

**WIRES FOR  
INNOVATIVE  
ELECTRICAL  
SOLUTIONS**



Madhav copper has world class manufacturing facilities ISO 9001:2015, ISO 14001:2015 and BS OHSAS 18001 accreditation. The group has diverse product portfolio in various segments ranging from ferrous product Steel, Round Bars, Ingots, Ship Breaking, Construction, Textile, Diamond and Jewelry etc.

Madhav Copper, a part of Madhav Group, has a great vision and power of innovation in the field of Copper Busbar, Copper Rod, Profile, copper fabricated products, Enamelled Copper Wire, Paper Covered Copper Conductor, Poly wrap submersible winding wire, Fiberglass Copper Conductor, Tapped Insulated Copper Conductors, Bare Copper Wire, and Copper Strips.

Madhav Copper draws its strength and quality from the latest technological state-of-the-art manufacturing facilities. Also, the latest PC based equipment for measurement of Dielectric Dissipation Factor (Tan d), Spectrometer for Metallographic of copper, Oxygen Analyzer to maintain < 5 ppm oxygen content and torsion tests ensure that only the flawless copper rods are made available for processing. and well-equipped quality testing laboratories ensures consistent wire quality during production.

Madhav Copper offers extensive range of Copper Busbar, Copper Rod, Profile, copper fabricated products, Enamelled Copper Wire, Paper Covered Copper Conductor, Poly wrap submersible winding wire, Fiberglass Copper Conductor, Tapped Insulated Copper Conductors, Bare Copper Wire, and Copper Strips, suitable for any known application in Pump, Motors, Transformer, Generators, Hydro Generators, Alternators, wind generators, Panel, Switch Gear – has enormously contributed to this success. Our wires and Copper Product are also suitable for use in high speed automatic coil winding machines and to fabricate in automatic CNC machine.

Our Copper Fabricated Product and Winding wires as manufactured to National and International Standards such as IS, IEC, NEMA, BS, ASTM, EN and JIS. The Copper Rod is manufactured from 100% LME (London Metal Exchange) registered grade 'A' copper cathode used as a raw material. The Copper Conductors are manufactured from 99.997% of pure ETP and OFC grade copper and insulated with high thermal class engineered insulation material, which provides excellent dielectric properties and excellent resistance to cracking.



**Madhav Group is leading manufacturer of ferrous and Non-Ferrous Metal products with International Presence**



## OUR VISION

- To be a Global Electrical Solutions, Total Quality and Latest Technology Leaders.
- To be the Global Preferred Supplier for Key Customers and the Best Customer Service.
- Have an Indian market share of 25% in our field of products business by year 2025.

## OUR MISSION

- Be Globally sales present in important markets to serve the local needs of our customers and value creation for all stakeholders.
- Participate in joint R&D projects with strategic customers & provide Competitive Solutions.
- Signing of long-term contracts with Strategic customers.
- We help protect our environment, work safety and involve people in all our business affairs.

## OUR VALUES

- All actions are governed by integrity, sincerity and transparency.
- Customer is the God – We deliver total Customer Satisfaction.
- Leadership drives and establish us competent industry position
- Provide a Learning Organization.
- Respect values of individuality and employees of all backgrounds

Madhav Copper manufactured Copper Busbars, and rods are available in both high conductivity electrolytic tough pitch (MCL-ETP) and high conductivity Oxygen Free (OFC) copper. Both are high in copper purity with an electrical conductivity of approximately  $\geq 101\%$  IACS.

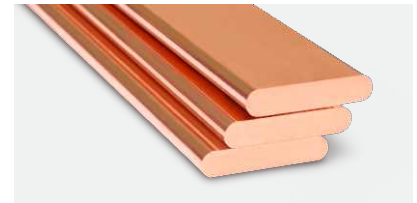
## STANDARDS

Product / Standard	IS	EN	ASTM	BS	JIS
Strips & Busbars	1897	13601	B 187	1432	3140
Rods	613	13601	B 187	1433	3250

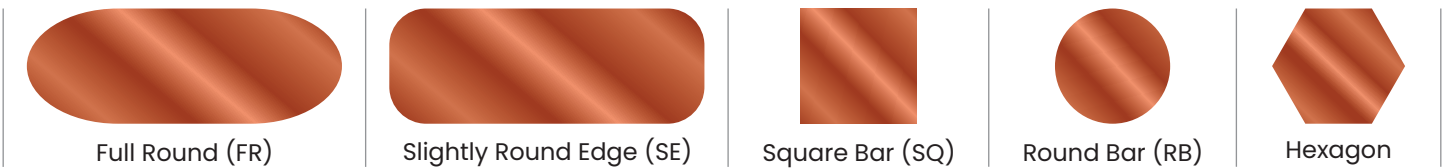


## SIZE RANGES

		Min	Max	Cross Section Area
COPPER BUS BARS	Width	5 mm	170 mm	5 – 2500 mm <sup>2</sup>
	Thickness	1 mm	25 mm	
Round Bar and Hexagon Bar ( $\phi$ )		5 mm	60 mm	maximum
Square Bar		5 mm	50 mm	



## SHAPES



## PRODUCT SPECIFICATIONS

The raw materials are pure copper cathodes grade "A" London Metal Exchange with purity of 99.990% and above. This allows Madhav Copper to meet International standards.

