

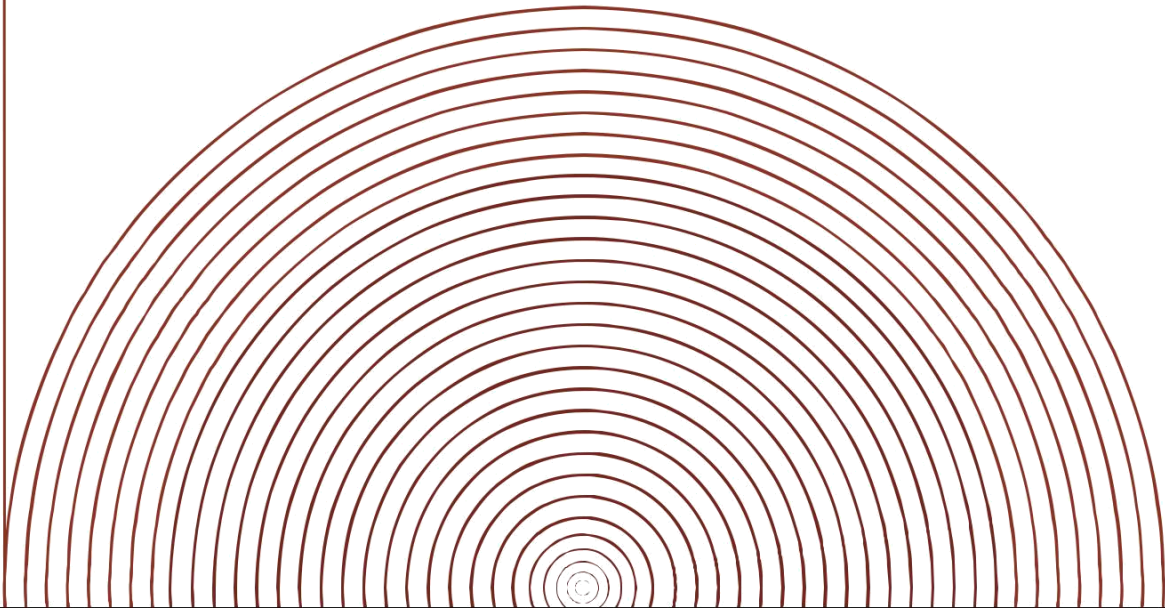




Technologically driven and inspired by innovation, we, at RR Shramik, work tirelessly to improve ourselves to meet the needs of the dynamic industry. Every product offered reflects the effort of the team that has endeavored to evolve the best the industry could receive.

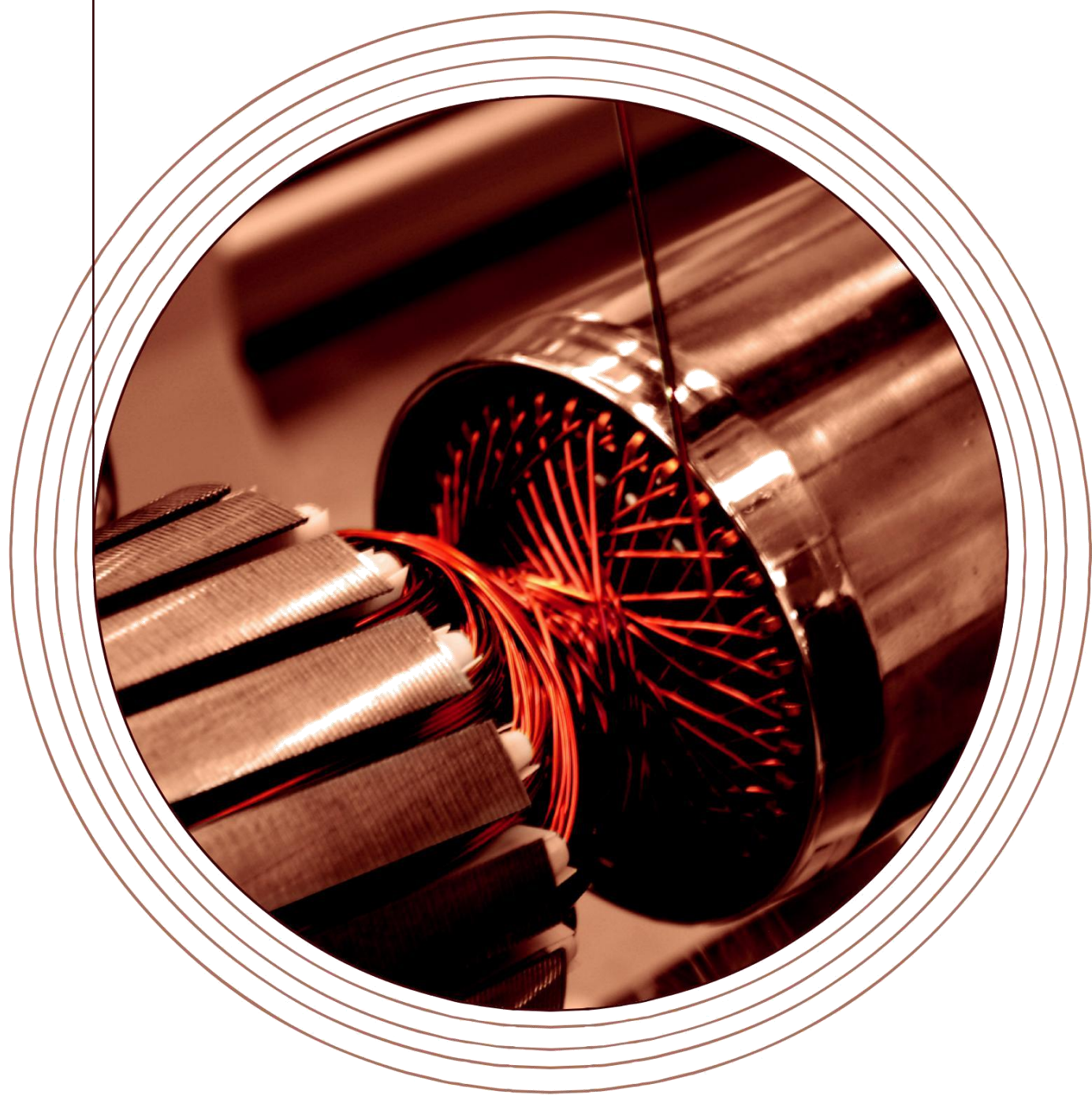
-Mr. Mahendra Kabra

Joint M.D. - Ram Ratna Wires Ltd.







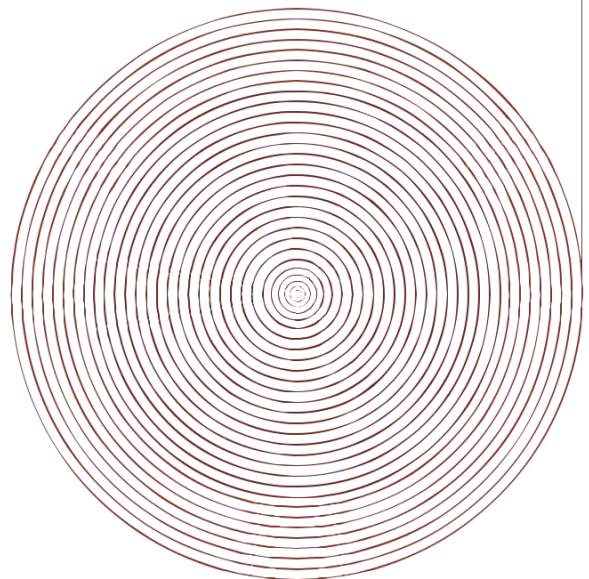


WINDING A PROMISING FUTURE

RR Shramik part of RR Global, is one of the leading conglomerates in the electrical and copper industry. For over 25 years, we have enjoyed unflinching patronage of our valued customers and are an established name in the Indian electrical industries, particularly known for our quality and commitment.

RR Shramik offers a wide range of high quality products to address the need of the ever evolving industry.

Being customer driven, we are constantly committed to keep powering ahead with the spirit of innovation to significantly enhance our abilities and optimize our potential to offer only the best to our customers.



Certificate

Standard **ISO 50001:2011**

Certificate Registr. No. **01 407 086546**

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: **RR Kabel Ltd. / Salasar Copper**
142/2, Madhuban Dam Road, Karad, Silvassa - 396 240 (UT of DNH)

Scope: **Development and Manufacture of Solid and Rigid Conductor PVC Insulated Cables, Flexible Conductor PVC Insulated, Sheathed Cables and Cords, Thermosetting Cables, Halogen Free Cables and Foam Insulated RG Cables**
Manufacture of Super Enameled Wires and Strips, Winding Wires and Bare Copper Wires and Strips

An audit was performed, Report No. 086546. Proof has been furnished that the requirements according to ISO 50001:2011 are fulfilled.

The due date for all future audits is 01-06 (dd.mm).

Validity: The certificate is valid from 13.01.2013 until 01.11.2015.

2013-01-13


TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

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Certificate

Standard **BS OHSAS 18001:2007**

Certificate Registr. No. **01 113 086546**

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: **R. R. Kabel Ltd. /Salasar Copper**
142/2, Madhuban Dam Road, Karad, Silvassa - 396 240. (Union Territory of Dadra & Nagar Haveli, India)

Including the locations according to annex

Scope: **Development, Manufacture and Supply of Copper Cables and Flexible Cords.**
Manufacture of Super Enameled and Bare Copper Wire and Strips.

An audit was performed, Report No. 086546. Proof has been furnished that the requirements according to BS OHSAS 18001:2007 are fulfilled.

The due date for all future audits is 17 - 04 (dd.mm).

Validity: The certificate is valid from 2014-06-03 until 2019-05-28. First Certification 2008-06-04.

2014-06-03


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Certificate

Standard **ISO 14001:2004 + Cor. 1:2009**

Certificate Registr. No. **01 104 086546**

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: **R. R. Kabel Ltd. /Salasar Copper**
142/2, Madhuban Dam Road, Karad, Silvassa - 396 240. (Union Territory of Dadra & Nagar Haveli, India)

Including the locations according to annex

Scope: **Development, Manufacture and Supply of Copper Cables and Flexible Cords.**
Manufacture of Super Enameled and Bare Copper Wire and Strips.

An audit was performed, Report No. 086546. Proof has been furnished that the requirements according to ISO 14001:2004 + Cor. 1:2009 are fulfilled.

The due date for all future audits is 25 - 03 (dd.mm).

Validity: The certificate is valid from 2014-06-04 until 2017-06-03. First Certification 2008-06-04.

2014-06-04


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CERTIFICATE

This is to certify that

Salasar Copper
(Prop. Ram Ratra Wires Limited)
Unit 1
142/2, Madhuban Dam Road
Opp Polytechnic College
Rahol - 396 240
Silvassa (U.T. of D & N.H)
INDIA

Unit 2
212/2, Near Dadra Check Post
Dadra - 396 191
Silvassa
INDIA

BR No: 20002460 BR No: 20002459

has implemented and maintains a **Quality Management System**.

Scope:
The Manufacture of the following Products:
Enameled Round and Rectangular Copper Wire; Bare Round & Rectangular Copper Wire
Enameled Round Aluminum Wire; Submersible Winding Wire, Paper Covered Rectangular Copper Wire; Glass Fibre Covered Bare or Enameled Copper Wires
As Per the Specifications Agreed with the Various Marketing Offices.

Through an audit, documented in a report, it was verified that the management system fulfils the requirements of the following standard

ISO 9001 : 2008

Certificate registration no. 20002460 QM08
Date of original certification: 2000-03-14
Date of certification: 2013-02-03
Valid until: 2016-02-02

UL DQS Inc.

Ganesh Rao
Managing Director

 **UL**

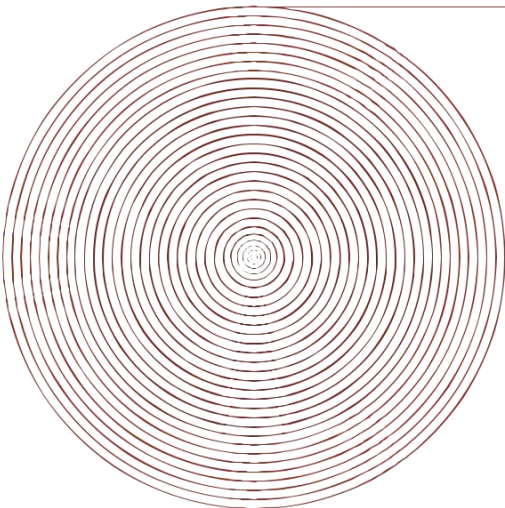
Certification Body: UL DQS Inc., 1130 West Lake Cook Road, Suite 340, Buffalo Grove, IL 60089 USA

OUR COMMITMENT

RR Shramik aims to enhance customer satisfaction by consistently meeting the expectations related to product and services. We are a ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007, ISO 50001:2011 company located at Silvassa in Gujarat, manufacturing a variety of winding wires for various applications.

RR Shramik is India's only manufacturer of enameled copper wires that offers the widest range starting from 0.018 mm to 4.876 mm (SWG 06 - 52) with additional intermediate and mm sizes. Employing world class technology like German made Annealing and intermediate wire drawing NIEHOFF machines and catalytic enameling individual automatic and semi automatic take up units of European technology with inline wire drawing arrangement, we ensure superior consistency in products.

All our wires are UL certified, RDSO and BHEL approved along with RoHS (Halogen Free) & REACH compliance. Our client list includes reputed Indian & Multinationals like OEMs like ABB, Alstom, Bosch, Chheda Electricals, C&S, Crompton Greaves, Cummins, Emerson, Godrej, Jagdish Electronics, Larsen & Toubro, Legrand, Lucas, Luminous, Mecc Alte, Minda, Roots, Siemens, Schneider, Sukam & Varroc amongst others. All of this highlights the quality of our products, manufacturing processes and our global ability.

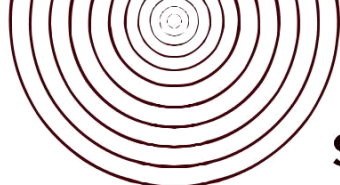






PRODUCTS WE OFFER

01. Super Enamelled Copper Wires	10 - 15
02. Fine And Ultra-fine Enamelled Copper Wires	16 - 22
03. Super Enamelled Aluminium Winding Wires	23
04. Super Enamelled Copper Strips	24
05. Glass Fibre Covered Strips	25
06. Triple Insulated Winding Wires	26 - 27
07. Submersible Winding Wires	28 - 29
08. Submersible Flat Cables	30
09. Paper Covered Magnet Wires	31 - 32
10. Corona Resistant Winding Wires	33
11. Crepe Kraft Paper Insulated Copper Cables	34
12. Cotton Covered Copper Conductors	35
13. Nylon Coated Enamelled Wires	36
14. Self Bonding Enamelled Wires	37
15. Sole Coat Alw Enamelled Wires	38
16. Litz Wires	39
17. Super Enamelled Aluminium Strips	40
18. Bunched and Braided Bare Copper Wire	41
19. M. H. Classic Submersible Flat Cables	42
20. M. H. Classic Submersible Winding Wire	43 - 44



SUPER ENAMELLED COPPER WIRES

We offer a superior range of enamelled copper wires aiming to cater the wide variety of applications in the industry ranging from a common motor rewinding to most critical applications like in automobiles. Enamelled winding wire is a film insulated copper (or aluminum) electrical conductor used in form of coil windings in motors, transformers, generators and other electromagnetic equipments. When wound into coils, and energized, enamelled winding wire creates an electromagnetic field, which is utilized to generate the required output form of energy – viz electrical to mechanical (or vice versa) electrical to electrical, and electrical to magnetic energy.

