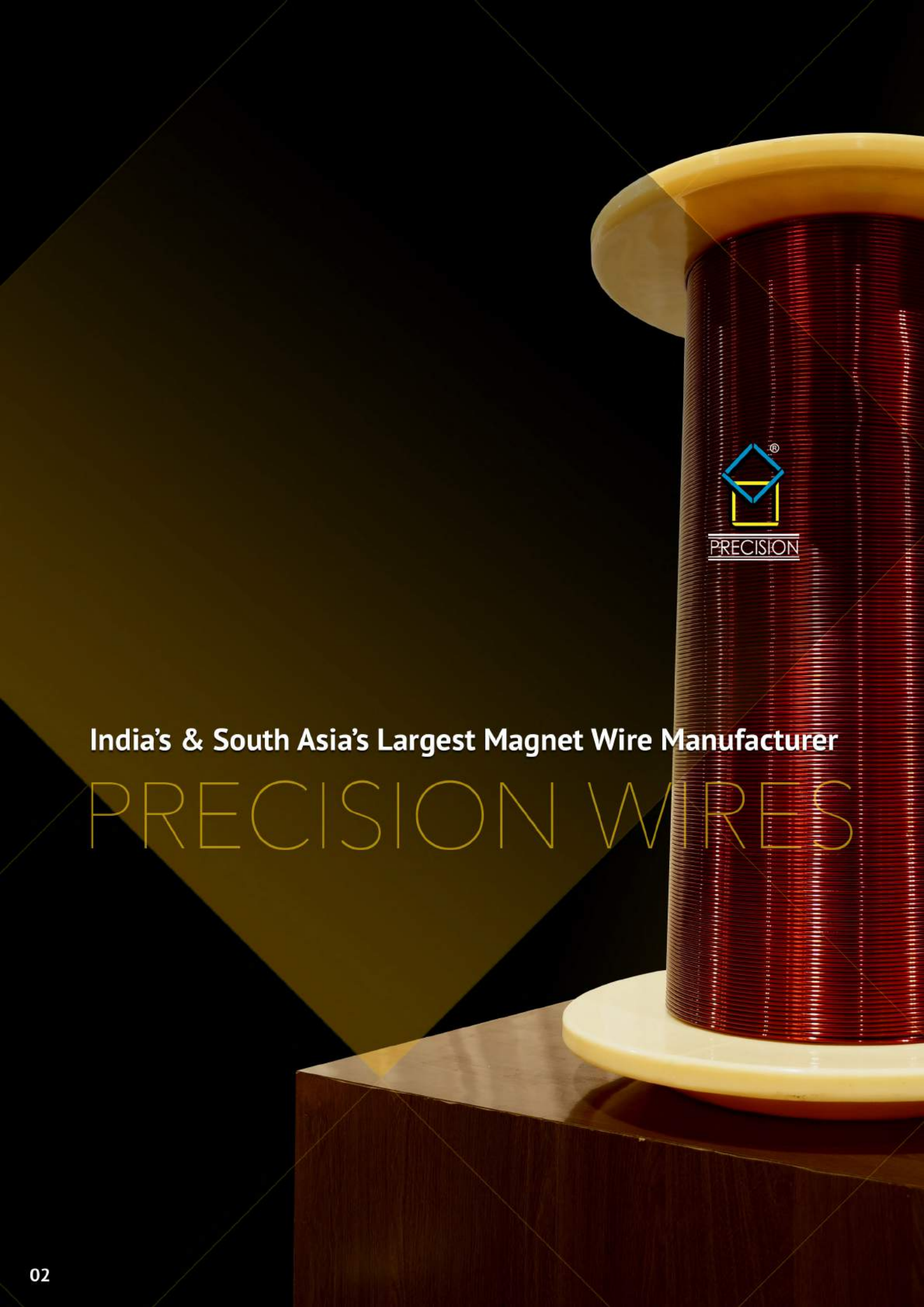
to any length...

PRECISION WIRES INDIA LIMITED

PRECISION

MILAN®
WINDING WIRES



India's & South Asia's Largest Magnet Wire Manufacturer

PRECISION WIRES

MILAN®
WINDING WIRES

INDIA LIMITED

1981
Atlas Wires Ltd. commenced production with a small capacity of 300 MT/year.

1989
Precision Wires India Ltd. incorporated

1993
Precision Wires starts commercial production

2001
Atlas Wires and Precision Wires merged into one company

2006
Start of commercial production of Rectangular Insulated Conductors including CTC with a Technology Transfer Agreement with Invex S.p.A. (now Essex Italy)

2006-2021
Continuous expansion and investments. Installed capacity was about 40000 MT/year as on 31st March 2022.