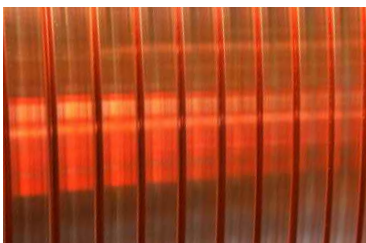
- High Purity
- Highest electrical and thermal conductivity
- Excellent weldability, brazeability and solderability
- Excellent formability and impact strength
- Excellent Surface finish & Flatness

## MECHANICAL & ELECTRICAL PROPERTIES

Temper	Tensile Strength (MPA) Min.	Elongation (%) (Min.)	Hardness (HV)	Resistivity at 20C Ohm mm <sup>2</sup> /meter(Max)	Conductivity (%) IACS (Min).
Annealed	200	35	40-65	0.017241	100
Half – Hard	250	15	66-90	0.017777	99
Hard	300	8	91-100	0.017777	97

## PACKING

Bars and Rods wrapped with paper/plastic, then packed in bundle or wooden boxes



## ORDERING INFORMATION

We need the following information from our valued clients to understand fully your requirement and deliver the right product:

- Size: Width X Thickness, Round: Diameter ( $\phi$ )
- Corner Radius.
- Tensile Strength of the Conductor.
- Hardness: - Annealed Soft/ Half Hard / Hard
- Length of the Conductor piece and Tolerance.

- Tin-plated copper busbar helps upgrade design and provide the best quality for switchgears, switchboards, electrical panels, power transformers and busducts.
- Tin plating process is done using 99.5% tin anode on a continuous plant with PLC smart process controls as per international standards.
- It gives a shiny surface finish and provides protection from environmental surface corrosion.
- Decrease joint resistance which increase jointing efficiency in electrical systems.
- Controlled consistent coating thickness 330, microns as per customer specification.
- Mill test certificate is provided for coating thickness and coating adhesion tests.



## APPLICATIONS

Switchboards, Switchgears, Electrical Panels, Power Transformers, Busduct, Earthing, Electrical Conductors, etc.

## COPPER PROFILE

Copper profile are available as extruded and drawn versions for specific applications. With our advanced technology, quality engineered standard copper profiles or tailor-made as per customers' drawings will meet exact engineering needs. There are many critical parts that require copper profiles with exact dimensions. Madhav Copper can produce copper profiles with strict dimensional tolerances such as C-connectors, L-shape, Y-shape, H-shape, etc. Our copper parts can be used without the need for further machining - saving processing time and cost.

## APPLICATIONS

Power generation - Hydro-generators, turbo-generators, wind-generators and Nuclear-generators Electrical appliances, Heat Sinks or CPU Coolers, etc.



## FABRICATED COPPER PRODUCT/ BUS BARS-TAILORED FOR READY TO USE

Madhav Copper's fabricated copper busbar provides a speedy, convenient, and economical solution for switchboard and switchgear makers.

## CUSTOMER'S BENEFITS

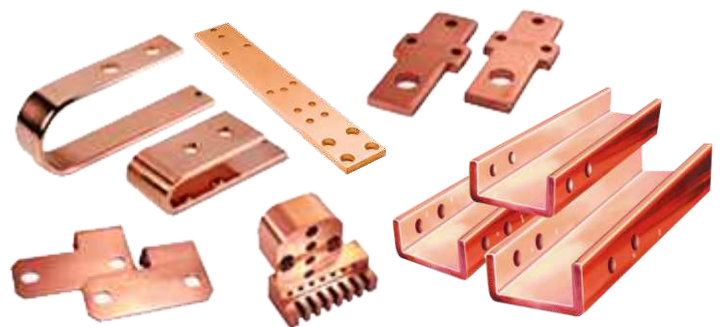
- Reduce scrap
- Save processing time
- Ease of installation
- Enrich profit margins
- Reduce maintenance cost for equipment
- Quick delivery

## FABRICATION PROCESS INCLUDE

Punching-Bending-Brazing-Tapping-Cutting-Tin plating etc.

## APPLICATIONS

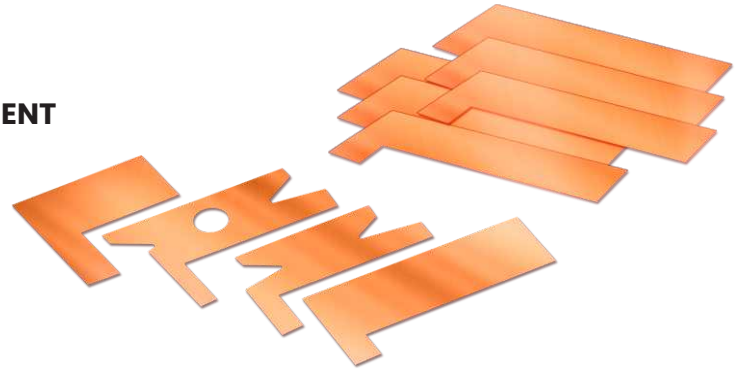
Switchboards, Switchgears, etc.



Silver-bearing copper is another quality product of Madhav Copper. The addition of a small amount of silver in the copper improves the resistance to softening of materials. Most applications for this material are commutator bars and segments in traction motor and various industrial DC motors. Madhav Copper can produce silver-bearing copper in many shapes according to customer's requirements.

## SPECIFICATIONS OF COMMUTATOR BARS / SEGMENT

- IEC 60356
- BS 1434:1985
- JIS C 2801:1995



## CHEMICAL COMPOSITION (%)

Class	Cu	Cu+Ag	Ag
Class 1	99.9 min	-	-
Class 2	-	99.9 min	0.15 to 0.25
Class 3	-	99.9 min	0.08 to 0.12
Class 4	-	99.9 min	0.06 to 0.10

## APPLICATIONS

Commutator Bars, Segments in traction motor and various industrial DC motors, Vacuum Interrupters, Stators & Rotors of Turbo-Generators, Hydro-generators and Nuclear-generators, etc.