PRODUCT RANGE & QUALITY SPECIFICATIONS

Wire Type Properties	Modified Polyester	Modified Polyester	Polysterimide	Dual Coated Wire PE/PEI + PAI
Thermal Class Class Insulation Colour	130 B Brown / Reddish-Golden	155 F Light Brown to Dark Brown	180 H Dark Brown (Mahogany)	200 H+ Reddish Brown to Golden
Range-Copper Range-Aluminium	0.06 to 5.0 mm 0.25 to 5.0 mm	0.06 to 3.0 mm 0.25 to 5.0 mm	0.06 to 5.0 mm 0.25 to 5.0 mm	0.06 to 4.0 mm 0.25 to 5.0 mm
Specifications-Copper Specifications-Aluminium	IS 13730-34 IEC 60317-34 IS 13730-9 IEC 60317-9 for 1.00 mm wire	IS 13730-3 IEC 60317-3 for 1.00 mm Wire	IS 13730-8 IEC 60317-8 IS 13730-15 IEC 60317-15 for 1.00 mm wire	IS 13730 -13 IEC 60317 - 13 NEMA MW 35A/35C IEC 60317 - 25 for Aluminium
Mechanical Tests Flexibility Peel Abrasion Av. N Aluminium	1 x D N x D = 150 10.4 5.20	1 x D N x D = 130 10.4 –	1 x D N x D = 110 10.9 5.45	1 x D N x D = 110 11.3 6.75
Thermal Tests Heat Shock Cut Through Heat Shock - Aluminium	6 x D 155°C - 30 min 240°C - 2 min 6.33Ø - 155°C - 30 min	2.24 x D 175°C - 30 min 240°C - 2 min –	2.24 x D 200°C - 30 min 300°C - 2 min 3.35Ø -200°C - 30 min	2.24 x D 220°C - 30 min 320°C - 2 min 15% Str - 3xd - 240°C
Chemical Tests Solvent Resistance Refrigerant Resistant Solderability Transformer Oil	Good N.A. N.A. N.A.	Good N.A. N.A. N.A.	Very Good Very Good N.A. Excellent	Excellent Excellent N.A. Excellent
Resistance Electrical Resistance Breakdown Voltage Cont. of Covering (Pin Holes) Tandent Delta - Bending Point	Within Range Above 8.0 KV Normally - Nil 110 - 120	Within Range Above 8.0 KV Normally - Nil 145 - 155	Within Range Above 8.0 KV Normally - Nil 175 - 195	Within Range Above 8.0 KV Normally - Nil 175 - 195
Application	Domestic equipments, pumps, motors, stabilizers, transformers, fans and auto electricals requiring high mechanical properties.	General purpose rotating & static equipments like large pump motors, generators, air cooled transformers, voltage stabilizers, heavy duty domestic appliances like mixer - grinder, washing machines, where temprature is above class insulation B.	Continously rated heavy duty motors and tools, oil filled transformers, hermetic grade for AC and refriragerator compressor, furnace motors, and for all class insulation H applications.	Special purpose machines like wind generators, large motors and generators, extra heavy duty equipments like crane motors with heavy shock loads, AC and refrigerator compressor windings.

Wire Type Properties	Modified Polyester	Modified Polyester	Polysterimide	Dual Coated Wire PE/PEI + PAI
Advantages	Balanced thermal properties. Very good flexibility and mechanical properties.	High continuous operating temperature. Good chemical stability. Excellent dry & wet di-electric characteristics.	Good thermal properties. High resistance to overloads. Good transformer oil resistance. Suitable for hermatic applications.	Excellent smooth surface compatible for high speed winding. Very high thermal & overload resistance.
Precautions	Not suitable for oil filled transformers & hermatic motors.	Not suitable for oil filled transformers & hermatic motors.	Not recommended for highspeed winding applications.	Excellent for A/C refrigerators and hermatic use.

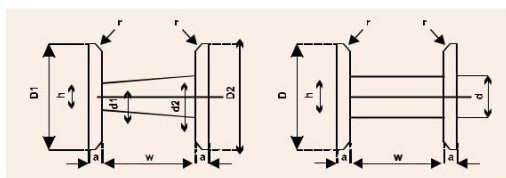
*These are only indicative values. Improvement is an ongoing process at RRWL and efforts are made to exceed average values.

PACKING OF ENAMELLED WIRES

Type of Bobbin	Diameter of Flange	Diameter of Barrel (mm)	Thickness of Flange (mm)	Inside Spacing of Flange (mm)	Bevelling of Inside Flange Face (mm)	Diameter of Axle Hole (mm)	Mass of Bobbin (g)	Mass Enamelled Copper Wire (approx/kg)	Normal Range of Enamelled Copper Wire (mm)
	D	d	a	W	r	h			
P-1	80±0.5	50±0.3	10±0.2	65±0.2	3	16±0.5	65	1	0.350 - 0.100
P-3	125±0.5	26±0.3	10±0.2	71±0.2	3	22±0.5	110	3	0.350 - 0.100
P-5	160±0.5	100±0.5	12±0.2	128±0.2	5	22±0.5	310	6	0.500 - 0.300
P-10	200±0.5	88±0.5	12±0.2	115±0.2	5	38±0.5	460	10	0.600 - 0.450
P-20	250±0.5	110±0.5	15±0.2	120±0.2	5	36±0.5	980	20	1.800 - 0.650
W-25	265±1.0	110±1.5	12±0.2	115±0.2	5	38±0.5	1350	25	4.00 - 1.800

LONG TRAVERSE TAPERED TYPE

Type of Bobbin	Diameter of Flange	Diameter of Barrel (mm)	Thickness of Flange (mm)	Inside Spacing of Flange (mm)	Bevelling of Inside Flange Face (mm)	Diameter of Axle Hole (mm)	Mass of Bobbin (g)	Mass Enamelled Copper Wire (approx/kg)	Normal Range of Enamelled Copper Wire (mm)
	D	d	a	W	r	h			
PT-10	160 180±0.5	96 110±0.5	10±0.2	200±0.4	3	32±0.5	500±25	10	0.600 - 0.200
PT-15	180 200±0.5	96 110±0.5	10±0.2	200±0.4	3	32±0.5	700±25	15	0.600 - 0.200
PT-25	215 230±0.5	110 130±0.5	10±0.2	250±0.4	3	32±0.5	1000±25	25	1.000 - 0.400
PT-45	236 250±0.5	140 160±0.8	32±0.3	335±1.0	5	100±0.5	2100±50	45	1.200 - 0.300
PT-90	300 315±0.8	180 200±1.0	38±0.5	425±1.0	5	100±0.5	2800±100	90	1.200 - 0.500
WT-45	265 275±2.0	110 120±2.0	15±2.0	190±1.0	5	40±0.5	2000±100	45	4.000 - 1.200
WT-90	266 280±2.0	110 120±2.0	20±2.0	300±1.0	6	40±0.6	3600±100	86	4.000 - 1.200
WT-180	375 400±0.8	224 250±1.0	50±0.8	530±1.0	5	100±0.5	3600±100	180	1.200 - 0.500
WT-270	435 460±2.0	255 250±1.0	50±0.8	528±2.0	5	100±0.5	5500±100	270	4.000 - 1.200



P = Plastic
PT = Plastic Taper
W = Wooden
WT = Wooden Taper



GENERAL DATA FOR ENAMELLED ROUND COPPER WIRES AS PER IS 13730-0-1/IEC 60317-0-1 (SWG)

SWG	Size mm Nom.	Conductor Tolerance ± mm	Resistance Min. @ 20° C Ohm/mtr.	Resistance Max. @ 20° C Ohm/mtr.	Grade 2 (Medium Covering)		For Grade 2 Wires			SWG
					Min. Inc.	Max. OD	Elongation %	BDV Volts	Spring Back	
5	5.384	0.054	0.000729	0.000772	0.096	5.527	36	2500	5.0°	5
5½	5.131	0.052	0.000803	0.000851	0.095	5.273	36	2500	5.0°	5½
6	4.877	0.05	0.000889	0.000942	0.094	5.018	36	2500	5.0°	6
6½	4.674	0.048	0.000967	0.001025	0.094	4.815	36	2500	5.0°	6½
7	4.470	0.045	0.001058	0.001121	0.092	4.607	36	2500	5.0°	7
7½	4.268	0.045	0.001160	0.001230	0.092	4.405	36	2500	5.0°	7½
8	4.064	0.043	0.001279	0.001357	0.092	4.201	36	2500	5.0°	8
9	3.657	0.038	0.001580	0.001675	0.089	3.790	35	2500	5.0°	9
9½	3.454	0.036	0.001771	0.001878	0.086	3.583	35	2500	5.0°	9½
10	3.251	0.034	0.001999	0.002120	0.086	3.380	35	2500	5.0°	10
10½	3.099	0.031	0.002203	0.002332	0.084	3.225	35	2500	5.0°	10½
11	2.946	0.03	0.002436	0.002581	0.084	3.072	34	2500	5.0°	11
12	2.642	0.027	0.003028	0.003209	0.081	2.764	34	2500	5.0°	12
12½	2.489	0.025	0.003413	0.003614	0.079	2.607	33	5000	5.0°	12½
13	2.337	0.024	0.003870	0.004102	0.079	2.455	33	5000	5.0°	13
13½	2.184	0.024	0.004425	0.004703	0.077	2.299	33	5000	5.0°	13½
14	2.032	0.02	0.005123	0.005421	0.077	2.147	33	5000	5.0°	14
14½	1.930	0.02	0.005673	0.006015	0.075	2.042	33	5000	5.0°	14½
15	1.829	0.019	0.006317	0.006698	0.075	1.941	33	5000	5.0°	15
15½	1.727	0.018	0.007084	0.007513	0.073	1.836	32	5000	5.0°	15½
16	1.626	0.017	0.007991	0.008476	0.073	1.735	32	5000	5.0°	16
16½	1.524	0.016	0.009096	0.009650	0.071	1.630	32	5000	30	16½
17	1.422	0.015	0.010447	0.011085	0.071	1.528	32	5000	30	17
17½	1.320	0.013	0.012140	0.012846	0.069	1.422	32	5000	34	17½
18	1.219	0.013	0.014212	0.015088	0.067	1.318	31	5000	37	18
18½	1.118	0.011	0.016924	0.017907	0.065	1.215	30	5000	41	18½
19	1.016	0.0111	0.020449	0.021730	0.065	1.113	30	5000	41	19
19½	0.965	0.01	0.022692	0.024061	0.063	1.059	30	5000	45	19½
20	0.914	0.01	0.025267	0.026852	0.063	1.008	30	5000	45	20
20½	0.864	0.009	0.028305	0.030018	0.060	0.953	29	5000	48	20½
21	0.813	0.009	0.031926	0.033947	0.060	0.902	29	5000	48	21
21½	0.762	0.008	0.036384	0.038599	0.056	0.846	28	4900	43	21½
22	0.711	0.008	0.041729	0.044402	0.056	0.795	28	4900	43	22
22½	0.660	0.007	0.048489	0.051462	0.053	0.739	28	4800	47	22½
23	0.610	0.006	0.056850	0.060151	0.050	0.684	27	4800	50	23
23½	0.584	0.006	0.061971	0.065684	0.050	0.682	27	4800	50	23½
24	0.559	0.006	0.067576	0.071757	0.047	0.629	26	4600	44	24
25	0.508	0.006	0.081652	0.087078	0.047	0.578	26	4600	44	25

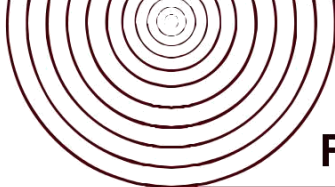
SWG	Size mm Nom.	Conductor Tolerance ± mm	Resistance Min @ 20° C Ohm/mtr.	Resistance Max @ 20° C Ohm/mtr.	Grade 2 (Medium Covering)		For Grade 2 Wires			SWG
					Min. Inc.	Max. OD	Elongation %	BDV Volts	Spring Back	
25½	0.483	0.005	0.090584	0.096042	0.045	0.570	25	4600	47	25½
26	0.457	0.005	0.101067	0.107408	0.045	0.523	25	4600	47	26
27	0.417	0.005	0.121134	0.129277	0.042	0.480	25	4400	48	27
27½	0.397	0.005	0.133487	0.142805	0.042	0.475	24	4400	50	27½
28	0.376	0.005	0.148608	0.159429	0.042	0.435	24	4400	50	28
29	0.345	0.005	0.176098	0.189827	0.038	0.401	23	4300	53	29
30	0.315	0.004	0.211987	0.226879	0.035	0.367	23	4100	55	30
31	0.295	0.004	0.241295	0.259137	0.035	0.347	23	4100	55	31
32	0.274	0.004	0.279127	0.301015	0.033	0.323	22	4000	53	32
33	0.254	0.004	0.324080	0.351104	0.033	0.303	22	4000	53	33
34	0.234	0.004	0.380835	0.414820	0.032	0.281	22	3900	56	34
35	0.213	0.003	0.462364	0.497596	0.029	0.255	21	3700	59	35
36	0.193	0.003	0.561538	0.607866	0.027	0.232	21	3500	62	36
37	0.173	0.003	0.696411	0.759307	0.025	0.210	20	3300	65	37
38	0.152	0.003	0.897900	0.988423	0.023	0.186	19	3200	67	38
39	0.132	0.003	1.183651	1.318669	0.021	0.163	18	3000	67	39
40	0.122	0.003	1.380611	1.549606	0.019	0.155	17	2800	70	40
41	0.112	0.003	1.631156	1.846980	0.017	0.137	17	2700	73	41
42	0.102	0.003	1.956648	2.238952	0.017	0.127	17	2700	73	42
43	0.091	0.003	2.441381	2.833674	0.016	0.115	16	950	73	43
44	0.081	0.003	3.057262	3.066833	0.015	0.107	15	900	77	44
45	0.071	0.003	3.939379	4.745669	0.012	0.091	13	700	-	45
46	0.061	0.003	5.266612	6.523179	-	0.081	12	700	-	46
47	0.051	0.003	7.397819	9.524294	-	0.068	10	650	-	47
48	0.041	0.003	11.142583	15.196657	-	0.056	9	600	-	48
49	0.031	0.003	18.660935	27.989761	-	0.041	8	375	-	49
50	0.025	0.003	27.515358	45.338786	-	0.034	7	300	-	50

* These are only indicative values. Improvement is an ongoing process at RRWL and efforts are made to exceed average values.