2022-2023
Further investments are planned to take the installed capacity to about 45000 MT/year.

PRECISION®

MILAN® WINDING WIRES

Precision Wires India Limited

Founded in 1989, PWIL has been amongst the most successful companies in the wire industry in India. Today, with an installed capacity of about 40000 MT/year, we are the largest producers of Magnet Wires/Winding Wires in South Asia.

Our state-of-the-art facilities at Silvassa, India manufacture a wide range of products including Enamelled Round and Rectangular Copper Magnet Wires/Winding Wires, Continuously Transposed Conductors (CTC), Paper/Mica/Nomex® Insulated Copper Conductors (PICC), and Submersible Winding Wires which are used across the globe by the electrical/electronics industry.

Over the years, our wires have been synonymous with the very best in quality, reliability and integrity. This, with our long history and expertise in the industry has enabled us to develop long term associations with the top manufacturers across applications and industries.

PWIL is the preferred source for high performance wires/conductors in India.

Exports

We export our products to many countries across the globe, including in Europe, North American, Africa and the Middle East.
Our quality, technical service and support, and quick delivery time are our strengths.

Certifications & Recognitions

The high Quality & Consistency of our products has won the confidence of our customers. Several of our prestigious customers have rated us as the best supplier.


DNV

MANAGEMENT SYSTEM CERTIFICATE

Precision Wires India Limited

IATF 16949:2016

MANUFACTURE OF ENAMELLED ROUND WINDING WIRES MADE OF COPPER

EXCLUSION: 8.3 PRODUCT DESIGN


DNV

MANAGEMENT SYSTEM CERTIFICATE

Precision Wires India Limited

ISO 9001:2015


DNV·GL

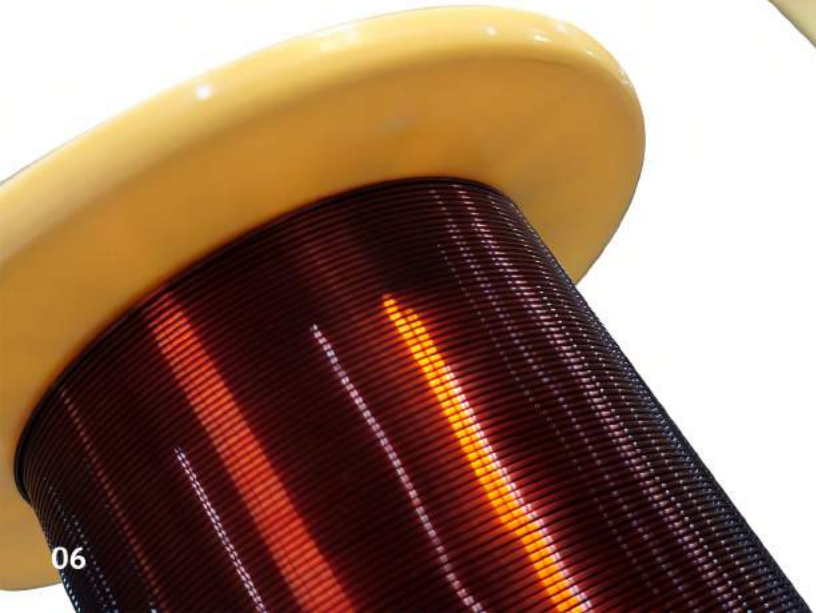
MANAGEMENT SYSTEM CERTIFICATE

Precision Wires India Limited

ISO 14001:2015

- पावरग्रिड POWERGRID **765 kV approved**
- **Many wires types** UL **certified**