## COPPER EARTH RODS (INTERNAL/ EXTERNAL THREADED)

Madhav Copper offering a wide range of High Quality and Standard Copper Earth Rods. The offered Copper Earth Rods are characterized by optimum electrical conductivity. Copper Earth Rods are manufactured using high-quality raw materials and globally accepted technology at our manufacturing unit. We customize Copper Earth Rods as per the customer's specification of shape and size. The offered Copper Earth Rods are widely used for its low maintenance and robust construction. We manufacture Copper Earth Rods with the quality raw material as well as under the guidelines and supervising of the latest industrial norms.



Madhav Copper's copper anodes are made from high purity copper cathode with a purity of  $\geq 99.90\%$ . Our advanced technological process enables us to produce the finest copper anode that has perfect properties for copper electroplating.

## PHOSPHOROUS-DEOXIDIZED COPPER ANODE (Cu-DHP)

Chemical composition	Weight percentage
Cu	99.90 %.
Phosphorous	0.015 $\geq$ 0.040 %
Iron	Nil

### FEATURE

- High electrical conductivity >80 % IACS
- High purity copper
- Smaller grain size
- Very low impurity resulting in minimal sludge development
- Very fine and uniform grain structure
- Oil Free
- Smooth and unique surface shape allows even dissolution
- Consistent Phosphorous content and evenly distributed
- Black film fast generated and stably adhered
- Good resilience in normal and industrial atmospheres



## OXYGEN FREE COPPER ANODE (Cu-OF) AND ELECTROLYTIC TOUGH PITCH (Cu-ETP)

Chemical composition	Weight percentage
Cu	99.99 %.
Oxygen	Less than 10 PPM
Iron	Nil
Other Impurity	Nil

### FEATURE

- Excellent electrical conductivity
- Highest purity copper
- Smaller grain size
- Very low impurity resulting in minimal sludge development
- Very fine and uniform grain structure
- Oil Free
- Smooth and unique surface shape allows even dissolution
- Consistent dissolution

### APPLICATION

Electro Plating Applications, Antimicrobial properties Coating, Sea Water Pipe-work Anti-fouling, etc.

- OFHC & Phosphorised- Copper grade is the ideal material for electroplating on
- Printed circuit boards
- Rotogravures Printing Cylinders
- Copper Bonded Earth Rod
- ABS Plastic
- Monogram plating
- Decorative Industries
- And many other electroplating applications

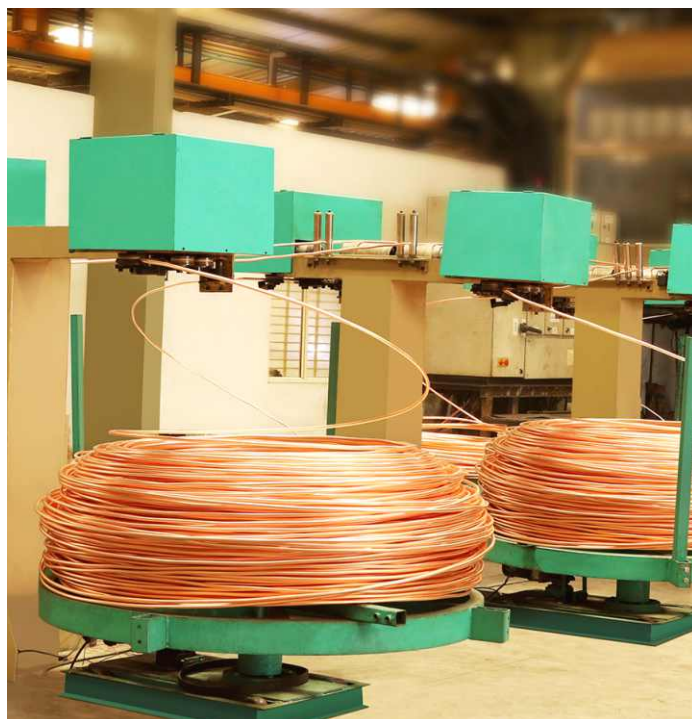
Madhav copper Ltd.'s copper rod is manufactured from 100% LME (London Metal Exchange) registered grade "A" copper cathode used as a Raw material.

## TECHNICAL SPECIFICATION

	Oxygen Free	Electrolytic Copper (ETP)
<b>SPECIFICATION / STANDARD</b>	ASTM B-170	ASTM B-115:2010, B-49-2015a
Size	8-20 MM	8-20 MM
Copper Content	99.99%	99.99% Min
Breaking Resistance	> 175 N/MM2	> 225 N/MM2
Copper Density	8.89 Kg/M3	8.89 Kg/M3
Oxygen Content	< 10 ppm	100-650 ppm
Electrical Conductivity	> 101% (IACS)	> 100% (IACS)
Elongation	> 30%	> 30%

## PROPERTIES

- Oxygen (o2) free copper rod (OFC).
- Superior electrical conductivity (101%) and purity 99.99%.
- High thermal conductivity.
- High ductility.
- Less surface oxide.
- High creep resistance.
- Inclusion free product.
- Good weldability



## APPLICATION

- Copper Rod is the primary raw material for manufacturing a wide range of a electrical cables.
- Wires with applications including power transmission, data and signal cables, control and instrumentation cables.
- General wiring in buildings, transformers, motors and Enamelled wire.
- Multi strand drawing machine
- Strips being made with conform process.
- Telecom industry cables, requiring high electrical conductivity, good weld ability, tight physical tolerance and very clean product.
- Used for earthing in all kinds of building & Structure.
- Wires, cables and conductors for energy and heat transfer system e.g. solar and thermal panels.