GENERAL DATA FOR ENAMELLED ROUND COPPER WIRES AS PER IS 13730-0-1/IEC 60317-0-1 (MM SIZE)

Size mm Nom.	Conductor Tolerance ± mm	Resistance Min @ 20° C Ohm/mtr.	Resistance Min @ 20° C Ohm/mtr.	Grade 2 (Medium Covering)		For Grade 2 Wires			Size mm Nom.
				Min. Inc.	Max OD	Elongation %	BDV Volts	Spring Back	
5.000	0.050	0.000846	0.000896	0.094	5.141	36	2500	5.0	5.000
4.500	0.045	0.001044	0.001106	0.092	4.637	36	2500	5.0	4.500
4.250	0.043	0.001170	0.001240	0.092	4.387	36	2500	5.0	4.250
4.000	0.040	0.001322	0.001399	0.089	4.133	35	2500	5.0	4.000
3.750	0.038	0.001503	0.001593	0.089	3.883	35	2500	5.0	3.750
3.350	0.034	0.001884	0.001996	0.086	3.479	35	2500	5.0	3.350
3.000	0.030	0.002350	0.002488	0.084	3.126	34	2500	5.0	3.000
2.800	0.028	0.002697	0.002856	0.081	2.922	34	2500	5.0	2.800
2.500	0.025	0.003384	0.003582	0.079	2.618	33	5000	5.0	2.500
2.240	0.022	0.00422	0.00446	0.077	2.355	33	5000	5.0	2.240
2.000	0.020	0.00529	0.00560	0.075	2.112	33	5000	5.0	2.000
1.900	0.019	0.00586	0.00620	0.075	2.012	33	5000	5.0	1.900
1.800	0.018	0.00653	0.00691	0.073	1.909	32	5000	5.0	1.800
1.700	0.017	0.00732	0.00775	0.073	1.809	32	5000	5.0	1.700
1.600	0.016	0.00826	0.00875	0.071	1.706	32	5000	30	1.600
1.500	0.015	0.00940	0.00995	0.071	1.606	32	5000	30	1.500
1.400	0.014	0.01079	0.01142	0.069	1.502	32	5000	34	1.400
1.320	0.013	0.01214	0.01285	0.069	1.422	32	5000	34	1.320
1.250	0.013	0.01352	0.01434	0.067	1.349	31	5000	37	1.250
1.180	0.012	0.01518	0.01609	0.067	1.279	31	5000	37	1.180
1.120	0.011	0.01686	0.01784	0.065	1.217	30	5000	41	1.120
1.060	0.011	0.01881	0.01994	0.065	1.157	30	5000	41	1.060
1.000	0.010	0.02115	0.02239	0.063	1.094	30	5000	45	1.000
0.950	0.010	0.02341	0.02483	0.063	1.044	30	5000	45	0.950
0.900	0.009	0.02611	0.02764	0.060	0.989	29	5000	48	0.900
0.850	0.009	0.02924	0.03103	0.060	0.939	29	5000	48	0.850
0.800	0.008	0.03304	0.03498	0.056	0.884	28	4900	43	0.800
0.750	0.008	0.03755	0.03986	0.056	0.834	28	4900	43	0.750
0.710	0.007	0.04196	0.04440	0.053	0.789	28	4800	47	0.710
0.670	0.007	0.04707	0.04992	0.053	0.749	28	4800	47	0.670
0.630	0.006	0.05333	0.05636	0.050	0.704	27	4800	50	0.630
0.600	0.006	0.05874	0.06219	0.050	0.674	27	4800	50	0.600
0.560	0.006	0.06734	0.07150	0.047	0.630	26	4600	44	0.560
0.500	0.005	0.08459	0.08956	0.045	0.566	25	4600	47	0.500
0.450	0.005	0.1042	0.1108	0.042	0.513	25	4400	48	0.450
0.425	0.005	0.1167	0.1244	0.042	0.488	25	4400	48	0.425
0.400	0.005	0.1315	0.1406	0.040	0.459	24	4400	50	0.400
0.375	0.005	0.1494	0.1603	0.040	0.434	24	4400	50	0.375
0.355	0.004	0.1674	0.1781	0.038	0.411	23	4300	53	0.355
0.315	0.004	0.2120	0.2269	0.035	0.367	23	4100	55	0.315

Size mm Nom.	Conductor Tolerance ± mm	Resistance Min @ 20° C Ohm/mtr.	Resistance Min @ 20° C Ohm/mtr.	Grade 2 (Medium Covering)		For Grade 2 Wires			Size mm Nom.
				Min. Inc.	Max OD	Elongation %	BDV Volts	Spring Back	
0.300	0.004	0.2334	0.2505	0.035	0.352	23	4100	55	0.300
0.280	0.004	0.2675	0.2881	0.033	0.329	22	4000	53	0.280
0.265	0.004	0.2981	0.3221	0.033	0.314	22	4000	53	0.265
0.250	0.004	0.3344	0.3626	0.032	0.297	22	3900	56	0.250
0.236	0.004	0.3745	0.4077	0.032	0.283	22	3900	56	0.236
0.212	0.003	0.4667	0.5024	0.029	0.254	21	3700	59	0.212
0.200	0.003	0.5235	0.5654	0.027	0.239	21	3500	62	0.200
0.190	0.003	0.5791	0.6275	0.027	0.228	21	3500	62	0.190
0.180	0.003	0.6442	0.7004	0.025	0.217	20	3300	65	0.180
0.170	0.003	0.7208	0.7868	0.025	0.205	20	3300	65	0.170
0.150	0.003	0.9215	1.0155	0.023	0.182	19	3200	67	0.150
0.140	0.003	0.0549	1.1692	0.021	0.171	18	3000	67	0.140
0.132	0.003	0.1837	1.3187	0.021	0.162	18	3000	67	0.132
0.125	0.003	0.3167	1.4743	0.019	0.154	17	2800	70	0.125
0.118	0.003	0.4734	1.6593	0.019	0.145	17	2800	70	0.118
0.112	0.003	0.6312	1.8470	0.017	0.139	17	2700	73	0.112
0.100	0.003	0.0334	2.3322	0.016	0.125	16	950	73	0.100
0.090	0.003	0.4942	2.8992	0.015	0.113	15	900	77	0.090
0.080	0.003	0.1314	3.7011	0.014	0.101	14	850	80	0.080
0.071	0.003	3.9394	4.7457	0.012	0.091	13	700	80	0.071
0.051	0.003	7.3978	9.5243	-	0.068	10	650	-	0.051
0.045	0.003	9.3629	12.4399	-	0.061	9	600	-	0.045
0.040	0.003	11.669	16.0292	-	0.054	9	600	-	0.040
0.036	0.003	14.1828	20.1506	-	0.049	8	600	-	0.036
0.032	0.003	17.6098	26.0927	-	0.043	8	375	-	0.032
0.028	0.003	22.4474	35.1104	-	0.038	7	375	-	0.028
0.025	0.003	27.5154	45.3388	-	0.340	7	300	-	0.025



FINE AND ULTRA-FINE ENAMELLED COPPER WIRES

RR Shramik offers an industry-leading range of high quality fine and ultra-fine enamelled copper wires. The enamelled wire properties governing proper selection not only require consideration of the end use conditions but system compatibility and ease of use in production.

SALASAR COPPER ENAMELLED WIRES TYPE

Product Name / Code	RR Shramik SSFC 155°C	RR Shramik SSFC+N 155°C
General Description	Modified Polyurethane	Modified Polyurethane with Polyamide Overcoat
Standards : IEC (Including the following norms)	IEC 60317-20	IEC 60317-19 / IEC 60317-20
NEMA (including the following norms)	MW 79-C	MW 80-C
JIS (including the following norms)	JIS 3202	-
Diameters Available	0.010 mm - 1.6 mm	0.010 mm - 0.700 mm
Properties	Very Good Solderability & High Thermal Properties	Very Good Solderability & High Thermal Properties
Applications	Small Transformers, Linear Motors, Relays, Solenoids, Small Motors, Clock Coils, Watch Coils, Transformers, Magnetic Heads, Instruments	Appliance Motors, Encapsulated Coils, Solenoids, Transformers, Toroids
UL Approved	Yes	Yes
Thermal Values of Sole Coat		
Temp. Index 20,000 h acc. to IEC 60172		
Cut Through Temperature	157.9°C	157.9°C
0.05 mm : acc. to 0.250 mm IEC 60851-6.4	≥ 200°C	≥ 200°C
Typical Value (RR Shramik)	225°C	225°C
0.25 mm : acc. to 0.450 mm IEC 60851-6.4	≥ 200°C	≥ 200°C
Typical Value (RR Shramik)	230°C	230°C
Heat Shock		
0.050 mm : acc. to 0.250 mm IEC 60851-6.3	≥ 175°C	≥ 175°C
Typical Value (RR Shramik)	190°C	190°C
0.251 mm : acc. to 0.450 mm IEC 60851-6.3	≥ 175°C	≥ 175°C
Typical Value (RR Shramik)	180°C	180°C
Electrical Values		
High Voltage Continuity for Grade 1 wires		
0.050 mm : acc. to 0.080 mm IEC 60851-5.1	≤ 40	≤ 40
Typical Value (RR Shramik)	0	0
0.081 mm : acc. to 0.125 mm IEC 60851-5.2	≤ 40	≤ 40
Typical Value (RR Shramik)	1	1
0.125 mm : acc. to 1.600 mm IEC 60851-5.2	≤ 25	≤ 25
Typical Value (RR Shramik)	1	1
Break Down Voltage (at 20°C, 35% Humidity)		
0.050 mm : Typical Value (RR Shramik)	220 V/μm	210 V/μm
0.081 mm : Typical Value (RR Shramik)	210 V/μm	200 V/μm
0.125 mm : Typical Value (RR Shramik)	180 V/μm	180 V/μm
Pinholes acc. to JIS with 0.45 mm : 0% Elongation	Good	Good
Mechanical Values		
Elongation for Grade 1 Wires		
0.05 mm : acc. to IEC 60851-3 Part 3.1	≤ 14%	≤ 14%
Typical Value (RR Shramik)	22%	22%
0.800 mm : acc. to IEC 60851-3 Part 3.1	≤ 29%	≤ 29%
Typical Value (RR Shramik)	38%	38%
Solderability		
Solderability for Grade 1 Wires		
0.05 mm : acc. to IEC 60851-3 Part 4.5	2.0s / 390°C	2.0s / 390°C
Typical Value (RR Shramik)	0.9s / 390°C	0.9s / 390°C
0.800 mm : acc. to IEC 60851-3 Part 4.5	8.0s / 390°C	8.0s / 390°C
Typical Value (RR Shramik)	5.0s / 390°C	5.0s / 390°C
Chemical Compatibility		
Compatibility to Standard Solution		
Pencil Hardness acc. to IEC 60851-4.3 with treatment	4H	4H
Pencil Hardness acc. to IEC 60851-4.3 without treatment	4H	4H

Solderability, abrasion resistance, bondability, flexibility, insulation builds, etc. are all typical production and design considerations. Higher temperature requirements and more complex systems dictate the need for knowledgeable selectivity of enamelled wires. In addition to the product featured in this catalogue, we can manufacture custom insulated wires to meet your requirements.

RR Shramik SSFCP 155°C	RR Shramik SSHC 180°C	RR Shramik SSHC+N 180°C	RR Shramik SSPEI 180°C
Modified Polyurethane	Modified Polyurethane	Modified Polyurethane with Polyamide Overcoat	Self Solderable Polyurethane
IEC 60317-20	IEC 60317-51	IEC 60317-51	IEC 60317-23
MW 79-C	MW 82-C	MW 83-C	MW 77-C
JIS 3202	JIS 3202	JIS 3202	-
0,010 mm - 1,6 mm	0,010 mm - 1,6 mm	0,010 mm - 0,700 mm	0,010 mm - 0,700 mm
Very Good Solderability & High Thermal Properties, No Elongation Pinholes	Good Solderability at 395°C, High Thermal Properties	Very Good Solderability with High Thermal Properties	Solderable at High Temperatures, High Thermal Properties & Good Chemical Resistance
Small Transformers, Timers, Relays, Small Motors, Solenoids, Clock Coils, Watch Coils, Magnetic Heads	Automotive Coils as Relays and Ignition Coils, Transformers and Solenoids	Appliance Motors, Encapsulated Coils, Solenoids, Transformers, Toroids	Automotive Coils as Relays and Ignition Coils, Transformers and Solenoids
Yes	Yes	Yes	Yes
165°C	200°C	200°C	200°C
≥ 200°C	≥ 230°C	≥ 230°C	≥ 265°C
225°C	260°C	260°C	280°C
≥ 200°C	≥ 230°C	≥ 230°C	≥ 265°C
230°C	265°C	265°C	290°C
≥ 175°C	≥ 200°C	≥ 200°C	≥ 200°C
190°C	210°C	210°C	260°C
≥ 175°C	≥ 200°C	≥ 200°C	≥ 200°C
180°C	200°C	200°C	250°C
≤ 40	≤ 40	≤ 40	≤ 40
0	0	0	0
≤ 40	≤ 40	≤ 40	≤ 40
1	1	1	1
≤ 25	≤ 25	≤ 25	≤ 25
1	1	1	1
220 V/μm	220 V/μm	220 V/μm	220 V/μm
210 V/μm	210 V/μm	210 V/μm	210 V/μm
180 V/μm	180 V/μm	180 V/μm	180 V/μm
Very Good	Very Good	Very Good	Very Good
≤ 14%	≤ 14%	≤ 14%	≤ 14%
22%	22%	22%	22%
≤ 29%	≤ 29%	≤ 29%	≤ 29%
38%	38%	38%	38%
2,0s / 390°C	2,0s / 390°C	2,0s / 390°C	2,0s / 470°C
0,9s / 390°C	0,9s / 390°C	0,9s / 390°C	1,8s / 470°C
8,0s / 390°C	8,0s / 390°C	8,0s / 390°C	8,0s / 470°C
5,0s / 390°C	5,0s / 390°C	5,0s / 390°C	5,0s / 470°C
4H	4H	4H	4H
4H	4H	4H	4H