Enamelled
Round Winding Wires



Technical Details

SIZE RANGE
0.08 - 5.0 mm

IEC 60317-1 NEMA MW15C	IEC 60317-3 NEMA MW5C	IEC 60317-4 NEMA MW75C	IEC 60317-8 NEMA MW30C	Specification
Polyvinyl Acetal	Modified Polyester	Polyurethane	Polyesterimide	Enamel Base Coat
N/A	N/A	N/A	N/A	Enamel Top Coat
105	155	130	180	Thermal Class
0.5-5.0	0.5-5.0	0.08-2.0	0.08-5.0	Size Range
IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	Insulation Thickness
N/A	N/A	N/A	N/A	UL Designation (File no. E174288)
- High mechanical properties - Good transformer oil resistance - Suitable for 130°C hermetic applications - Used in oil filled transformers & equipments requiring high mechanical properties.	- Upgraded thermo-mechanical properties compaired to ordinary polyesters - Used in ignition coils, oil filled transformers, relays, FHP motors. -This can also be made with upgraded abrasion properties.	- Self solderable - Good insulation resistance & high flexibility - Used in communication equipments relays, magnetic spools, universal & non-impregnated winding of all kinds of transformers.	- Good resistance against refrigerants and transformer oil - High burnout resistance - Used in FHP motors, hermetic application & thermal class 180° equipments.	Characteristics

Note :

△ Customised solutions can also be offered

Specification	IEC 60317-12	IEC 60317-13 NEMA MW35C / 73C (Hermetic)	NEMA MW37C	IEC 60317-20 NEMA MW79C
Enamel Base Coat	Polyvinyl Acetal	Polyesterimide	Polyesterimide	Polyurethane
Enamel Top Coat	N/A	Polyamide-imide	Polyamide-imide	N/A
Thermal Class	120	200	220	155
Size Range	0.5-5.0	0.08-5.0	Single 14-44 AWG Heavy 2-44 AWG Triple 14-44 AWG Quad 10-30 AWG	0.08-2.0
Insulation Thickness	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	NEMA Single / Heavy / Triple / Quad	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple
UL Designation (File no. E174288)	N/A	Preci-7	Preci-12	Preci-9
Characteristics	- High mechanical properties - Good transformer oil resistance - Used in oil filled transformers & equipments requiring high mechanical properties.	- Very good resistance to refrigerants & chemicals - High burn out resistance - Excellent windability - Low coefficient of friction, high slotfill factor - Used in special motor including Hermetic motors, Armatures, Alternators, Power tools & high HP motors, suitable for high speed coil winding, motors for Hybrid/Electric vehicles.		- Self solderable - Low dielectric desipation factor under high frequency - Can be widely used in electrical instruments of machine tools, motors which require of this type of enamel.

Note :

△ **Customised solutions can also be offered**

Wide range of products including corona resistant, self lubricating and self bonding options.

IEC 60317-21 NEMA MW80C	IEC 60317-22 NEMA MW76C	IEC 60317-23 NEMA MW77C	IEC 60317-26 NEMA MW81C	Specification
Polyurethane	Polyester/ Polyesterimide	Polyesterimide	Polyamide-imide	Enamel Base Coat
Polyamide	Polyamide	N/A	N/A	Enamel Top Coat
155	180	180	200	Thermal Class
0.08-1.6	0.08-5.0	0.08-1.6	0.08-5.0	Size Range
IEC Grade 1B/2B NEMA Type 1/ Type 2	IEC Grade 1B/2B NEMA Type 1/ Type 2	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	Insulation Thickness
Preci-10	Preci-2	N/A	N/A	UL Designation (File no. E174288)
- Low coefficient of friction besides regular properties of polyurethane - Suitable for high speed winding in small & medium electrical instruments.	- Can be used in 180° class equipments requiring high speed machine winding and low coefficient of friction.	- Self solderable with high potential both under the dry & humid conditions - Good heat shock & cut through - Suitable for coils of various motors, appliances, instruments & telephone equipments.	- High burn out resistance - Excellent windability - Low coefficient of friction, high slot fill factor - Used in special motors including Hermetic motors, armatures, alternators, power tools & high HP motors, suitable for high speed coil winding.	Characteristics

Note :