## PACKING

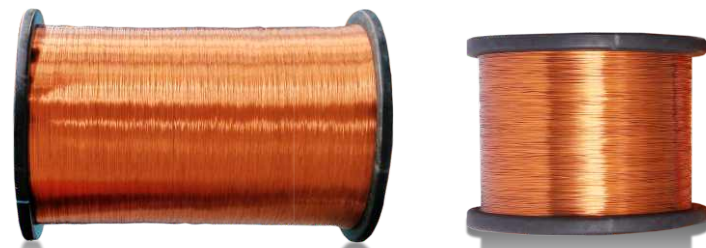
- Plastic wrapping & Wooden pallet packing

**PRODUCT SPECIFICATION**

	1	2	3	4	5
<b>Type of Enamelled wire</b>	Self solderable	General Purpose	General Purpose	Self solderable	Self solderable
<b>THERMAL CLASS</b>	130 (B)	130 (B)	155(F)	155 (F)	155 (F)
<b>SPECIFICATION STANDARD</b>	IS : 13730-4 IEC-60317-4 NEMA MW-75C JIS C 3202	IS : 13730-34 IEC-60317-34 JIS C 3202-1988	IS : 13730-3 IEC-60317-3 NEMA MW-5C	IS : 73730-19 IEC- 60317-19 NEMA MW-28C	IS : 13730-19 IEC-60317-20 NEMA MW-79C
<b>Chemical base of Base Coat</b>	Polyurethane	Polyester	Modified Polyester	Polyurethane	Polyurethane
<b>Chemical base of Top Coat</b>	Not applicable	Not applicable	Not applicable	Nylon	Not applicable
<b>Range of wire (Dia.)</b>	0.800-0.300 mm	3.000-0.300 mm	3.000-0.300 mm	1.000-0.300 mm	0.800-0.300 mm
<b>Insulation Range</b>	Grade 1, 2 & 3 as per IEC and Single, Heavy & Triple as per NEMA				
<b>Standard Colour</b>	Standard Color – Raddish Brown, other colors as per requirement				

**TECHNICAL PROPERTIES AS PER IS : 13730-0-1 IEC-60317-0-1**

<b>Heat Shock</b>	155	155	175	155	175
<b>Cut Through (°C)</b>	170	240	240	170	200
<b>Solderable temperature(°C)</b>	375	Not applicable	Not applicable	375	390
<b>Resistance to abrasion for 1.00 mm dia grade 2 wire (n)</b>	>9.3	>10.4	>10.4	>9.3	>8.1
<b>Resistance refrigerants</b>	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
<b>Flexibility &amp; Adherence</b>	Good	Good	Good	Good	Good
<b>Bonding Temperature (°C)</b>	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
<b>SPECIAL CHARACTERISTICS</b>	Self solderable Property with good insulation resistance, high flexibility	Good thermal & electrical properties	Upgraded thermo mechanical properties compared to ordinary polyesters	Lot coefficient of friction, besides properties of general purpose polyurethane	Self solderable property with its low dielectric dissipation factor under high freq.
<b>APPLICATION</b>	Relays, magnetic spools, universal & impregnated winding for transformers	General Purpose rotating & static electrical equipments, oil transformers, Control coils	Ignition coils, oil filled transformers, relays-contractors, FHP motors,	Small size motors, coils of electrical instruments, especially of high speed winding.	Electrical instruments of machine tools, motors which have special requirements of this enamel



	6	7	8	9	10	11
<b>Type of Enamelled wire</b>	General Purpose	Self solderable	High Temperature	High Temperature	Self solderable High Temperature	Self solderable
<b>THERMAL CLASS</b>	155 (F)	155(F)	180(F)	180(H)	180(H)	200(C)
<b>SPECIFICATION STANDARD</b>	IS : 13730 IEC-60317 NEMA MW-24C	IS : 13730-54 IEC-60317-54	IS : 13730-4 IEC- 60317-8 NEMA MW-30C JIS C 3202-1988	IS : 13730-22 IEC – 60317-22 NEMA MW-76C	IS : 13730-51 IEC – 60317-51 NEMA MW-28C	IS : 13730-13 IEC – 60317-13 NEMA MW-35C (Hermetic)
<b>Chemical base of Base Coat</b>	Polyester	Polyester	Polyesterimide	Polyester/ Polyesterimide	Polyurethane	Theicpolyester/ Polyesterimide
<b>Chemical base of Top Coat</b>	Not applicable	Not applicable	Not applicable	Nylon	Not applicable	Polyamiderimide
<b>Range of wire (Dia.)</b>	1.60-0.300 mm	3.000-0.300 mm	3.000-0.300 mm	3.000-0.300 mm	1.000-0.300 mm	3.000-0.300 mm
<b>Insulation Range</b>	Grade 1, 2 & 3 as per IEC and Single, Heavy & Triple as per NEMA					
<b>Standard Colour</b>	Standard Color – Raddish Brown, other colors as per requirement					

**TECHNICAL PROPERTIES AS PER IS : 13730-0-1 IEC-60317-0-1**

<b>Heat Shock</b>	175	175	200	200	200	220
<b>Cut Through (°C)</b>	240	200	300	265	240	320
<b>Solderable temperature(°C)</b>	Not applicable	Not applicable	Not applicable	Not applicable	450	Not applicable
<b>Resistance to abrasion for 1.00 mm dia grade 2 wire (n)</b>	>10.0	>10.4	>10.3	>10.3	>7.8	>11.3
<b>Resistance refrigerants</b>	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
<b>Flexibility &amp; Adherence</b>	Good	Good	Good	Good	Good	Very Good
<b>Bonding Temperature (°C)</b>	Not applicable	170/200	Not applicable	Not applicable	170/120	Not applicable
<b>SPECIAL CHARACTERISTICS</b>	Good mech, electrical & chemical resistance properties improved for high speed winding	General Purpose 155°C Polyester with heat shock at higher manderal diameter	Good resistance against refrigerants, transformers oil, high burnout resitance.	Used in all 180°C class equipments requiring high speed winding, low coefficient of friction	Good mechanical electrical & chemical resistance properties improved for fast Solderability	Good resistance for refrigerants & chemical, burn out resistant windability low coefficient of friction
<b>APPLICATION</b>	FHP motors, coils & relays audio & instrument coils.	General Purpose rotating & static electrical equipments, oil transformers, Control coils	FHP motors, hermetic application & thermal class 180oC equipments	General Purpose rotating & static electrical equipments	Fractional & intergral horsepower motors, coils, relays instrument & audio coils	Hematic motors, Armatures, Altermators, Power tools & high motors, Suitable for high speed coil winding