DIMENSIONS AND TECHNICAL DATA OF ENAMELLED COPPER WIRES BASED ON IEC 60317

Nominal Diameter	Conductor (Bare Wire)		Enamelled Copper Wire (Overall Diameter)						Resistance at 20° C			Elongation acc. to IEC
			Grade 1		Grade 2		Grade 3					
[mm]	Tolerance [mm]	Section [mm²]	Min. [mm]	Max. [mm]	Min. [mm]	Max. [mm]	Min. [mm]	Max. [mm]	Nom. [Ohm/m]	Min. [Ohm/m]	Max. [Ohm/m]	Min. [%]
0.010	*	0.000078540	0.0111	0.0120	0.0121	0.0130	0.0131	0.0140	217.65	195.88	239.41	3
0.012	*	0.000113097	0.0132	0.0143	0.0144	0.0155	0.0156	0.0170	151.14	136.03	166.26	3
0.014	*	0.000153938	0.0154	0.0167	0.0168	0.0180	0.0181	0.0200	111.04	99.94	122.15	4
0.016	*	0.000201062	0.0175	0.0190	0.0191	0.0210	0.0211	0.0230	85.02	76.52	93.52	5
0.018	*	0.000254469	0.020	0.022	0.023	0.024	0.025	0.026	67.18	60.46	73.89	5
0.019	*	0.000283529	0.021	0.023	0.024	0.026	0.027	0.029	60.29	54.26	66.32	6
0.020	*	0.000314159	0.022	0.024	0.025	0.027	0.028	0.030	54.41	48.97	59.85	6
0.021	*	0.000346361	0.023	0.026	0.027	0.028	0.029	0.031	49.35	44.42	54.29	6
0.022	*	0.000380133	0.024	0.027	0.028	0.030	0.031	0.033	44.97	40.47	49.47	6
0.023	*	0.000417476	0.025	0.028	0.029	0.031	0.032	0.035	41.14	37.03	45.26	7
0.024	*	0.000452389	0.026	0.029	0.030	0.032	0.033	0.036	37.79	34.01	41.56	7
0.025	*	0.000490874	0.028	0.031	0.032	0.034	0.035	0.038	34.82	31.34	37.31	7
0.027	*	0.000572555	0.030	0.033	0.034	0.036	0.037	0.041	29.86	26.87	32.84	7
0.028	*	0.000615752	0.031	0.034	0.035	0.038	0.039	0.043	27.76	24.99	30.54	7
0.030	*	0.000706858	0.033	0.037	0.038	0.041	0.042	0.046	24.18	21.76	26.60	8
0.032	*	0.000804248	0.035	0.039	0.040	0.043	0.044	0.048	21.25	19.13	23.38	8
0.034	*	0.000907920	0.037	0.041	0.042	0.046	0.047	0.051	18.83	17.13	20.52	8
0.036	*	0.001017880	0.040	0.044	0.045	0.049	0.050	0.054	16.79	15.282	18.305	8
0.038	*	0.001134000	0.042	0.046	0.047	0.051	0.052	0.056	15.07	13.716	16.429	10
0.040	*	0.001257000	0.044	0.049	0.050	0.054	0.055	0.059	13.60	12.379	14.827	10
0.043	*	0.001452	0.047	0.052	0.053	0.058	0.059	0.063	11.770	10.712	12.831	12
0.045	*	0.001590	0.050	0.055	0.056	0.061	0.062	0.067	10.750	9.781	11.715	12
0.048	*	0.001810	0.053	0.059	0.060	0.065	0.066	0.070	9.447	8.596	10.297	14
0.050	*	0.001963	0.055	0.060	0.061	0.066	0.067	0.072	8.706	7.922	9.489	14
0.053	*	0.002206	0.058	0.064	0.065	0.070	0.071	0.076	7.748	7.051	8.446	15
0.056	*	0.002463	0.062	0.067	0.068	0.074	0.075	0.080	6.940	6.316	7.565	15
0.060	*	0.002827	0.066	0.072	0.073	0.079	0.080	0.085	6.046	5.502	6.590	16
0.063	*	0.003117	0.069	0.076	0.077	0.083	0.084	0.089	5.484	4.990	5.977	16
0.067	*	0.003526	0.074	0.080	0.081	0.088	0.089	0.093	4.848	4.412	5.285	17
0.070	*	0.003848	0.077	0.083	0.084	0.090	0.091	0.096	4.442	4.042	4.842	17
0.071	*	0.003959	0.078	0.084	0.085	0.091	0.092	0.097	4.318	3.929	4.706	17
0.075	*	0.004418	0.082	0.089	0.090	0.095	0.096	0.102	3.869	3.547	4.235	17
0.080	±0.003	0.005027	0.087	0.094	0.095	0.101	0.102	0.108	3.401	3.133	3.703	17
0.085	±0.003	0.005675	0.093	0.100	0.101	0.107	0.108	0.114	3.012	2.787	3.265	18
0.090	±0.003	0.006362	0.098	0.105	0.106	0.113	0.114	0.120	2.687	2.495	2.900	18
0.095	±0.003	0.007088	0.103	0.111	0.112	0.119	0.120	0.126	2.412	2.247	2.594	19
0.100	±0.003	0.007854	0.108	0.117	0.118	0.125	0.126	0.132	2.176	2.034	2.333	19
0.106	±0.003	0.008825	0.115	0.123	0.124	0.132	0.133	0.140	1.937	1.816	2.069	20
0.110	±0.003	0.009503	0.119	0.128	0.129	0.137	0.138	0.145	1.799	1.690	1.917	20

Nominal Diameter	Breakdown Voltage acc. to IEC			Length of 1 kg of Enamelled Wire			Filling Factor Number of Enamelled			Tension	Nominal Diameter
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3		
[mm]	Min. [V]	Min. [V]	Min. [V]	Approx. [km]	Approx. [km]	Approx. [km]	[n]	[n]	[n]	Max. [cN]	[mm]
0,010	70	125	170	1358.2	1313.3	1267.9	865576	733132	628913	1.4	0,010
0,012	80	150	190	946.0	914.9	879.5	610751	516639	434604	2.0	0,012
0,014	90	175	230	694.9	672.9	645.6	448249	381391	318185	2.5	0,014
0,016	100	200	290	533.1	513.3	491.2	346692	287237	237494	3.2	0,016
0,018	115	240	380	417.6	398.3	382.7	261837	209090	177578	3.9	0,018
0,019	120	250	410	375.9	356.2	336.3	238574	184752	147283	4.3	0,019
0,020	120	250	410	340.1	323.2	306.2	218280	170814	137301	4.7	0,020
0,021	125	265	440	306.8	292.2	279.9	192370	152688	128300	5.1	0,021
0,022	130	275	470	280.2	265.4	252.6	177578	137301	112764	5.5	0,022
0,023	145	290	470	257.0	244.0	231.0	164429	128300	102892	6.0	0,023
0,024	150	300	470	236.5	225.1	213.6	152688	120156	97013	6.5	0,024
0,025	150	300	470	215.5	205.4	195.2	132686	106033	86673	7.0	0,025
0,027	165	315	510	185.6	177.6	168.3	116372	94261	75917	8.0	0,027
0,028	170	325	530	172.9	164.7	155.4	109321	86673	68691	8.5	0,028
0,030	180	350	560	150.3	142.8	135.2	94261	74007	59644	9.6	0,030
0,032	190	375	590	132.6	126.4	120.2	84346	67046	54570	10.8	0,032
0,034	210	400	620	117.8	112.1	106.3	75917	59644	48092	12.0	0,034
0,036	225	425	650	104.4	99.57	94.69	65459	52273	42703	13.2	0,036
0,038	240	450	680	93.97	89.87	85.72	59644	48092	39599	14.5	0,038
0,040	250	475	710	84.68	80.81	77.25	53403	42703	35540	15.9	0,040
0,043	265	520	710	73.55	70.15	67.01	47126	37487	31032	18.0	0,043
0,045	275	550	710	66.82	63.85	60.85	41894	33741	27756	19.4	0,045
0,048	290	580	780	58.73	56.08	53.81	36821	29560	24972	21.7	0,048
0,050	300	600	830	54.42	52.26	50.08	34925	28637	23906	23.2	0,050
0,053	315	625	860	48.42	46.45	44.62	31032	25343	21374	25.6	0,053
0,056	325	650	890	43.36	41.69	40.01	27756	22906	19225	28.2	0,056
0,060	355	680	960	37.79	36.33	34.97	24253	19991	16965	31.7	0,060
0,063	375	700	1020	34.27	32.92	31.74	21968	18042	15433	34.4	0,063
0,067	400	700	1060	30.31	29.19	28.21	19475	16172	13944	38.0	0,067
0,070	425	700	1020	27.83	26.91	26.06	18042	15256	13208	41.0	0,070
0,071	425	700	1100	27.07	26.19	25.37	17599	14911	12930	42.0	0,071
0,075	425	765	1140	24.26	23.52	22.82	15796	13495	11781	46.0	0,075
0,080	425	850	1200	21.39	20.73	20.11	14093	12023	10473	52.0	0,080
0,085	465	875	1250	18.92	18.37	17.86	12400	10676	9372	57.0	0,085
0,090	500	900	1300	16.92	16.43	15.96	11208	9630	8435	63.0	0,090
0,095	500	925	1350	15.19	14.75	14.35	10086	8656	7632	69.0	0,095
0,100	500	950	1400	13.72	13.31	12.97	9124	7822	6939	75.0	0,100
0,106	1200	2650	3800	12.22	11.88	11.56	8154	7048	6197	83.0	0,106
0,110	1300	2700	3900	11.34	11.03	10.74	7571	6528	5767	88.0	0,110

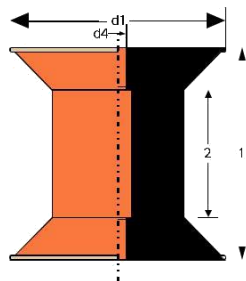
DIMENSIONS AND TECHNICAL DATA OF ENAMELLED COPPER WIRES BASED ON IEC 60317

Nominal Diameter	Conductor (Bare Wire)		Enamelled Copper Wire (Overall Diameter)						Resistance at 20° C			Elongation acc. to IEC
			Grade 1		Grade 2		Grade 3					
[mm]	Tolerance [mm]	Section [mm²]	Min. [mm]	Max. [mm]	Min. [mm]	Max. [mm]	Min. [mm]	Max. [mm]	Nom. [Ohm/m]	Min. [Ohm/m]	Max. [Ohm/m]	Min. [%]
0.112	±0.003	0.009852	0.121	0.130	0.131	0.139	0.140	0.147	1.735	1.632	1.848	20
0.118	±0.003	0.010936	0.128	0.136	0.137	0.145	0.146	0.154	1.563	1.474	1.660	20
0.120	±0.003	0.011310	0.130	0.138	0.139	0.148	0.149	0.157	1.511	1.426	1.604	20
0.125	±0.003	0.012272	0.135	0.144	0.145	0.154	0.155	0.163	1.393	1.317	1.475	20
0.130	±0.003	0.013273	0.141	0.150	0.151	0.160	0.161	0.169	1.288	1.220	1.361	21
0.132	±0.003	0.013685	0.143	0.152	0.153	0.162	0.163	0.171	1.249	1.184	1.319	21
0.140	±0.003	0.015394	0.151	0.160	0.161	0.171	0.172	0.181	1.110	1.055	1.170	21
0.150	±0.003	0.017671	0.162	0.171	0.172	0.182	0.183	0.193	0.9673	0.9219	10.159	22
0.160	±0.003	0.020106	0.172	0.182	0.183	0.194	0.195	0.205	0.8502	0.8122	0.8906	22
0.170	±0.003	0.022698	0.183	0.194	0.195	0.205	0.206	0.217	0.7531	0.7211	0.7871	23
0.180	±0.003	0.025447	0.193	0.204	0.205	0.217	0.218	0.229	0.6718	0.6444	0.7007	23
0.190	±0.003	0.028353	0.204	0.216	0.217	0.228	0.229	0.240	0.6029	0.5794	0.6278	24
0.200	±0.003	0.031416	0.214	0.226	0.227	0.239	0.240	0.252	0.5441	0.5237	0.5657	24
0.212	±0.003	0.035299	0.227	0.240	0.241	0.254	0.255	0.268	0.4843	0.4669	0.5026	24
0.224	±0.003	0.039408	0.239	0.252	0.253	0.266	0.267	0.280	0.4338	0.4188	0.4495	24
0.236	±0.004	0.043744	0.253	0.267	0.268	0.283	0.284	0.298	0.3908	0.3747	0.4079	25
0.250	±0.004	0.049087	0.267	0.281	0.282	0.297	0.298	0.312	0.3482	0.3345	0.3628	25
0.265	±0.004	0.055155	0.283	0.297	0.298	0.314	0.315	0.330	0.3099	0.2982	0.3223	26
0.280	±0.004	0.061575	0.298	0.312	0.313	0.329	0.330	0.345	0.2776	0.2676	0.2882	26
0.300	±0.004	0.070686	0.319	0.334	0.335	0.352	0.353	0.369	0.2418	0.2335	0.2506	26
0.315	±0.004	0.077931	0.334	0.349	0.350	0.367	0.368	0.384	0.2193	0.2121	0.2270	26
0.335	±0.004	0.088141	0.355	0.372	0.373	0.391	0.392	0.408	0.1939	0.1878	0.2004	27
0.355	±0.004	0.098980	0.375	0.392	0.393	0.411	0.412	0.428	0.1727	0.1674	0.1782	27
0.375	±0.005	0.110447	0.396	0.414	0.415	0.434	0.435	0.453	0.1548	0.1494	0.1604	27
0.400	±0.005	0.125664	0.421	0.439	0.440	0.459	0.460	0.478	0.1360	0.1316	0.1407	27
0.425	±0.005	0.141863	0.447	0.466	0.467	0.488	0.489	0.508	0.1205	0.1167	0.1244	28
0.450	±0.005	0.159403	0.472	0.491	0.492	0.513	0.514	0.533	0.1075	0.1042	0.1109	28
0.475	±0.005	0.177205	0.499	0.519	0.520	0.541	0.542	0.562	0.09646	0.09366	0.9938	28
0.500	±0.005	0.196350	0.524	0.544	0.545	0.566	0.567	0.587	0.08706	0.08462	0.08959	28
0.560	±0.006	0.246176	0.585	0.606	0.607	0.630	0.631	0.653	0.06938	0.06734	0.07150	27
0.630	±0.006	0.311567	0.657	0.679	0.680	0.704	0.705	0.728	0.05482	0.05333	0.05540	28
0.710	±0.007	0.395719	0.738	0.762	0.763	0.789	0.790	0.814	0.04316	0.04196	0.04365	29
0.800	±0.008	0.502400	0.830	0.855	0.856	0.884	0.885	0.911	0.03399	0.03304	0.03439	29
0.900	±0.009	0.635850	0.932	0.959	0.960	0.989	0.990	1.018	0.02686	0.02611	0.02717	30
1.000	±0.01	0.785000	1.034	1.062	1.063	1.094	1.095	1.124	0.02176	0.02115	0.02201	30
1.120	±0.011	0.984704	1.154	1.184	1.185	1.217	1.218	1.248	0.01734	0.01686	0.01754	31
1.250	±0.013	1.226563	1.285	1.316	1.317	1.349	1.350	1.381	0.01392	0.01352	0.01410	32
1.400	±0.014	1.538600	1.436	1.468	1.469	1.502	1.503	1.535	0.01110	0.01079	0.01123	32
1.600	±0.016	2.009600	1.638	1.670	1.671	1.706	1.707	1.740	0.00850	0.00826	0.00860	32