△ Customised solutions can also be offered

Specification	IEC 60317-34	IEC 60317-35 NEMA MW135C	IEC 60317-36	IEC 60317-37
Enamel Base Coat	Polyester	Polyurethane	Polyesterimide	Polyesterimide
Enamel Top Coat	N/A	Polyamide	Polyamide	Polyamide
Thermal Class	130	130	180	180
Size Range	0.08-5.0	0.08-0.8	0.08-1.6	0.08-1.6
Insulation Thickness	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1B/2B NEMA Type 1/ Type 2	IEC Grade 1B/2B NEMA Type 1/ Type 2	IEC Grade 1B/2B NEMA Type 1/ Type 2
UL Designation (File no. E174288)	N/A	N/A	N/A	N/A
Characteristics	- Good thermal & electrical properties - Used in general purpose rotating & static electrical equipments, oil filled transformers, control coils.	- Self Solderable thermoplastic bonded by heat & solvent - Used for self supported coils for television small motors, relays, magnets, telephones & voice coils of all kinds - Can be bonded in forms by heating at 170-180°C.	- Self Solderable thermoplastic bonded by heat & solvent - Used for self supported coils for television small motors, relays, magnets, telephones & voice coils of all kinds - Can be bonded in forms by heating at 170-180°C.	- Polyesterimide enamelled wire (Thermal Class 180°C) with self bonding overcoat.

Note :

△ **Customised solutions can also be offered**

IEC 60317-38 NEMA MW102C	IEC 60317-46 NEMA MW20C	IEC 60317-51 NEMA MW82C	IEC 60317-57 NEMA MW81C	Specification
Polyesterimide	Polyimide	Polyurethane	Polyamide-imide	Enamel Base Coat
Polyamide-imide + Self bonding	N/A	N/A	N/A	Enamel Top Coat
180	240	180	220	Thermal Class
0.079 - 1.628	0.2-5.0	0.08-1.0	0.08-5.0	Size Range
IEC Grade 1B/2B NEMA Type 1/ Type 2	IEC Grade 1 / 2 NEMA Single / Heavy	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	IEC Grade 1 / 2 / 3 NEMA Single / Heavy / Triple	Insulation Thickness
N/A	N/A	N/A	N/A	UL Designation (File no. E174288)
- Dual coated enamelled wire (Thermal Class 200°C) with self bonding overcoat.	-Excellent Heat shock, Thermal Resistance, Abrasion Resistance - Used in many special application ranging from aerospace to medical appliances, high performance motors for Hybrid/Electric vehicles.	- Self solderable - Can be widely used in electrical instruments of machine tools, motors which require Thermal Class 180°C insulation.	-High burn out resistance - Excellent windability - Low coefficient of friction, high slot fill factor - Used in special motors including Hermetic motors, armatures, alternators, power tools & high HP motors, suitable for high speed coil winding, high performance motors for Hybrid/Electric vehicles.	Characteristics

Note :

△ Customised solutions can also be offered

Delivery Spools

PWIL make Enamelled Round Winding Wires are supplied on 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.

Indian equivalent Cylindrical Barrelled Plastic spools, non-returnable type.

Please refer to the table below for the available spool sizes against size range of wire :

Wire sizes & Respective Spool Types :