## PRODUCT SIZE

SWG Size	AWG Size	Nominal Conductor Diameter	Conductor Tolerance	Conductor Diameter		Nominal Conductor	Conductor Weight for 1000m (L)	Conductor Resistance for Length at 20°C
		(mm)	(mm)	Minimum	Maximum	(mm <sup>2</sup> )	(mm)	(Ω/m)
11	9	2.946	0.031	2.915	2.977	6.813	60.567	0.0025
		2.906	0.031	2.875	2.937	6.629	58.934	0.0026
12	10	2.641	0.026	2.615	2.667	5.475	48.675	0.0031
		2.588	0.026	2.562	2.614	5.258	46.741	0.0033
13	11	2.336	0.023	2.313	2.359	4.284	38.082	0.0040
		2.304	0.023	2.281	2.327	4.167	37.046	0.0041
		2.052	0.021	2.031	2.073	3.305	29.385	0.0052
14	13	2.032	0.020	2.012	2.052	3.241	28.815	0.0053
15		1.829	0.019	1.810	1.848	2.626	23.345	0.0065
16	14	1.626	0.017	1.609	1.643	2.075	18.451	0.0082
	15	1.450	0.017	1.433	1.467	1.650	14.673	0.0104
17	16	1.422	0.015	1.407	1.437	1.587	14.111	0.0108
		1.290	0.015	1.275	1.305	1.306	11.613	0.0132
18	17	1.219	0.013	1.206	1.232	1.166	10.370	0.0146
		1.515	0.013	1.138	1.164	1.040	9.245	0.0166
19	18	1.016	0.011	1.005	1.027	0.810	7.204	0.0211
20	19	0.914	0.010	0.904	0.924	0.656	5.830	0.0260
21	20	0.813	0.009	0.804	0.822	0.519	4.613	0.0329
		0.711	0.008	0.703	0.719	0.397	3.528	0.0430
22	22	0.643	0.008	0.635	0.651	0.325	2.885	0.0531
		0.610	0.006	0.604	0.616	0.292	2.597	0.0585
24	23	0.559	0.006	0.553	0.565	0.245	2.181	0.0696
25	24	0.508	0.006	0.502	0.514	0.203	1.801	0.0843
26	25	0.457	0.005	0.452	0.462	0.164	1.457	0.1042
27	26	0.417	0.005	0.412	0.422	0.137	1.214	0.1251
28	27	0.376	0.005	0.371	0.381	0.111	0.987	0.1539
29		0.345	0.004	0.341	0.349	0.093	0.831	0.1828
		0.320	0.004	0.316	0.324	0.080	0.715	0.2144
30	28	0.315	0.004	0.311	0.319	0.078	0.692	0.2193
31		0.295	0.004	0.291	0.299	0.068	0.607	0.2500
32	29	0.274	0.004	0.270	0.278	0.059	0.524	0.2898
33	30	0.254	0.004	0.250	0.258	0.051	0.450	0.3372
34	31	0.234	0.004	0.230	0.238	0.043	0.382	0.3973
35	32	0.213	0.004	0.210	0.216	0.036	0.317	0.4795
36		0.193	0.003	0.190	0.196	0.029	0.260	0.5841
37	33	0.173	0.003	0.170	0.176	0.023	0.209	0.7269
38	36	0.152	0.003	0.149	0.155	0.018	0.161	0.9417
39		0.132	0.003	0.129	0.135	0.014	0.122	1.2486
40		0.122	0.003	0.119	0.125	0.012	0.104	1.4617

# PAPER INSULATED COPPER CONDUCTOR (ROUND/RECTANGULAR)

## INSULATION TYPE

Electrical Grade Kraft Paper, Thermally Upgrade Paper, Polyester Paper      Nomex Paper, Mica Paper, Crepe Paper

## SPECIFICATION/STANDARDS

IEC 60317-27, 43 & 44, IS 13730- 27, 43 & 44, NEMA MW-31, 33, 60 & 61 DIN, OTHER RELEVANT  
INTERNATIONAL/CUSTOMIZED STANDARD

## SIZE RANGE

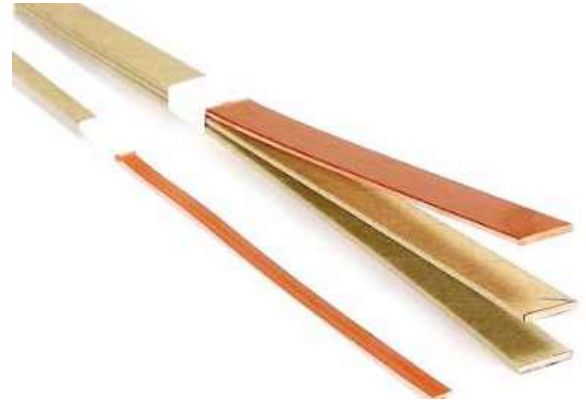
	MIN	MAX
WIDTH	3 MM	25 MM
THICKNESS	0.8 MM	10 MM
CROSS SECTION AREA	3.2 SQ. MM	125 SQ. MM
WIDTH/THICKNESS RATIO	1:9	
PERIPHERY OF RECTANGULAR CONDUCTOR	50 MM MAX	
BUNCH	1	6

## INSULATION DETAILS

INSULATION THICKNESS	0.300 MM	6 MM
NO OF LAYERS	1	40
TYPE OF LAPPING	Butt lapped, 30-50% Overlapped, Interlocked, in various combination	

## APPLICATION

- Oil filled Power and Distribution Transformers
- Dry Type Transformers
- High Tension Motors/Generator
- Traction Equipment
- Hydro generators
- HT Motors
- Alternators
- Turbo generators



## ORDERING INFORMATION

We need the following information from our valued clients to understand fully your requirement and deliver the right product:

- Size: Width X Thickness.
- Proof Stress of the Conductor.
- Single / bunched or triple.
- Type of Insulation.
- Thickness of Insulation.
- Type of Lapping
- Min. No. of layers of Insulation.
- Length/Quantity of Conductor and Tolerance.
- No. and Type of Bobbins.