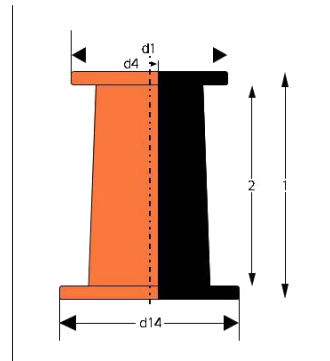
Nominal Diameter	Breakdown Voltage acc. to IEC			Length of 1 kg of Enamelled Wire			Filling Factor Number of Enamelled			Tension	Nominal Diameter
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3		
[mm]	Min. [V]	Min. [V]	Min. [V]	Approx. [km]	Approx. [km]	Approx. [km]	[n]	[n]	[n]	Max. [cN]	[mm]
0.112	1300	2700	3900	10.95	10.65	10.37	7331	6336	5607	91.0	0.112
0.118	1400	2750	4000	9.870	9.626	9.379	6627	5808	5132	99	0.118
0.120	1500	2800	4100	9.550	9.305	9.057	6431	5607	4933	102	0.120
0.125	1500	2800	4100	8.803	8.575	8.356	5934	5166	4567	110	0.125
0.130	1550	2900	4150	8.131	7.928	7.733	5454	4775	4241	118	0.130
0.132	1550	2900	4150	7.891	7.697	7.511	5307	4655	4140	121	0.132
0.140	1600	3000	4200	7.030	6.860	6.687	4775	4190	3707	133	0.140
0.150	1650	3100	4300	6.125	5.987	5.840	4165	3686	3267	150	0.150
0.160	1700	3200	4400	5.390	5.265	5.139	3686	3250	2887	168	0.160
0.170	1700	3300	4700	4.771	4.667	4.561	3250	2887	2581	186	0.170
0.180	1700	3300	4700	4.263	4.168	4.072	2931	2594	2312	206	0.180
0.190	1750	3400	4900	3.823	3.743	3.664	2618	2332	2100	226	0.190
0.200	1800	3500	5100	3.456	3.384	3.312	2386	2127	1908	247	0.200
0.212	1850	3600	5150	3.075	3.010	2.944	2118	1885	1689	274	0.212
0.224	1900	3700	5200	2.759	2.704	2.648	1916	1715	1544	302	0.224
0.236	2000	3800	5350	2.481	2.429	2.376	1708	1521	1364	331	0.236
0.250	2100	3900	5500	2.215	2.171	2.127	1538	1378	1241	366	0.250
0.265	2150	3950	5650	1.972	1.934	1.895	1373	1233	1110	406	0.265
0.280	2200	4000	5800	1.769	1.737	1.704	1241	1121	1014	448	0.280
0.300	2200	4050	5950	1.542	1.514	1.485	1083	979	886	507	0.300
0.315	2200	4100	6100	1.400	1.376	1.351	990	898	817	553	0.315
0.335	2250	4200	6250	1.238	1.216	1.195	874	791	722	618	0.335
0.355	2300	4300	6400	1.104	1.086	1.068	785	715	655	687	0.355
0.375	2300	4350	6500	0.989	0.973	0.957	704	641	586	759	0.375
0.400	2300	4400	6600	0.871	0.858	0.844	625	571	525	854	0.400
0.425	2300	4400	6700	0.772	0.760	0.748	554	506	465	954	0.425
0.450	2300	4400	6800	0.689	0.679	0.669	498	457	421	1060	0.450
0.475	2350	4500	6900	0.618	0.609	0.601	446	410	379	1170	0.475
0.500	2400	4600	7000	0.559	0.551	0.543	405	374	347	1287	0.500
0.560	2.600	4600	7100	0.450	0.444	0.438	292.21	271.41	251.15	1681	0.560
0.630	2.600	4800	7200	0.356	0.352	0.347	231.67	216.26	201.2	2070	0.630
0.710	2.600	4800	7400	0.280	0.277	0.274	183.61	171.77	160.23	2556	0.710
0.800	2.700	4900	7600	0.221	0.219	0.216	145.16	136.47	127.68	3156	0.800
0.900	2.700	5000	7600	0.175	0.173	0.171	115.12	108.51	102.03	3886	0.900
1.000	2.700	5000	7600	0.142	0.140	0.139	93.532	88.498	83.401	4681	1.000
1.120	2.700	5000	7600	0.113	0.112	0.111	75.091	71.214	67.407	5719	1.120
1.250	2.700	5000	7600	0.091	0.090	0.089	60.561	57.654	54.87	6943	1.250
1.400	2.700	5000	7600	0.072	0.072	0.071	48.494	46.34	44.267	8481	1.400
1.600	2.700	5000	7600	0.056	0.055	0.055	37.271	35.814	34.319	10737	1.600

SPOOLS AND PACKAGING

	Graph	Wire Sizes	Characteristics
Biconical	1	0.010 mm - 0.15 mm	Biconical spool for fine and ultrafine wire, superb de-reeling capability, ideal for high speed winding machines.
Tapered	2	0.070 mm - 1.60 mm	Stable winding due to tapered barrel spool for heavier sizes.

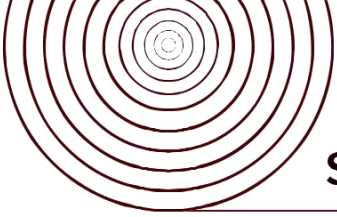


Graph 1: Biconical Spool



Graph 2: Tapered Spool

Spool Types	d1 [mm]	d4 [mm]	l1 [mm]	l2 [mm]	d14 [mm]	Spool Weight [g]	Nom. net wire weight [kg]	Recommended for wires sizes [mm]	Spools per box	Boxes per pallet
Biconical										
76/45	63.4	16	86.3	60	-	70	0.3	0.010 - 0.019	6	120
79/45	80	16	100	70	-	70	0.7	0.020 - 0.024	4	72
PL1S	80	16	100	72	-	70	1.0	0.018 - 0.035	8	72
PL2S	100	16	100	47	-	130	1.2	0.025 - 0.040	8	24
124/45R	125	16	125	57	-	160	2.5	0.040 - 0.080	4/9	24
PL4-S	135	20	175	110	-	260	4.2	0.040 - 0.132	4	24
159/45R	160	22	160	73	-	315	5.5	0.040 - 0.132	4	18
199/45R	200	22	200	92.5	-	600	11.0	0.050 - 0.150	1	21
Tapered										
PT 4	124	22	200	170	140	340	5.5	0.070 - 0.100	4	24
PT 10	160	22	230	200	180	620	10	0.100 - 0.600	2	36
PT 15	180	22	230	200	200	740	15	0.100 - 0.600	2	45
PT 25	215	32	280	250	230	1000	26	0.160 - 0.500	1	36
PT 45	236	100	400	335	250	2150	45	0.120 - 1.600	Container	8
PT 60	270	45	400	350	300	2400	60	0.280 - 1.600	Container	12
PT 90	300	100	500	425	3900	3900	90	0.200 - 1.600	Container	6



SUPER ENAMELLED ALUMINUM WINDING WIRES

The demand of aluminum magnet wires in many industrial applications has sky rocketed due to unprecedented increase in copper rates. To cater this demand, We proudly declare the addition of super enamelled aluminum magnet wires in the product armory. These are manufactured as per Indian as well International standards and as per the specifications given by the customers. The product is available in different sizes, types and grades of coverings to cater to specific needs for special fields of applications. The latest technology is adopted for manufacturing to offer high quality products.

APPLICATIONS

Aluminum is an excellent electrical conductor next to copper. The super enamelled aluminum wire can be used to replace the copper enamelled wires with proper design modifications. Mainly it is used in electronic circuits, television degaussing coils and so on for many more applications including washing machine motors, fans and AC compressors. These wires have same properties for the enamel film but differ for the conductor properties when compared with enamelled copper wires. Our products have very good elongation and smooth surface.

SIZE RANGE, TYPES AND SPECIFICATIONS

- Wire Dia Sizes from 4.0 to 0.25 mm (8 to 33 SWG), Grade – 1, 2, and 3
- Modified Polyesters, Class 130, 155. As per IS 13730 part 9 / IEC 60317 part 9
- Hermetic Grade, Class 180. As per IS 13730 part 15 / IEC 60317 part 15
- Dual Coated, Class 200. As per IS 13730 part 25 / IEC 60317 part 25 and NEMA MW 35A

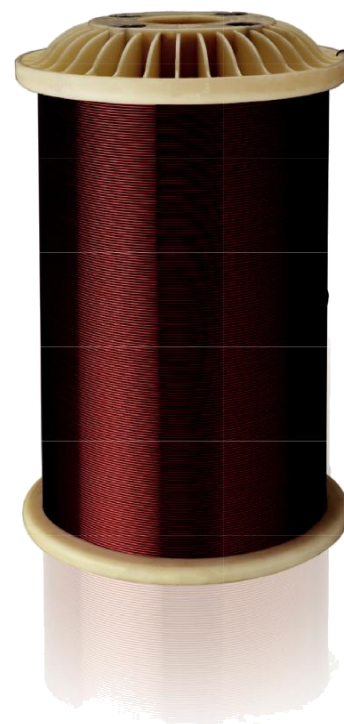
SIZE CALCULATION

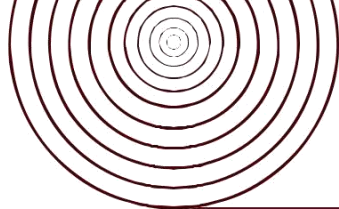
An indicative calculation for getting aluminum magnet wire size to replace copper magnet wire can be as below.

Resistivity (ρ) of Cu is $0.01709 \Omega\text{mm}^2/\text{m}$ & that of aluminum is $0.02789 \Omega\text{mm}^2/\text{m}$.

By using formula of resistance $R = \rho L/A$

D (diameter) for aluminum = $1.277 \times D$ of Copper





SUPER ENAMELLED COPPER STRIPS

Enamel film insulated rectangular copper conductors are known as enamelled copper strips. The manufacturing process of enamelled strips, are essentially same as round wires, but most critical. The rectangular shape of copper conductors with nominal corner radii, helps to pack maximum copper in small space. This characteristic is beneficial in design aspect of the transformer windings. At the same time the insulation strength and flexibility has to be excellent to withstand the winding stresses, bending / shaping etc. At Salasar Copper, we provide very special attentions towards the flexibility and adherence of the insulation film of enamelled strips. We are having many esteemed and satisfied customer using enamelled strips for critical applications.

GENERAL PROPERTIES

Property		Specification values
Elongation		32% Minimum
Conductor tolerances		
Nominal width or thickness in mm		Tolerance + in mm
Over	Up to including	
-	3.15	0.030
3.15	6.30	0.050
6.30	12.50	0.070
12.50	16.00	0.100
Flexibility		4 x W / T No crack
Adherence		15% pre-stretched shall pass
Corner Radius		0.50 to 1.0 mm
Springiness		5 degree max.
Break Down Voltage		1 to 2 Kv at RT
		0.05 - 0.5 Kv at ET
Packaging		40 to 100 kgs spools
W/T Ratio		1.4:1 min, 8:1 max.

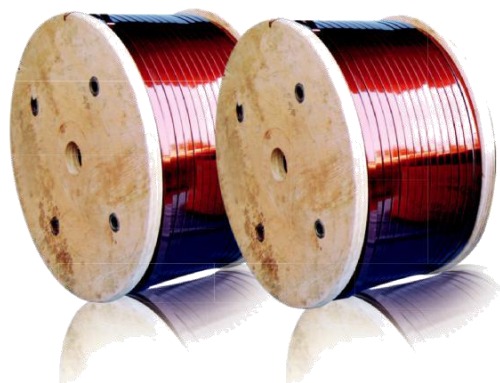
SIZE RANGE

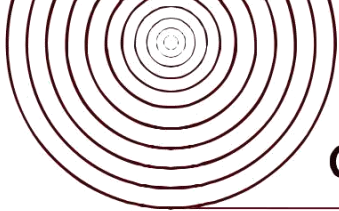
Width	14 mm max.
Thickness	5 mm max.
Cross Sectional Area	65 mm ² max

Specification	IS 13730 / 16 /28 / 29	
Grade of covering	Minimum	Minimum
1 (Fine)	0.06 mm	0.11 mm
2 (Medium)	0.11 mm	0.16 mm

INSULATION TYPES

A	Modified Polyester
Thermal Class	155°C
Specification	IS 13730-16 IEC 60317-16
Heat Shock	175°C - ½ Hour 6XW/T - No CRACK
B	Polystermide
Thermal Class	180°C
Specification	IS 13730-28 IEC 60917-28
Heat Shock	200°C - ½ Hour 6XW/T - No CRACK
C	DC (PEI + PAI)
Thermal Class	200°C
Specification	IS 13730-29 IEC 60317-29
Heat Shock	220°C - ½ Hour 6XW/T - No CRACK





GLASS FIBRE COVERED STRIPS

The glass in glass fibre conductor may be applied in woven tape form or as a continuous fibre. It has proved to be an efficient insulation providing coil winders with thermal stability, and equate electrical properties and good resistance to abrasion after varnishing. The glass fibre is bonded with a varnish, to improve dielectric strength and mechanical properties.

Glass fibre-lapped conductors (bare or enamelled) are very suitable for windings of electric motor stators, generators, special transformers and high voltage motors heavy magnet coils etc. In general this insulation can be applied, where high mechanical strength and high insulation properties are required. Most common application is in traction motors. It exhibits a very high degree of mechanical and thermal stability; either for class F and H insulation, when impregnated with polyester, polyester-imide or epoxy based impregnating varnishes. For higher thermal class, the glass fibre-lapped conductors can be impregnated with silicone based resins of thermal class 200. The production machinery includes high speed double six spindle fiber lapping and varnish application with inline heating oven and automatic take up reeling.

MANUFACTURING RANGE (IN MM)

Glass Fibre Covered Copper Strips

Width		Thickness		Cross Section Area (sq. mm)		Width / Thickness Ratio	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4.0	16.0	1.6	5.6	6.0	80.0	1.4:1	8:1

Nominal width of conductor		Increase in Dimension (mm)							
		Glass fibre would over bare conductor				Glass fibre would over Grade - 2 enamelled Wire			
		Single Covering		Double Covering		Single Covering		Double Covering	
Over	Up to and including	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
-	3.15	0.13	0.20	0.20	0.32	0.24	0.36	0.31	0.48
3.15	6.30	0.14	0.22	0.22	0.37	0.25	0.38	0.34	0.52
6.30	12.50	0.16	0.23	0.25	0.41	0.27	0.44	0.36	0.56
12.50	16.00	0.18	0.32	0.27	0.45	0.28	0.48	0.38	0.61

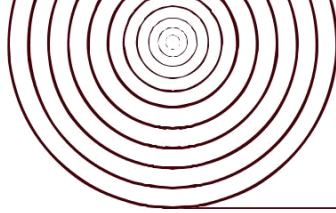
SPECIFICATIONS

CLASS : 155° : IEC 60317-32 (IS 13730-32)

CLASS : 180° : IEC 60317-31 (IS 13730-31)

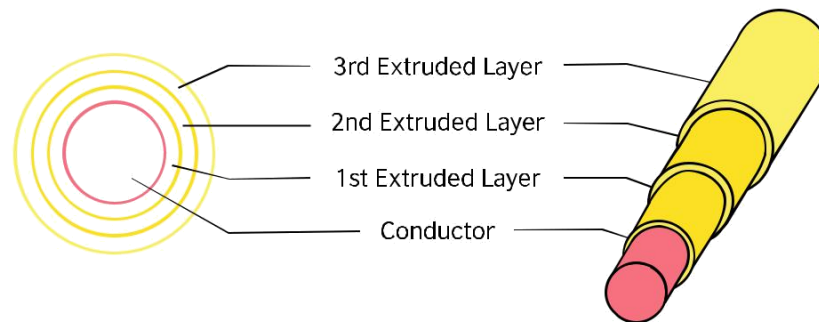
CLASS : 200° : IEC 60317-33 (IS 13730-33)



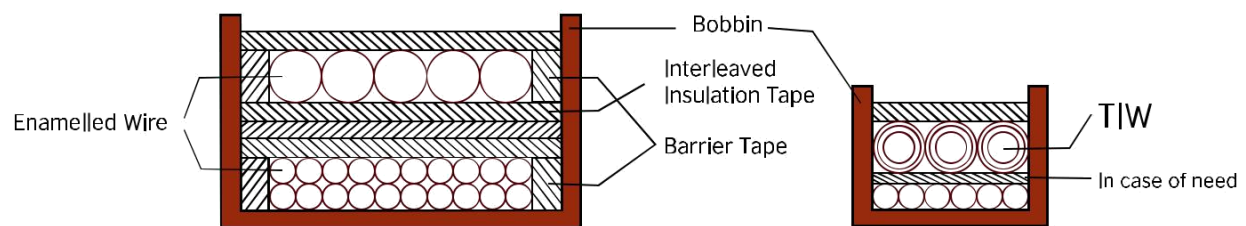


TRIPLE INSULATED WINDING WIRES

TIW, a unique product for small transformers. Three layer extruded coatings of high performance polymer resins gives excellent dielectric properties to this type of winding wires. Unlike enamelled wires, three layers of insulation are extruded over the copper conductor with automated manufacturing process ensure perfect central position of conductor. The conventional enamelled wire winding coils requires insulation between the primary and secondary coils by means of barrier tape or interlayer tape, to isolate primary and secondary windings. Since three layers coating is having very high dielectric strength, it has very less creepage factor. This positive feature of TIW serves to downsize switching transformers, and promises high production efficiency and cost reduction. Depending on the design, the transformer size can be reduced up to 40% and weight up to 60% as compared to transformers made up of enamelled wires.