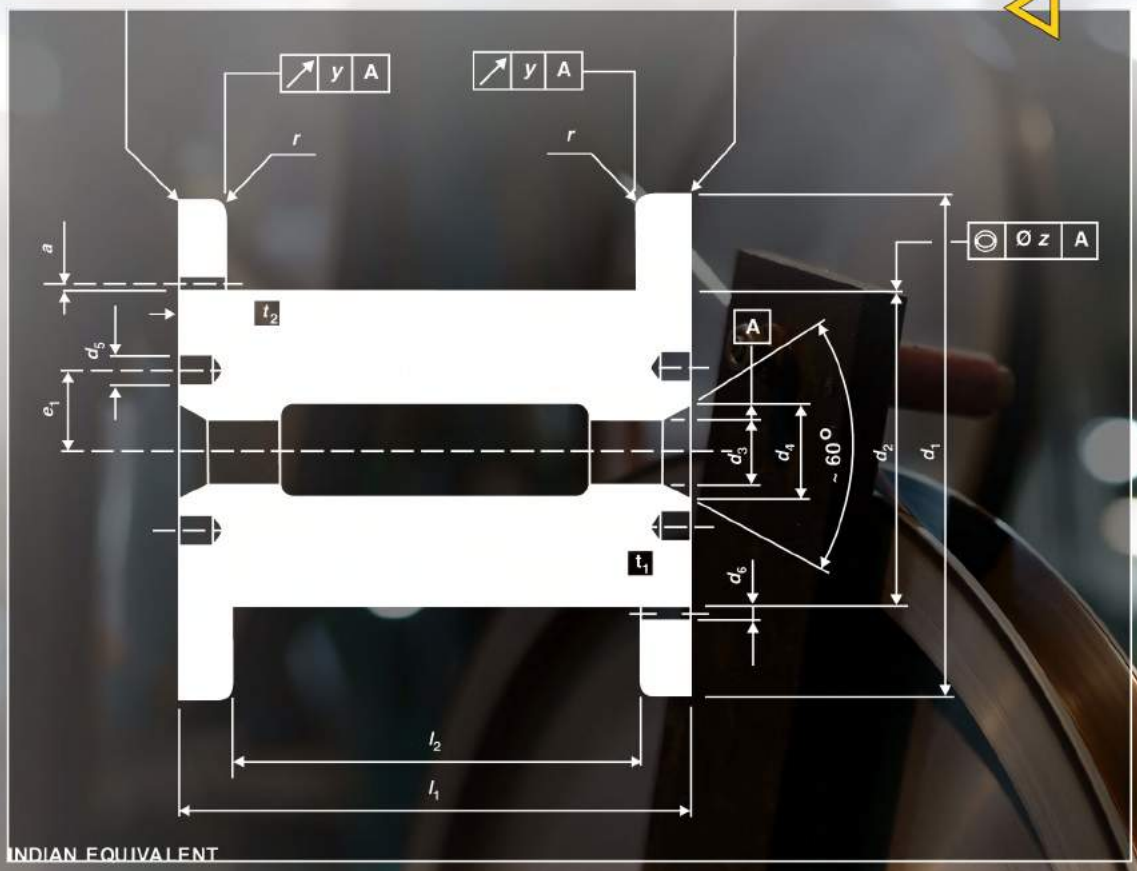
Cylindrical Barrelled Spools

Size Range (mm)	IEC 60264-2-2 (Cylindrical Barrelled Spools)	Indian Equivalent Spools
2.37 to 5.00	—	500W & 410W
0.50 to 2.36	355, 265, 250 & 200	500W, 410W, 265 & 250
0.490 to 0.350	160	160 PT-4/PT-10
0.349 to 0.200	160 & 125 PT-4/10	160 & 125 PT-4/PT-10
0.190 to 0.080	160 & 125 PT-4/10	160 & 125 PT-4/PT-10

Taper Barrelled Spools

Size Range (mm)	IEC 60264-3-2 (Taper Barrelled Spools)	As per JIS Spools
2.37 to 5.00	315/500, 400/630 & 500/800	—
0.50 to 2.36	200/315, 250/400, 315/500 400/630 & 500/800	—
0.500 to 0.200	200/315, 250/400, 315/500 & 400/630	—
0.200 to 0.120	200/315, 250/400, 315/500 & 400/630	PT-10
0.120 to 0.080	—	PT-10 & PT-4

Other Spools available on request.



INDIAN EQUIVALENT

Figure 1: Cylindrical Barrelled Spool

Table 1 : Dimensions of Cylindrical Barrelled Spools (Returnable) (See Figure 1)

Spool Type	Dimensions (mm)																	Net Weight, Max. (Kg.)	APPLICABLE SPECS.
	d_1	d_2	d_3		d_4	d_5	d_6	l_1	l_2		a	t_1	t_2	z	y	e_1	r		
			Nom.	Tol.					Nom.	Tol.									
125	125	80	16	+0.20	24	7	3	125	100	0.2	1.5	25	8	0.6	0.2	20	3	3	IEC 60264-2-2
160	160	100	22	+0.20	34	13	3	160	128	0.2	1.5	28	12	0.6	0.3	32	4	7	
200	200	125	22	+0.20	34	13	3	200	160	0.3	1.5	32	12	0.6	0.3	32	4	14	
250	250	160	22	+0.20	34	13	4	200	160	0.4	2.0	36	12	1.0	0.4	32	5	22	
265	265	160	40	+0.20	48	13	4	200	160	0.4	2.0	–	–	1.0	0.4	40	5	25	
355	355	224	22	+0.50	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	–	–	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	–	–	0.6	0.2	24	2	5	
250	250	112	40	+0.2	48	13	4	142	114	0.4	2.0	–	–	1.0	0.4	32	5	22	
410W	410	200	40	+0.6	50	16	6	215	175	0.6	3.0	–	–	1.2	0.5	80	6	70	
500W	500	290	40	+0.6	50	16	8	210	165	0.6	4.0	–	–	1.2	0.5	80	6	100	