## INSULATION TYPE

Polymerized Thermosetting Varnish, Class B (130°C), F (155°C), H (180°C) Insulations 'E' Grade Yarn. The Insulation Consists of 2 Layers of E Grade Fiber Glass Yarn Tangentially Lapped and Bonded with Highly Polymerized Thermosetting Varnish in Tandem Operations.

## SPECIFICATION/STANDARDS

IEC 60317- 31,32 & 33, IS 13730- 31,32 & 33,NEMA MW- 41, 43 & 50, DIN, OTHER RELEVANT INTERNATIONAL/CUSTOMIZED STANDARD

## SIZE RANGE

	MIN	MAX
WIDTH	4 MM	25 MM
THICKNESS	0.8 MM	10 MM
CROSS SECTION AREA	4 SQ. MM	125 SQ. MM



## Application

- HT Motor stator
- Generators and Hydro generators
- Special Type of Motors.
- Traction Equipment

# KAPTON POLYIMIDE COVERED COPPER CONDUCTOR

## INSULATION TYPE

Kapton Polyimide Wire, Corona resistant polyimide wire, Class 240

## SPECIFICATION/STANDARDS

IEC 60317, IS 13730, DIN 1787, OTHER RELEVANT INTERNATIONAL/ CUSTOMIZED STANDARD

## SIZE RANGE

	MIN	MAX
WIDTH	4 MM	25 MM
THICKNESS	0.8 MM	10 MM
CROSS SECTION AREA	4 SQ. MM	125 SQ. MM



## Application

- Traction Machines Winding
- Water immersed Winding
- Special Type motors

# SUBMERSIBLE WINDING WIRES (POLY WRAPPED WINDING WIRES)

We manufacture high quality submersible winding wires that are specially insulated with Polyester film & Biaxial Oriented Poly Propylene (BOPP) films to ensure their full capability to withstand extremely high temperature and mechanical abrasion. The most modern plant with sophisticated wrapping heads & in line continuous heat shrinkage furnace installed to get uniform covering. A Complete quality assurance testing by instrument conforming to all governing standards available.

## APPLICATION

Used in submersible pumps motors of all sizes for Domestic and industrial applications.

## SPECIAL SALIENT FEATURES

- Save Energy - 99.997% Pure ETP grade high conductivity annealed copper used.
- Less current leakage - No air gap between the films
- Tear resistance - High mechanical strength - High tensile strength
- Each coil tested at 5000 V
- Heat shock test - At 150°C
- Easy winding - Resistance annealed copper and controlled OD
- Manufactured by ultra modern automation plant and tested as per IS 8783 (Part 4/Sec 3)

## FLEXIBILITY & ADHERENCE

The insulation is produced by biaxial oriented synthetic film. It has very high flex life in comparison to any other insulating materials.

## WORKING TEMPERATURE RANGE

For short time up to 120°C, For longer or Continuous duration 60°C to 120°C.

## SPECIAL CHARACTERISTICS

The structure of insulation Bi-axially Oriented, Propagation of tear is very difficult. And also very Good Dielectric Strength, Higher Cut Through & Abrasion resistance, Higher Tensile Strength. Easy for Coil Winding.

## GENERAL SPECIFICATIONS

Nominal Conductor Diameter (mm)	Tolerance ± (mm)	Min. Insulation Thickness (mm)	Over All Diameter (mm)	Nominal Resistance Ω/Km At 20°C	Weight of Poly Wrap Wire (Kg/Km)	Elongation Minimum %
0.40	0.004	0.20	0.80	136.00	1.477	24
0.50	0.005	0.20	0.90	87.00	2.155	25
0.60	0.006	0.20	1.00	60.92	2.980	26
0.70	0.007	0.20	1.10	44.78	3.946	28
0.80	0.008	0.20	1.20	34.00	5.055	28
0.90	0.009	0.20	1.30	27.00	6.299	29
1.0	0.010	0.20	1.40	22.00	7.684	30
1.10	0.011	0.20	1.50	18.15	9.209	30
1.20	0.012	0.20	1.60	15.26	10.874	31
1.13	0.013	0.20	1.70	12.98	12.679	32
1.14	0.014	0.20	1.80	11.00	14.890	32
1.50	0.015	0.25	2.00	9.74	16.990	32
1.60	0.016	0.25	2.10	9.00	19.228	32
1.70	0.017	0.25	2.20	7.60	21.605	32
1.80	0.018	0.25	2.30	7.00	24.122	32
1.90	0.019	0.25	2.40	6.07	26.780	32
2.00	0.020	0.25	2.50	5.46	29.576	33
2.10	0.021	0.25	2.60	4.98	32.513	33
2.20	0.022	0.25	2.70	4.54	35.589	33
2.30	0.023	0.25	2.80	4.15	38.805	33
2.40	0.024	0.25	2.90	3.81	42.161	33
2.50	0.025	0.25	3.00	3.51	45.657	34
2.60	0.026	0.25	3.10	3.25	49.292	34
2.70	0.027	0.25	3.20	3.01	53.070	34
2.80	0.028	0.25	3.30	2.80	56.990	34
2.90	0.029	0.25	3.40	2.61	61.041	34
3.00	0.030	0.25	3.50	2.44	65.237	34



## TESTING FACILITIES FOR SUBMERSIBLE WINDING WIRES

Test is conforms to IS 8783:1995 (Part 4/Sec.3) is as follows.