Third external layer of polyamide gives excellent flexibility and high mechanical strength to the wire, thus enabling high speed machine windings suitable. Moreover the insulation coating is directly solderable at the appropriate temperature, making the production process much faster.



ADVANTAGES

- Greatly reduces size and weight of transformer. No need of interlayer insulations, tapes, barriers etc.
- Very high dielectric strength withstands 6000V AC for 1 minute. Breakdown voltages above 10 kV.
- Polyamide covering gives mechanical strength. Ideal for automated winding.
- Auto controlled manufacturing process with fault detectors per length.
- Directly solderable - No need to strip off the insulation.
- Reliability of transformer winding. Conforms to Japanese standard JIS 3005.
- In addition to the reduction in size and economy in material cost of the transformer made, TIW has an advantage of improving its performance by reducing the distance between the coils.

TECHNICAL SPECIFICATIONS

Conductor Diameter (mm)	Tolerance (mm)	Nominal Overall Diameter (mm)	Max. Overall Diameter (mm)	Breakdown Voltage (V)	Max Conductor Resistance (20°C) Ohm / km	Elongation (%)	Weight/ Length (kg/ km)	Spool Size
0.20	±0.008	0.400	0.420	6000	607.6	15	0.400	PT 5
0.25	±0.008	0.450	0.470	6000	382.5	15	0.577	PT 5
0.28	±0.008	0.480	0.500	6000	296.6	18	0.701	PT-5
0.30	±0.010	0.500	0.520	6500	262.9	20	0.789	PT 5
0.32	±0.010	0.520	0.540	6500	228.3	20	0.885	PT-5
0.35	±0.010	0.550	0.570	6500	191.2	20	1.036	PT 5
0.37	±0.010	0.570	0.590	6500	189.8	20	1.146	PT-5
0.40	±0.010	0.600	0.625	7000	145.3	20	1.318	PT 5
0.45	±0.010	0.650	0.675	7000	114.2	20	1.635	PT 5, PT 10
0.50	±0.010	0.700	0.725	7000	91.43	20	1.987	PT 5, PT 15
0.55	±0.020	0.750	0.780	7000	78.15	20	2.374	PT 5, PT 10
0.60	±0.020	0.800	0.830	7000	65.26	20	2.796	PT 5, PT 10
0.65	±0.020	0.850	0.880	7000	55.31	20	3.252	PT 5, PT 10
0.70	±0.020	0.900	0.930	7000	47.47	20	3.744	PT 10, PT 15
0.75	±0.020	0.950	0.980	7000	41.17	25	4.272	PT 10, PT 15
0.80	±0.020	1.000	1.030	7000	36.08	25	4.832	PT 10, PT 15
0.85	±0.020	1.050	1.08	7000	31.85	28	5.430	PT 10, PT 15
0.90	±0.020	1.100	1.130	7000	28.35	28	6.059	PT 10, PT 15
0.95	±0.020	1.150	1.180	7000	25.37	28	6.728	PT 10, PT 15
1.00	±0.030	1.200	1.230	7000	23.33	28	7.427	PT 10, PT 15

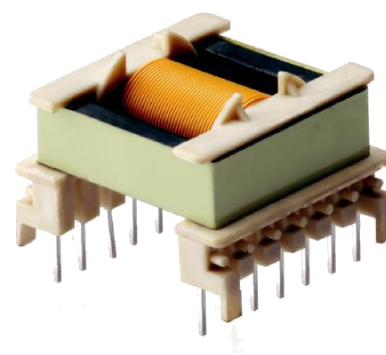
Product range : 0.200 mm to 1.00 mm • **Packing :** PT 5, PT 10 & PT 15 bobbin packing

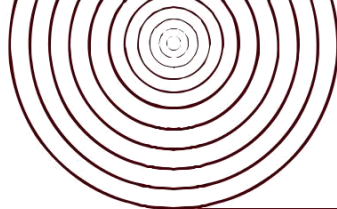
*Intermediate sizes can be customized as per specific requirements.

APPLICATIONS

- Their applications cover most switching transformers, information and telecommunications equipment, game machines, consumer goods, inverters and other similar devices.
- SMPS for units of printer, facsimile, memory, computer, monitor, inverter, game machine.
- Battery Charger for assemblies of digital camera, portable telephone, 8 mm VCR, AC adapter, personal computer, DVD.
- Operating Frequencies: Typically 85 kHz to 200 kHz but level with a maximum of 500 kHz

These products demonstrate considerable effects in terms of loss reduction and mitigating temperature rises when used in switching power transformers, which are widely used in industrial and consumer-use equipment.





SUBMERSIBLE WINDING WIRES

We also offer poly wrapped winding wire commonly known as “**Submersible Copper Winding Wire**”. The copper conductor is wrapped with thin polyester film and Biaxial oriented poly propylene (BOPP) films. The most modern plant with sophisticated wrapping heads and in line continuous heat shrinkage furnace is installed to get uniform covering. A complete quality assurance testing by instruments covering all governing standards is available. The test standards followed are IS 8783:1995.

APPLICATION

Used in submersible pumps motors of all sizes for domestic and industrial application.

PACKAGING

Available in coil form with suitable length as per size, in polythene bag and packed in inner and outer corrugated boxes.

• SPECIAL SALIENT FEATURES

- Saves energy - ETP grade high conductivity annealed copper used
 - Less current leakage - No air gap between the films.
 - Tear resistant - High mechanical strength - High tensile strength
 - Each coil tested at 3500 V
 - Heat shock test - at 150°C
 - Easy winding - Resistance annealed copper and controlled OD
- Manufactured by ultra modern automatic plant as per IS 8783 (Part 4 / Sec.3)

TESTING FACILITIES

The quality assurance having all the testing facilities with ultra modern, high precision instruments and rigorous testing plans. Details of test which conforms to IS 8783 (Part 4 / Sec. 3) is as follows.

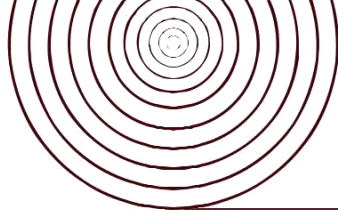
Sr. No.	Name of the Tests	Units	Instruments Used
1	Size (Diameters)	mm	Micrometer
2	Elongation	Percentage	Tensile tester
3	Conductor resistance	Ohm / KM	Resistance meter
4	Volume resistivity	Ohm - cm	Million mega meter
5	High voltage test	kV	High voltage tester
6	Thermal ageing	Change in elongation and tensile	Ageing oven and tensile tester
7	Shrinkage test	Percent	Circulating hot air oven
8	Water absorption	mg / cm ²	Vaccum oven and pump desecrator
9	Hot deformation	Percent	Circulating hot air oven
10	Heat shock test	No sign of cracks / scales / separation of layers	Circulating hot air oven and mandrels

GENERAL PROPERTIES

Sr. No.	Nominal conductor diameter (mm)	Tolerance $\pm$ (mm)	Nominal resistance Ohms/KM at 20°C	Over all diameter	Weight of poly wrapped (kg/km)	Elongation minimum (%)
1	0.40	0.004	137.15	0.80	1.467	24
2	0.50	0.005	87.78	0.90	2.154	25
3	0.60	0.006	60.96	1.00	2.980	26
4	0.70	0.007	44.78	1.10	3.946	28
5	0.80	0.008	34.29	1.20	5.052	28
6	0.90	0.009	27.09	1.30	6.298	29
7	1.00	0.010	21.94	1.40	7.683	30
8	1.10	0.011	18.14	1.50	9.208	30
9	1.20	0.012	15.24	1.60	10.873	31
10	1.30	0.013	12.98	1.70	12.678	32
11	1.40	0.014	11.20	1.90	14.891	32
12	1.50	0.015	9.75	2.00	16.989	32
13	1.60	0.016	8.57	2.10	19.227	32
14	1.70	0.017	7.59	2.20	21.605	32
15	1.80	0.018	6.77	2.30	24.122	32
16	1.90	0.019	6.08	2.40	26.780	32
17	2.00	0.020	5.49	2.50	29.576	33
18	2.10	0.021	4.98	2.60	32.513	33
19	2.20	0.022	4.53	2.70	35.589	33
20	2.30	0.023	4.15	2.80	38.805	33
21	2.40	0.024	3.81	2.90	42.161	33
22	2.50	0.025	3.51	3.00	45.656	33
23	2.60	0.026	3.25	3.10	49.291	34
24	2.70	0.027	3.01	3.20	53.066	34
25	2.80	0.028	2.80	3.30	56.980	34
26	2.90	0.029	2.61	3.40	61.035	34
27	3.00	0.030	2.44	3.50	65.228	34

* These are only indicative values.
Improvement is an ongoing process at RRWL and efforts exceed average values.





SUBMERSIBLE FLAT CABLES

(Three Core) voltage grade 1100 V, confirming to IS 694 -2010

- Fits perfect required grommet
- As per IS dimension
- Perfect sheathing for underwater application

TECHNICAL SPECIFICATION

Conductor

Compactly bunched high purity bright, electrolytic grade, plain annealed copper with superb flexibility according to IS 8130 Class 2 & 5 available in various sizes. 'Unilay' conductor in the core will be provided on special order from 1 to 4 sq.mm.

Insulation and Sheathing

Generally available with 70°C insulation and PVC sheathing.

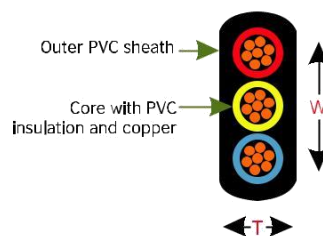
Nom. Cross Section Area of Conductor (mm) ²	Number of Nominal Dia. of Strands	Nom. Insulation Thickness (mm)	Nom. Sheath Thickness (mm)	Max. Resistance Per Km at 20°C (Ω/km)	Overall Dimension (Max.) (W X H) (mm X mm)	Current Carrying Capacity at 40°C (Amps)
1.5	22 / 0.3	0.6	0.9	12.1	12.0 X 5.6	18
2.5	36 / 0.3	0.7	1.0	7.41	13.0 X 6.2	24
4	56 / 0.3	0.8	1.0	4.95	15.3 X 7.1	28
6	84 / 0.3	0.8	1.1	3.30	19.2 X 8.4	36
10	140 / 0.3	1.0	1.4	1.91	24.2 X 10.4	48
16	126 / 0.4	1.0	1.4	1.21	29.0 X 12.4	64
25	196 / 0.4	1.2	2.0	0.78	36.5 X 15.7	80

SELECTION GUIDE FOR CORE FLAT CABLES

HP vs Current:

The full load current for submersible pump motors, 3 phase, 50 Hz, 415-440 V

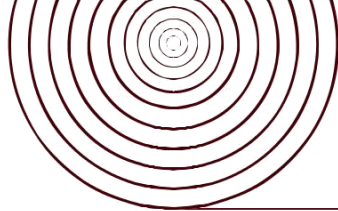
	5.0	7.5	10.0	12.5	15.5	17.5	20.0	25.0	30.0
Amps.	7.5	11.0	15.0	19.0	22.8	25.0	28.0	35.8	43.0



Note:

- Current derating factors as per IS 3961 part 5 shall be applicable for for different usage conditions.
- Standard sheath colours : Black
- Standard packing : 100 mtr. coils. Longer lengths supplied on order.





PAPER COVERED MAGNET WIRES

In spite of use of ever increasing number of new insulating materials, paper covered round and rectangular magnet wires found extensive use for the winding of large electrical machines especially oil cooled transformers, condensers, capacitors, UPS system etc. Standard paper covered magnet wires are manufactured by applying single, double or multiple layers of insulating paper tapes helically around conductors. The properties are determined by thermal, chemical & mechanical properties of the various types of insulating papers used.

Kraft Paper is a Class "Y" insulation suitable for use at a maximum operating temperature of 90°C & when impregnated or immersed in mineral transformer oil, it has a Class "A" rating (105°C). Also Kraft Paper insulation is characterized by outstanding dielectric strength when oil impregnated.

Nomex Paper: Nomex is aromatic polyamide, aramid fibrous material rolled in form of paper sheets. "Nomex" is trade name of DuPont and is mainly used in high temperature applications. The thermal class of insulation is 240 as per specification NEMA MW 60C and 61C.

APPLICATIONS

Kraft Paper covered conductors found it is main application in oil filled transformers where as Nomex paper covered conductors are used where very higher thermal class insulation is required like condensers, capacitors, UPS systems, special transformers. Multi paper covered stranded or single cables are commonly used for internal connections of the oil filled transformers.

SIZE RANGE AND TYPES

Rectangular conductor dimensions

Thickness: 2.00 - 8.00 mm

Width: 4.00 - 20.00 mm

Section: 8.00 - 100.0 mm²

Round or bunched conductor sizes are available from 1.32mm to 5.00mm diameters.

TYPE OF PAPERS

Electrical grade kraft paper

Nomex paper

Polyester films

Special papers as required

SPECIFICATIONS

Product conforms to IS 13730-27, IEC 60317 - 27, NEMA MW 31-C & 33-C specifications and as per customer specifications. Thermal class for Kraft paper covered shall be 90°C un-impregnated or 105°C impregnated or immersed in oil and for Nomex paper covered it shall be 240°C.

DIMENSIONS

The thickness of covering and no. of paper layers can be varied to suit the specific requirement. The increase in thickness as per NEMA standards for the paper covering shall be as below.

Minimum thickness increase = 2 (Equivalent no. of layers – 1) (Nom. tape thickness)

Maximum thickness increase = 2 (Equivalent no. of layers + 1) (Nom. tape thickness)

Note:

For rectangular wires, the increase in width due to paper covering shall be equal to or less than the increase in thickness.

PROCESS

The paper tapes are helically wrapped firmly, closely, evenly & continuously around the conductor. The taping operation is carefully controlled to provide a consistent insulation throughout multi layer buildups. Butt wrapping, overlapped wrapping, same or different direction wrapping can be done as per requirement.

The bare round and rectangular conductors used are manufactured from electrolytic grade copper rods by precision wire drawing and copper extrusion. The extruded rectangular conductors are fully annealed.

