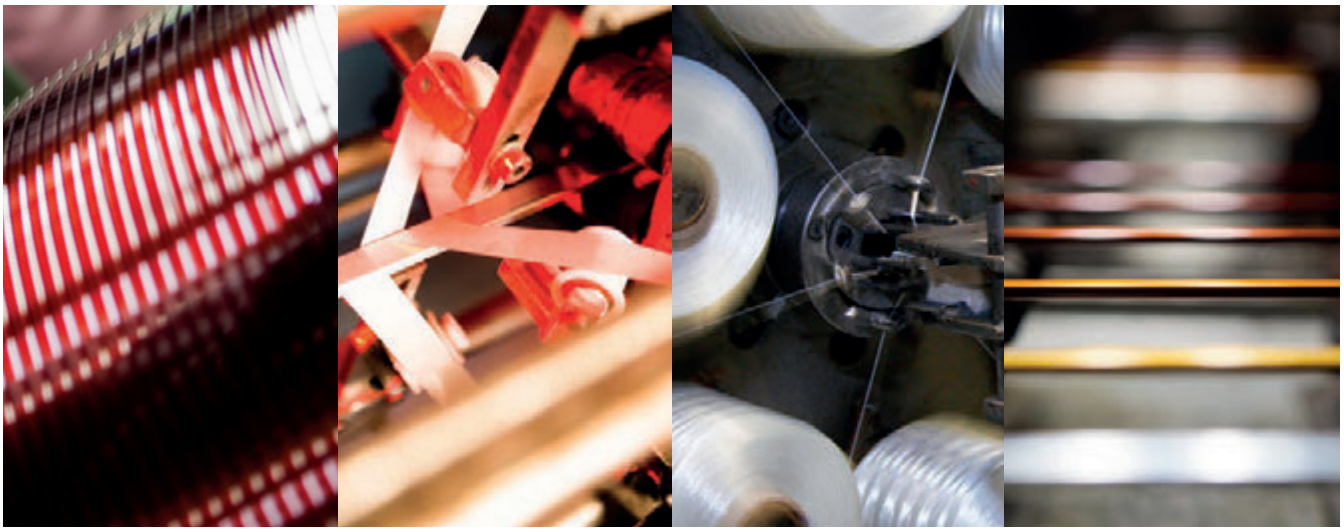


HANDLED WITH CARE

We regard packaging as an integral element of the manufacturing process to ensure that the wire reaches your production line in perfect condition. Packaging also plays a part in our environmental system; all packaging is recycled, cleaned and returned to our production units after use.

OVERVIEW
RECTANGULAR PRODUCTS

	Process insulation material class Conductor	Enamelling 200	Glass lapping Glass yarn 155/180	Mixed yarn lapping Glass-polyester 155	Epoxy impregnation Epoxy 155/180	Tape wrapping PET/mica 155	Tape wrapping Kapton® (CR) 240
Copper	Bare Cu Conductor		DAFIBRE	DAROGLAS	DAFIBRE EP	DAMIC	DAKAP (CR)
Cu + Enamel		DAMID DAMIDBOND	DAMIDFIBRE	DAMIDOGLAS	DAMIDFIBRE EP	DAMIDOMIC	
Aluminium	Bare AL Conductor		DAFIBRE AL	DAROGLAS AL	DAFIBRE EP AL		
Al + Enamel		DAMID AL	DAMIDFIBRE AL	DAMIDOGLAS AL	DAMIDFIBRE EP AL		



We are proud to live up to high expectations for quality, properties and precision – today and tomorrow.

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Ever since the early days of electricity LWW Group has been a partner to the electronics industry. Today we are a leading global supplier offering a complete range of high-quality copper and aluminium wire. You will find our wire employed in a wide range of applications, from computers and kitchen aids to trains and wind power turbines.

LWW group