S. No.	Name of Tests	Units	Testing Instruments used
1	Size (Diameters)	mm.	Digital Micrometers
2	Elongation	Percentage	Tensile Tester
3	Conductors Resistance	Ohm/KM	Resistance Meter
4	Volume Resistivity	Ohm-cm	Million mega meter
5	High voltage Test	KV	Higher Voltage Tester
6	Thermal Ageing	Change in elongation & Tensile	Ageing Oven & Tensile Te
7	Shrinkage Test	Percent	Circulating Hot Air Oven
8	Water absorption	Mg/cm2	Vacuum Oven & Pump desiccators
9	Hot Deformation	Percent	Circulating Hot air oven
10	Heat Shock Test	No sign of Cracks/ scales/ separation of layers	Circulating Hot air oven & mandrels

## ENAMELLED ROUND WINDING WIRES

MCL make Enamelled Round Winding Wires are supplied on high quality plastic spools, both Cylindrical Barrelled and Taper Barrelled as per the customer demand.

These spools are generally according to specifications:

- IEC 60264-2-2: Specification for Cylindrical Barrelled plastic spools, returnable type.
- IEC 60264-3-2: Specification for Taper Barrelled plastic spools, returnable type.

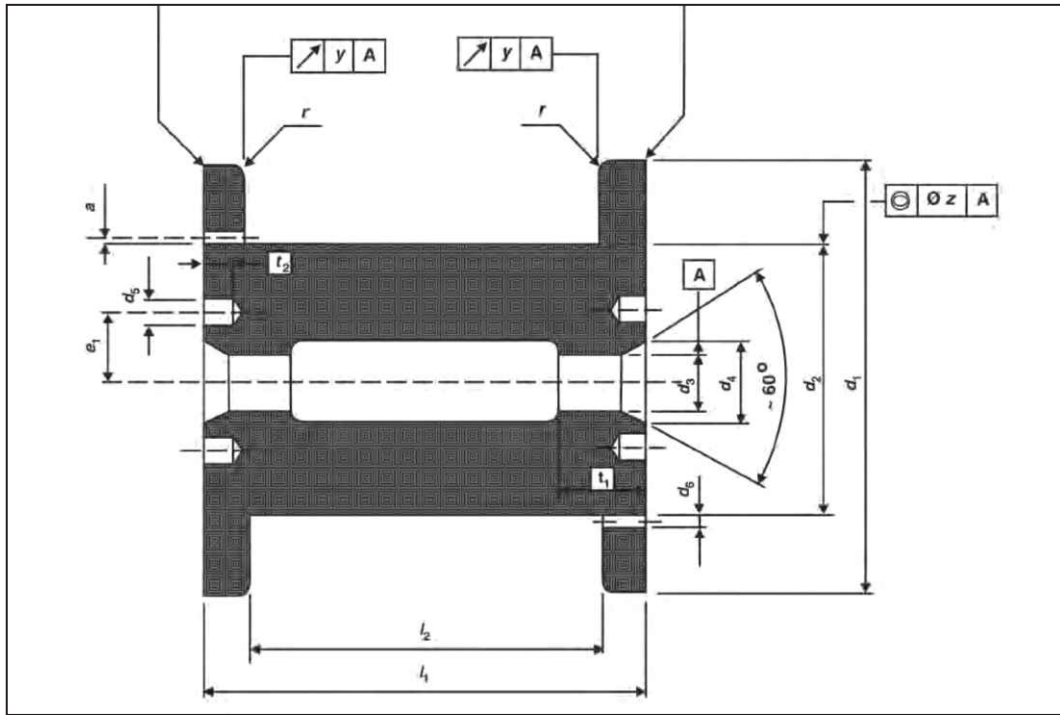


Figure 1: Cylindrical Barrelled Spools

**TABLE 1: DIMENSIONS OF CYLINDRICAL BARRELLED SPOOLS (RETURNABLE) (SEE FIGURE 1)**

Spool Type	Dimensions (mm)																Net weight max. (Kg.)	APPLICABLE SPECS.		
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>		d <sub>4</sub>	d <sub>5</sub>	d <sub>6</sub>	l <sub>1</sub>		l <sub>2</sub>		a	t <sub>1</sub>	t <sub>2</sub>	z	y			e <sub>1</sub>	r
			Nom.	Tol.					Nom.	Tol.										
125	125	80	16	+0.2	24	7	3	125	100	0.2	1.5	25	2	0.6	0.2	20	3	3	ICE 60264-2-2	
160	160	100	22	+0.2	34	13	3	160	128	0.2	1.5	28	12	0.6	0.3	32	4	7		
200	200	125	22	+0.2	34	13	3	200	160	0.3	1.5	32	12	0.6	0.3	32	4	14		
250	250	160	22	+0.2	34	13	4	200	160	0.4	2	36	12	1	0.4	32	5	22		
265	265	160	40	+0.2	48	13	4	200	160	0.4	2	-	-	1	0.4	40	5	25		
355	355	224	22	+0.5	60	26	4	200	160	0.4	2.5	40	30	1.2	0.5	80	5	48		
125	125	65	22	+0.2	30	8	4	90	70	0.2	2	-	-	0.6	0.2	24	2	2.5	INDIAN EQUIVALENT	
160	160	94	36	+0.2	40	13	4	124	100	0.2	2	-	-	0.6	0.2	24	2	5		
250	250	112	40	+0.2	48	13	4	142	114	0.4	2	-	-	1	0.4	32	5	22		
410W	410	200	40	+0.6	50	16	6	215	175	0.6	3	-	-	1.2	0.5	80	6	70		
500W	500	290	40	+0.6	50	16	8	210	165	0.6	4	-	-	1.2	0.5	80	6	100		