TESTING

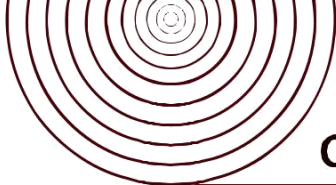
Below tests are carried out as per the specified specifications to ensure consistent good quality.

1. Dimension check
2. Visual inspection for continuity
3. Adherence
4. Flexibility
5. Elongation
6. Spring back
7. Dielectric breakdown

PACKING

The product shall be supplied on wooden or plastic spools as per requirement weighing from 40 kg to 100 Kg.





CORONA RESISTANT WINDING WIRES

In inverter driven motors, excessive surges and voltage peaks during speed variation, creates corona discharge in the stator windings, which induce extra thermal stress on the insulation, causing excessive thermal ageing there by weakening and even decomposing of the insulation, leading to premature failure of motors. Corona induced failure is a typical phenomenon. Mica based products are used in certain application where corona resistance is required. Mica is naturally occurring and is available easily. But it has its own inherent weakness. It has poor flexibility and large area and as such, the space required is more for any mica based application. This results in increasing the size of the motor, making it unusable where space constraints are there. Moreover it has poor adhesion to most of the resins. Improved dielectric materials having resistance to corona discharge-induced deterioration would therefore be highly necessary. M/s. Dupont has been manufacturing corona resistant Wire enamel under the brand name "Voltatex".

PROCESSING OF CORONA RESISTANT ENAMELLED WIRES

Dual coated wire, with Polyesterimide as the base coat and Polyamideimide as the topcoat has been the most commonly used for applications up to thermal class 200. As discussed earlier, even these types of wires are susceptible to corona related failures. In order to overcome this deficiency, base coat is replaced with special corona resistant enamel.

- Basecoat of Corona resistant wire enamel class 200°C
- Top coat of Polyamide-imide (PAI) class 200°C +

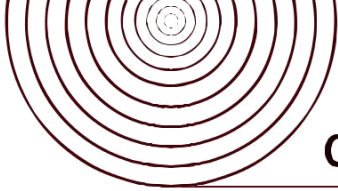
We process corona resistant wire in the range 3 mm to 0.63 mm. We can extend this range up to 0.3 mm by suitably modifying our machines. These corona resistant wires were tested for higher proof voltage and at elevated temperatures. There are certain guide lines about the voltage endurance test by RDSO. Our products conform to requirements of standards. Further to this, the wire was impregnated with class vinyl toluene based class 200 impregnating varnish (resin) and tested for proof voltage at elevated temperatures. Test results were found satisfactory.



Comparison of test results for 1.12 mm winding wire without impregnation

Sr. No.	Tests	Test Method	DC Wire	Corona Resistant Wire
1	Cut through, 320°C, 2 min.	IEC 60317 Part-13	Passes	Passes
2	Cut through, 400° C, 2 min.	Special test	Passes	Withstands >5min.
3	Break down voltage, kV	IEC 60317 Part-13	11.0	12.0
4	Break down voltage at 200°C	IEC 60317 Part-13	10.0	11.0
5	Proof Voltage, 2.0kV for 72hrs	Special test	2/3 Passes	3/3 Samples passes
6	Heat Shock 3xd, 220°C, 30 min	IEC 60317 Part-13	Passes	Passes
7	Heat Shock 3d, 240°C, 30 min	Special test	Passes	Passes
8	Heat Shock 1xd, 260°C, 30 min.	Special test	2/3 Passes	Passes

From our evaluation which includes the above test results we found this special coated wire is having a higher lifetime compared to traditional DC wire (PEI+PAI), since this wire could withstand higher proof voltage of 2.0kV which is also the indirect effect of voltage surges and peaks under inverter drives.



CREPE KRAFT PAPER INSULATED COPPER CABLES

Kraft paper insulation is most commonly used in oil filled transformers. The plain kraft papers are wrapped in number of layers on conductors, to acquire the needed insulation strength. However, plain kraft paper has limitations of the flexibility and leads to breakage of insulation in tight shaping of the coils. For this purpose, kraft papers are fabricated or creped. The folds made in creping process, increases the elasticity and flexibility during shaping of coils. It also enlarges the surface area of insulation and absorbs insulating oils resulting in better insulation and heat dissipation during operation.

FLEXIBLE COPPER CABLES WITH CREPE KRAFT PAPER MULTILAYERED INSULATION

Product Details: 120Sq. mm. stranded copper cable covered with crepe kraft paper

Insulation: 4 layers of crepe kraft paper in 50% overlapping

Conductor dia: Approx 13-14mm

Overall Dia: 16.5 to 15.5mm

CONDUCTOR SIZE RANGE

70 sq mm to 150 sq mm. Copper flexible cables.

INSULATION THICKNESS

0.50 mm to 5.00 mm, as per customer specification / design requirement

Conductor sq mm and covering / lapping can change as per customer specifications or transformer design.

PACKAGING

Supplied in wooden reels of 100 Kg capacity.

APPLICATIONS

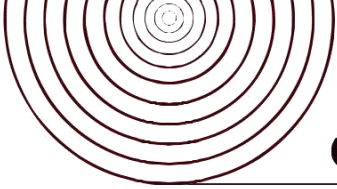
Mainly used as an insulation in oil cooled transformers, current transformers of type IMB, CT, CVT as leads and shields. Crepe paper has 300% more strength in machine and cross machine direction and hence is more resistant to breakage.

It can also take various shapes of the surface being insulated. The cable is wound on FRP Rings, 3 to 12 turns as per transformer application. This is also most suitable as lead wire and terminal wires of PT windings.

SIGNIFICANCE

Crepe kraft paper is used as an insulation in as it is elastic in properties and do not crack in bending of the cable in winding turns. Crepe paper also has greater surface area, which helps to retain more oil and hence lowers the working temperature of transformer. It is also a good insulator in presence of transformer oil.





COTTON COVERED COPPER CONDUCTORS

Cotton is one of the most useful naturally occurring insulators and is used from ancient time for its heat resistance. However, it also has moderate electrical insulation properties in dry condition. In certain low voltage applications, cotton yarns are used as wrapped around insulators, which proved to be long lasting, flexible and tough insulation. Cotton yarn soaked in impregnating resins and cured properly for the critical applications like servo stabilizer windings, magnet coils etc.

PRODUCT RANGE

SWG 5 to 15 (5.4 mm to 1.8 mm)

6 to 80 sq. mm. copper (Width 3 mm to 15 mm - Thickness 1.6 mm to 5 mm)

INSULATION

Double cotton yarn covering or first layer of fiber glass yarn covered with second layer of cotton yarn.

INSULATION THICKNESS

Can be supplied in range of 0.30 to 0.60 as per customer requirement.

INSULATION CONDITION

Dry, wrapped around tightly over copper conductor without varnish treatment.

SPECIFICATION

As per IS 7391 part 1 for round copper wires, IS 7391 part 2 for rectangular copper conductors.

APPLICATIONS

This product is exclusively used in dimmer stat windings of 40, 50, 75, 80, 90 Amp or even higher capacity. SWG 6, 9, and 11 are commonly used for this application. The wires are wound in form for toroid windings, which is further dipped in epoxy resins and cured / baked to form a solid, hard, tough insulation.

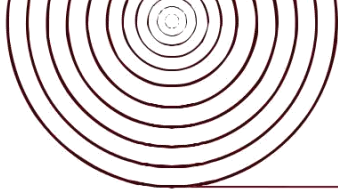
SIGNIFICANCE

There is very low voltage difference between turn to turn (approx. 2V) hence less insulation properties are required. Cotton, soaked in epoxy resin and cured, gives required insulation and toughness to the winding. It has better performance than enamelled wires for this application. As during the grinding application the cotton covering does not chip off. This is mainly used in variac servo windings above the range of enamelled wires windings (thicker wires).

OTHER APPLICATIONS

Antennas, high frequency coils, chokes, large magnet coils, servo windings etc.





NYLON COATED ENAMELLED WIRES

Nylon top coat is used over the regular enamelled copper wires to enhance the mechanical properties of insulation coat. Normal enamelled coating is stressed in coil winding applications like high speed auto winding and auto coil insertions in slots. Nylon top coat exhibits a smooth and tough slippery surface of top layer of insulation, thus, reducing chances of insulation damage and failures related to mechanical abuse of the thin insulation layer.

APPLICATIONS

Nylon top coat wires can be used in high speed windings for armature coils of home appliances, power tools, auto coiling machines for switch gears miniature coils in electronics etc. Nylon top coat applied over variety of primary insulation like polyester, polyester-imide, dual coated and solderable polyurethanes of class 130, 155 and 180.

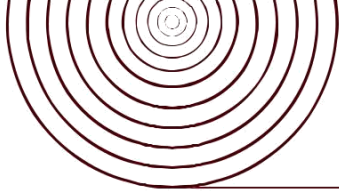
APPLICABLE STANDARDS

IEC 60317-19, Solderable polyurethane class 130 over coated with polyamide
IEC 60317-21, Solderable polyurethane class 155 over coated with polyamide
IEC 60317-22, Polyester or polyester-imide class 180 over coated with polyamide
IEC 60317-55, Solderable Polyurethane class 180 over coated with polyamide

PRODUCT RANGE

0.020 mm to 0.800 mm wire diameters.





SELF BONDING ENAMELLED WIRES

Normally enamelled copper conductors are used as coil components of various electrical products such as motors / transformers / home appliances / auto electrical components / chokes / AC compressors. Apart from AC compressors all other copper windings are under going for secondary insulation coating and curing of the same. The process is called as impregnation. The secondary insulation is used to get a firm compact winding, that can withstand the vibration and all the copper conductors are held firmly together. The voids in coil are also filled by the secondary insulation. It also prevents direct contact of moisture with the primary (enamel) insulation film. The basic property of secondary insulation (varnish) is to hold the winding together. However for certain applications (where the secondary insulation is not practical) self bonding enameled wires can be used. These wires have outer layer of bondable material which is usually thermoplastic and bonds the wires surfaces with each other once heated to the bonding temperature of the outer layer. Bondable wires, thus, benefits in reduction of cycle time and elimination of process of secondary insulation application / baking / curing cycle etc.

APPLICATIONS

Bondable wires can be used in power tools armature coils, electronics, miniature coils, TV yoke coils, continuous-transposed conductors etc. The bondable layer is applied over variety of primary insulation like polyester, polyester-imide, dual coated and solderable polyurethanes of class 130, 155 and 180.

TYPES OF BONDABLE COATS

Epoxy Resins - Mainly used along with lower temperature class base coats like PU / PVA / PVF. Used on the fine / ultra-fine solderable enamelled wires and enameled strips for CTC applications.

Polyamide - Moderate bonding temperatures and suitable over class 130, 155 and 180 enamelled insulations.

Aromatic Polyamide - Mainly used on higher temperature classes like class 180 and 200. These have higher re-softening temperatures hence can be used easily on higher thermal classes.

BONDING METHOD

Heat Bonding - The coils are heated either in oven or hot air, up to the bonding temperature of outer layers. On cooling of coil, to the room temperature, the wire turns are bonded with each other.

Solvent Bonding - The bonding is done by application of solvents on wound coils. The layers bond together due to chemical reaction with solvents.

Resistance Bonding - The entire coil is heated by circulating high current through conductor. This uniformly raises the temperature of coil up to the bonding temperature and cooling to room temperature gives rigid coil forming.

APPLICABLE STANDARDS

IEC 60317-35, Solderable Polyurethane, class 155 with a bonding layer

IEC 60317-36, Solderable Polyester-imide, class 180 with a bonding layer

IEC 60317-37, Polyester-imide, class 200 with a bonding layer

IEC 60317-38, Dual coated, class 200 with a bonding layer

BOND STRENGTHS

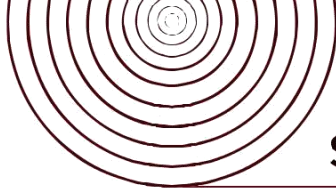
The bonding strength of bondable layers are usually determined by heating a helical coil of bondable wire up to the specified temperature and loading the coil with specified weights to observe that the coil turns do not separate at room temperature and also at resoftening temperature.

BONDING LAYERS THICKNESS

The thickness depends on the conductor dia as per IEC 60317 - 0 - 1 clause 4, the thickness of underlying layer can be grade 1B or grade 2B.

PRODUCT RANGE

0.20 mm to 1.00 mm grade 1B, 2B



SOLE COAT AIW ENAMELLED WIRES

The application of Polyamide-imide top coat over Polyester / Polyester-imide base coat, is well known to the user industry. The Polyamide-imide is class 200+ insulation which gives added thermal properties and chemical resistance to the substrate base coat. However, for certain applications the thermal, mechanical and dielectric properties are highly demanding. A typical example is in the automotive industry where the reliability of components is the crucial factor. The development of sole coat Polyamide-imide (PAI or AIW) wires, have cutting edge advantages over previous dual coated class 200 wires.

APPLICATIONS

Mainly used in automobile industry in various component coils. The insulation is capable of withstanding harsh environments like extreme temperatures, chemicals, oils greases mechanical stresses and vibrations. The insulation thickness grade can be selected as grade 1, 2 and 3 depending upon the component design and slot filling factor.

APPLICABLE STANDARDS

IEC 60317-26, Polyamide-imide round copper wires, class 200

NEMA MW 81-C Polyamide-imide round copper wires, class 220

PRODUCT RANGE

0.040 mm to 2.00 mm grade 1, grade 2

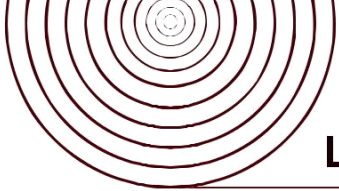
COLORED WIRES

We offer AIW wires in green OR black colour, as per customer requirements. This is helpful in colour coding and identification of AIW wound components at assembly lines.

ADVANTAGES

- Excellent high temperature characteristics
- Resistance to harsh chemicals and fuels
- High burnout resistance
- Lower dissipation factor at high temperature – Tan Delta values $>240^{\circ}\text{C}$
- Easily replaceable to Dual coated Class 200°C wires
- Durability





LITZ WIRE - BUNCHED ENAMELLED WIRES

Litz wire is a type of cable used in electronics to carry alternating current. The wire is designed to reduce the skin effect and proximity effect losses in conductors used at frequencies up to about 1 MHz. It consists of many thin wire strands, individually insulated and twisted / bunched, grouped or braided / woven together, as per the specific design and application. This often involves several levels (groups of twisted wires are twisted together etc.). This winding pattern equalizes the proportion of the overall length over which each strand is at the outside of the conductor. The individually insulated copper strands are basically the insulated magnet wires laid in form of cable strands.

APPLICATIONS

Typical applications for litz wire conductors include high-frequency inductors and transformers, motors, relays, inverters, power supplies, AC/DC converters, communication equipments, ultra-sonic equipments, sonar equipments, television equipments and heat induction equipments. The new innovations in information technology and communication devices have opened tremendous opportunities of usage of litz wires. A latest example can be a wireless mobile charger.

PRODUCT RANGE

Various AWG wire sizes range from 18 to 10 AWG comprising from enamelled copper winding wire individual strands of 0.050 to 0.500mm.