**TABLE 2 : DIMENSIONS OF TAPER BARRELLED SPOOLS (RETURNABLE) (SEE FIGURE 2)**

Parallel Barrel	Wire Range in mm.	Dimension in mm.							Reel Capacity (Kg)	Applicable Specs
		Flange Diameter		Barrel Diameter		Bore Dia.	Traverse Length	Overall Length		
DIN 4683 / IEC 60264 - 3		D1	D3	D2	D4	D5	L1	L2		
PT - 01	0.125 - 0.150	105	95	58	53	22	100	120	1	IEC 60264-2-2
PT - 04	0.190 - 0.250	140	125	84	73	25	170	198	4	
PT - 10	0.100 - 0.315	180	160	110	95	30	200	227	10	
PT - 15	0.100 - 0.315	200	180	108	95	30	200	227	15	
PT - 20	0.200 - 0.500	225	210	150	132	32	248	278	20	
PT - 25	0.500 - 1.120	225	210	128	108	32	248	278	25	
PT - 45	0.355 - 2.000	250	236	160	140	100	335	400	45	
PT - 90	1.400 - 2.000	315	300	200	180	100	425	500	90	

**Note:**  
Center Hole-PT4- $\Phi 26 + 0.20$ , Center Hole-PT10  $\Phi -30+0.20$

## RECTANGULAR TAPED CONDUCTORS

Dimensions of Drums (All dimensions in mm)

Flange Dia	Barrel Dia	Traverse	Flange thick	Bore Dia	Catch hole Distance	Slot/hole on barrel	No. of iron tube	Wt. Kgs.
450	300	240	20/22	52	125	15	5	65
500	300	240	20/24	52	125	15	5	115
560	300	240	20/24	52	125	15	5	150
610	300	240	20/24	52	125	15	6	180
710	400	300	22/24	52	170	15	7	240
710**	560	300	22/26	52	170	15	7	120
760**	560	300	22/26	52	170	15	8	210
810**	560	300	22/26	52	170	15	10	280
850**	560	300	22/30	52	170	15	10	350
910**	560	300	24/30	52	170	15	12	400
1000**	650	350	35/35	52	170	15	14	500
1100**	650	350	40	85	170	16	8*	800
1200**	650	400	40	85	170	20	8*	1100

**Note:**

- Catch hole for all drums will be 16mm.
- \* Rods of 16mm diameter.
- \*\*One additional hole of 18mm to be provided on flange at 290mm distance from centre.

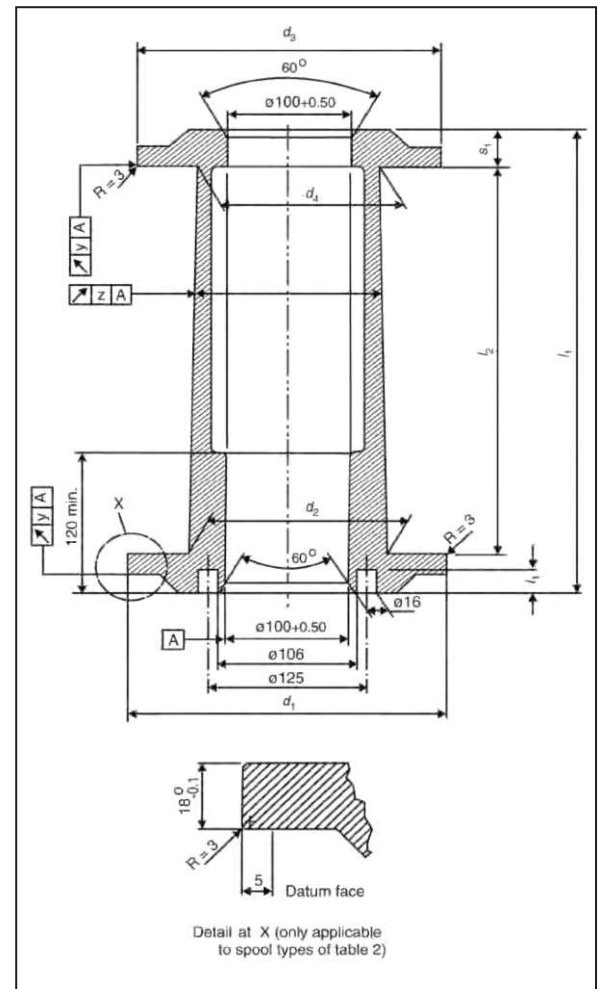


Figure 2: Taper Barrelled Spools

## QUALITY AND STANDARDS

- IEC-60317 for specification IEC- 60851 for testing method, Same way IS-13730, 13778, 8783, EN 13601, BS 1432, ASTM B-170, ASTM B-115:2010, B-49-2015a, NEMA and JIS.
- The Copper Extrusion, Up cast, Drawing, Enamelling, Paper Insulated, Tapped Insulated and Poly wrap machine is one of the best in Class and has excellent process control techniques, whereby it ensures highly even dimension control and even coating of insulation.
- Optical Emission PMT based Spectrometer, Oxygen elemental Gas analyzer, Computerized profile projector, HV test, BDV, and all Electrical, mechanical, thermal, chemical properties are conducted as per standards and customer requirement.

**MADHAV COPPER MANUFACTURES PRODUCTS FROM 99.997% PURE ETP GRADE COPPER**



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