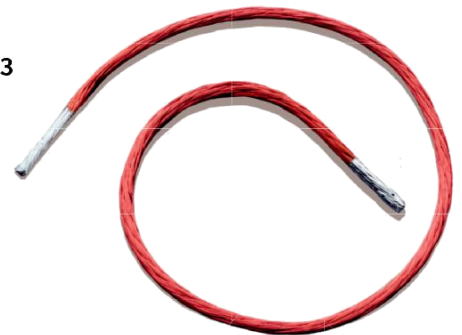
Insulation covering of enamelled strands can be
Polyurethane class 130, 155, 180 – Natural / Coloured
Polyesterimide class 180
Dual Coated class 200
Bunching / twisting can be customized as per customer drawing.

The term Litz wire originates from Litzendraht (coll. Litze), German, for braided / stranded wire or woven wire.

Litz Wire
Size: 0.125mm
Configuration: 5x3x28



Litz Wire
Size: 0.125mm
Configuration: 5x13

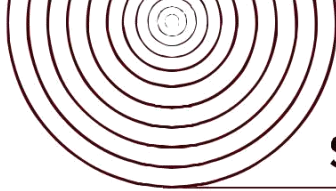


Litz Wire
Size: 0.315mm
Configuration: 7x7



Litz Wire
Size: 0.300mm
Configuration: (6x10)+(8x1)





SUPER ENAMELED ALUMINUM STRIPS

INTRODUCTION

Uncertainty and higher metal cost in copper have raised the need for alternate conductor metal in various electrical applications. Aluminum being the next good conductive material is most popular as replacement of copper. In certain applications like transformer windings this transition is happening rapidly. RR Shramik proudly announcing the addition of Super Enameled Aluminum Strips in the global product range. The manufacturing of bare aluminum strips is critical process, being the soft metal characteristics of aluminum. RR Shramik has most advanced technique machinery to make the aluminum conductors with precision controls in conductor dimensions and better surface properties. At the same time the insulation strength and flexibility has to be excellent to withstand the winding stresses bending / shaping etc. At Salasar Copper, We provide very special attention towards the flexibility and adherence of the insulation film of enameled strips.

PRODUCT RANGE

Width	15 mm Max	2.80mm Min
Thickness	5 mm Max	1.5mm Min
Cross section Area	75 mm ² max	5 mm ² Min

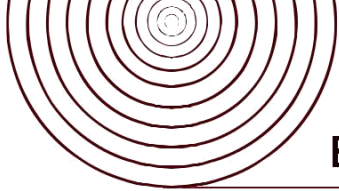
SPECIFICATION

General	IEC 60317 -0 -9 General Requirements Aluminum Enameled Strips
PVA Class 105	IEC 60317-67, NEMA MW 18A
PVA Class 120	IEC 60317-68,
Dual Coat Class 200	IEC 60317-73
Dual Coat Class 220	IEC 60317-69, NEMA MW 36A,
Polyester-imide Class 180	IEC 60317-74

ADVANTAGES

- Automated machines for Aluminum strip making enameling
- Online quality monitoring through blister and pin hole detectors
- Variety of Class of insulations and Variety in packing spools
- Stringent test procedures for consistent quality.





BUNCHED AND BRAIDED BARE COPPER WIRE

INTRODUCTION BUNCHED WIRE

Copper is a pretty valuable metal in the electrical industry. It is used in various forms and is utilized in quite a wide variety of applications. It has several beneficial features such as resistance to corrosion, malleability, and ductility. It is also a great conductor of heat and electricity.

TYPES OF COPPER WIRES

Copper wires come in two types – solid and stranded or bunched. In a solid wire, there is just one single strand or core of wire. It can be bare or be surrounded by a non-conductive insulator. These wires do not bend easily since they are rigid. They are usually installed in low-flex, permanent, applications, such as magnet wire in transformers and motors, house electrical wiring, or wires for breadboards.

STRANDED WIRES

Stranded wires are a group of small gauge wires that are compressed and twisted or braided together. They too are coated with a non-conductive material. They are wound together in half-frame arcs, semi-concentric, and concentric loops. This allows the wire to retain its properties, along with saving inventory space. They can be looped around an iron rod or a wooden one- depending upon the nature of the application. In the same cross-section, a stranded wire would be much more flexible and easier to install than a large solid one. It is a lot more tolerant of strain and, in fact, the more it is bent, the harder it becomes. The most typical uses of stranded copper wire is in speaker wires, automotive wires, appliance cables, headphone cables, etc.

Many Copper Wire Manufacturers offer optimized Bunched Copper Wire for electrical and industrial purposes. This is because these are extremely popular in these fields on the back of features such as reliability and flexibility. They are used as connectors due to their strength. Since they are kinks-free, they are used as ropes to tie knots as well. They are easier to rout.

APPLICATION

Many high-frequency applications, proximity effect is more severe than skin effect, and in some limited cases, simple stranded wire can reduce proximity effect. For better performance at high frequencies, which has the individual strands insulated and twisted in special patterns, may be used.

SIZE RANGE BUNCHED WIRE

1. Diameter of single core: $\phi 0.05 \sim \phi 0.28 \text{mm}$
2. Outer diameter of wire: $\phi 0.15 \sim \phi 0.90 \text{mm}$
3. Cross section area: $\phi 0.0137 \sim \phi 0.45 \text{mm}^2$

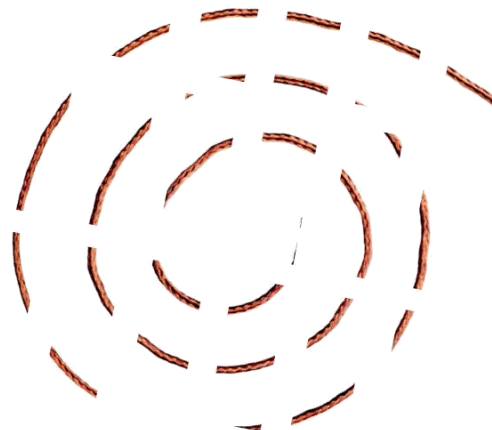
1. Single wire dia: $\phi 0.08 \sim \phi 0.25 \text{mm}$
2. Wire stranding outer dia: $\phi 0.15 \sim \phi 1.3 \text{mm}$
3. Cross section: $\phi 0.0137 \sim \phi 1.0 \text{mm}^2$

ADVANTAGES

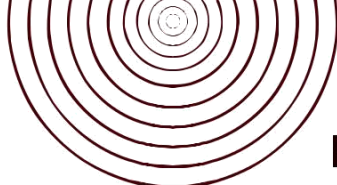
- Better Flexibility
- Excellent Current Carrying Capacity
- Higher Resistance
- Reduce skin effect
- Reduce corona effect

SIZE RANGE BRAIDED WIRE

- Braiding diameter 1-12mm
- Braiding pitch 6-68mm
- Material diameter 0.05mmX6-0.20mm/150D-900D



Braided Wire
Size: 0.070mm
No. of Strands: 651



M. H. CLASSIC SUBMERSIBLE FLAT CABLES

INTRODUCTION

Submersible flat cables are important accessories supplied along with the submersible pump. Flat cable provides the electrical supply to operate the pump. Good insulation properties and longer life is the technical demand from submersible flat cables.

From the beginning, flat cables have been developed with PVC insulation, which are having thicker insulations for getting required electrical properties. PVC cables are bulky and tend to lose the insulation properties over period of time. The thicknesses must be added to get the desired level of insulation, this cause more weight of wire and compromise the flexibility.

The latest development of PP core MH classic submersible flat cables is innovative product offered by RR Global. These cables are having less insulation thickness and better insulation properties. The insulation thicknesses are approx 50-60% less than the std PVC insulations, still it offers superior insulation, which are 4-20 times more than the normal PVC insulation.

Comparison of dimensions of cable 3C X 2.5sq mm

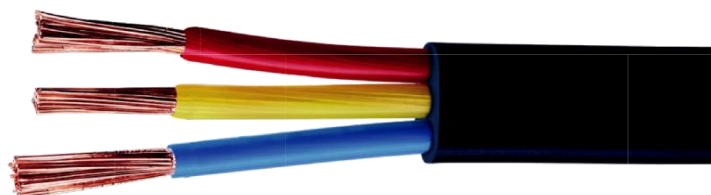
Sr. No.	Core Insulation data	Unit	Normal PVC Core + Sheathing	MH Classic, PP Core + PVC Sheathing
11	Material	-----	Passes	Passes
12	Nom. Insulation Thickness	mm	Passes	Withstands >5min.
13	Core Diameter	mm	11.0	12.0
14	Core Identification		10.0	11.0
Extruded Sheath				
15	Material	-----	2/3 Passes	3/3 Samples passes
16	Nom. Sheath Thickness		Passes	Passes
17	Approx Overall Dimension Of Cable (W x H)	mm	Passes	Passes
18	Colour	-----	2/3 Passes	Passes

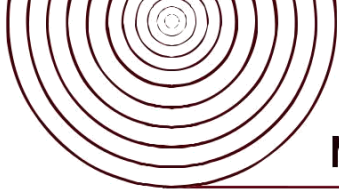
Comparison of Insulation resistance properties

Sr. No.	Parameters as per IS 5831	Unit	Normal PVC Core + Sheathing	MH Classic, PP Core + PVC Sheathing
1	Min. Volume resistivity at 27°C	Ω-Cm	48.12 x 1013	216.04 x 1013
2	Min. Volume resistivity at 70°C	Ω-Cm	189.05 x 1010	452.03 x 1011
3	Min. Insulation Resistance at 27°C	M-Ω-km	1764.36	6984.596
4	Min. Insulation Resistance at 70°C	M-Ω-km	6.93	310.25

ADVANTAGES

- Lower Insulation thickness
- Better Flexibility
- Very high Insulation volume resistivity
- Very high Insulation resistance
- Better and stable polymer compound for water resistance
- Good high temperature characteristics





M. H. CLASSIC SUBMERSIBLE WINDING WIRES

INTRODUCTION

Submersible winding wires are the type of winding wires having close contact with water Or different liquids. In fact many submersible motors are designed in such a way that windings are immersed in the water itself, which works as a cooling media while the pump is in operation. In early years, submersible winding wires have been developed with PVC insulation, which were having thicker insulations for getting required electrical properties.

Later, with the development of Poly wrapped wires, which has less insulation thickness and better properties. This reduced size of motors to great extent. We are manufacturing and supplying the poly wrapped RR SHRAMIK brand wires to you since long time. Now with the technological advances, we have developed a special insulating material, extruded wires of thickness and electrical properties which are better than poly wrap wires and having more softness with better surface finish. The extrusion process is auto controlled with laser diameter and HV spark tester.

The continuous extrusion process with on line spark tester gives consistent 100 % checked quality of wire. It can give longer lengths as required by customer. This avoids joints in winding and reduces winding process scrap and integrity of the windings. The superior surface properties with extra softness give an excellent ease of slot filling, and shaping.

The sample motors wound and tested for long term tests found excellent operational results.

Applicable Standards:- NA - Guide lines and requirements taken from IS 8783- Part 4 Section 3

Comparison Test Analysis of SWW Wrapped v/s MH Classic SWW

Sr. No.	Core Insulation data			
1	Surface	Smooth/ Wrapped	Wrapped wavy	Smooth
2	Dimension	As per Customer Specifications	OD ranges 0.300 to 0.500	OD ranges 0.250 to 1.00m possible
3	Concentricity	-	Fully concentric insulation, due to wrapping	Full operational controls for proper Concentricity. 95% Concentric
4	Softness of Wire	Fully Annealing	Slight harness due to wrapping and shrinking process	Excellent Softness
5	Volume Resistivity at 27°C (IS 10810 Pt-43), IS 5831	1 X 10 ¹⁶	1.8 - 2.2 X 10 ¹⁶	2.5 - 3.5 X 10 ¹⁶
6	Volume Resistivity at 90°C (IS 10810 Pt-43), IS 5831	1 X 10 ¹³	6.5 - 7.5 X 10 ¹³	7.9 - 8.5 X 10 ¹³
7	High Voltage test after 12 hours immersion in water	3.0Kv for 1 mints to pass	Passes Leakage current slight more due to air gap in wrapping	Passes - Leakage current significantly less due to Extrude material, high integrity of insulation films
7.1	Shrinkage Test at 150°C for 15 Mints	4% Max	2 to 3.5%	0 to 0.5%
7.2	Heat Shock Test	To pass at 150°C for 1 hrs	Passes- Layer separation forms at 170°C and HV/Megger mostly fails	Passes, No melting observed till 170°C for 10hr. HV/Megger passes after 10hrs

BENEFITS

- Smooth insulation surface along with super soft annealed copper wire
- Very low co-efficient of friction, easy for slot insertion
- Less springiness, does not require hammering for shaping of coils.
- Longer lengths coils/ Reels possible
- Throughout Laser OD control and HV spark testing.
- Benefits of extra meter lengths/Kg lesser weight compared to Poly Wrapped wire
- Fixed lengths coils are provided by meter counters.

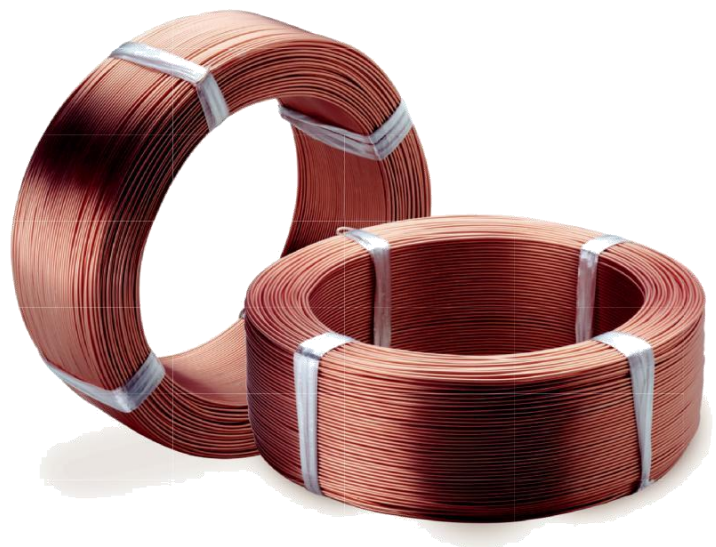
APPLICATIONS

All types of single phase, three phase submersible motor pumps. Conductor Dia range 0.40 to 2.50mm and Insulation covering range 0.30 to 1.00mm.

SAFETY AND PRECAUTIONS

Considering the fact that the insulation is softer than Poly wrapped wires, certain precautions must be taken during transit, handling usage of M. H. Classic Submersible Winding wires.

- Retain the original box packing till actual usage.
- Place the wire coils and wound coils on Rubber sheets to avoid damages.
- Use the provided bubble sheet to place coils – Do not place on corrugate boxes – they have staple pins, that can damage the insulations.
- Examine and rectify for any sharp Objects/Sharp corners which can come in wire path during coiling.
- Do not give more force on the coils to fit in slots. Avoid any sort of damages during coil fitting.
- Use proper grade of insulation paper to guide the coils through slots
- Only use smooth tipped wooden strip to push wires in slots
- If required, apply a small quantity of lubricant oil in holding cloth / felt tensioner
- Search for sharp objects on working stations and avoid contact with wound coils motors
- Check the wooden/plastic slot fillers. It should not damage the wires while pushing.
- Ensure proper transit/packaging of wound stator.



NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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