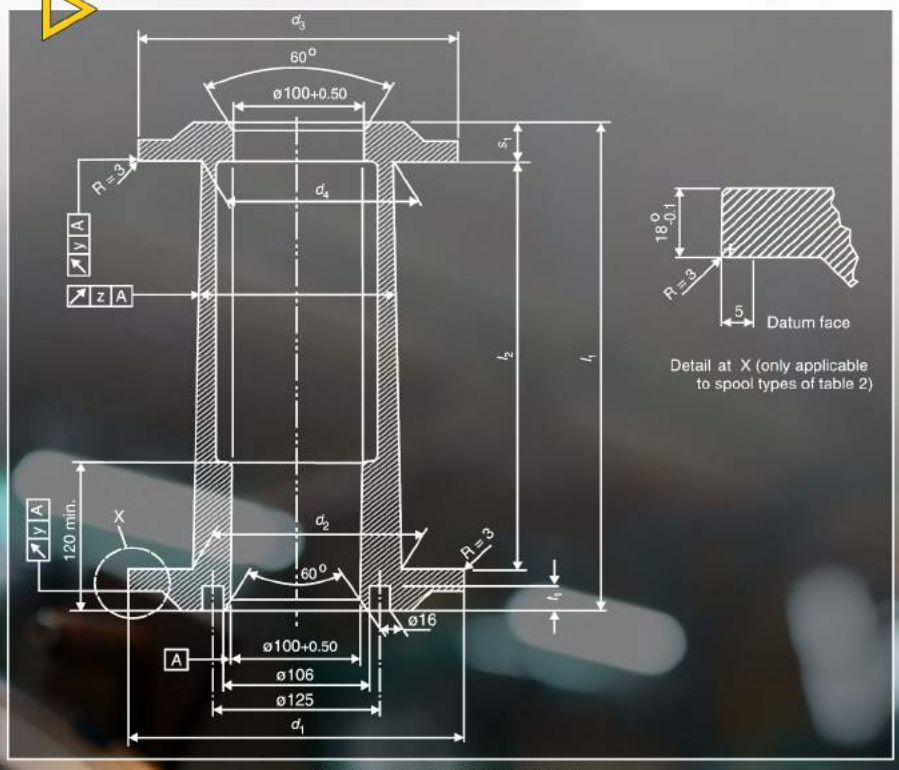


Figure 2: Taper Barrelled Spools

Figure 2: Taper Barrelled Spools

Table 2 : Dimensions of Taper Barrelled Spools (Returnable) (See Figure 2)

Spool Type	Dimensions (mm)											Net Weight, Max. (Kg.)	APPLICABLE SPECS.
	d_1	d_2	d_3	d_4	l_1	l_1		t_1	s_2	z	y		
					Max.	Nom.	Tol.		Max.				
200/315	200	125	190	112	315	265	+0.30	7	25	0.4	0.3	25	IEC 60264-2-2
250/400	250	160	236	140	400	335	+0.50	15	32.5	0.6	0.4	45	
315/500	315	200	300	180	500	425	+0.80	20	37.5	1.0	0.6	90	
400/630	400	250	375	224	630	530	+1.00	30	50	2.0	1.0	180	
500/800	500	315	475	280	800	670	+2.00	30	65	2.5	1.5	400	
PT4	140	85	125	75	200	175	+0.20	–	14	0.4	0.3	4	INDIAN EQUIVALENT
PT10	180	110	160	94	225	200	+0.20	–	14	0.3	0.2	10	

Note - Center Hole - PT4 - ϕ 26 + 0.20, Center Hole - PT10 ϕ - 30 + 0.20

Enamelled Square/Rectangular Winding Wires

PRECISION

MILAN®
WINDING WIRES

Technical Details

SIZE RANGE
2 - 75 mm²

IEC 60317-16	IEC 60317-17 / NEMA MW18C	IEC 60317-18 / NEMA MW87C	IEC 60317-18 / NEMA MW87C	Specification
Polyester	Polyvinyl Acetal	Polyvinyl Acetal	Polyvinyl Acetal	Enamel Base Coat
N/A	N/A	N/A	Epoxy Bond Coat	Enamel Top Coat
155	105	120	120	Thermal Class
Cross sectional area 2-75 mm² Thickness 0.8-5.5 mm Width 2-14 mm				Size Range
IEC Grade 1 / 2 NEMA Heavy / Quadruple Customised solutions also available				Insulation Thickness
N/A	N/A	N/A	N/A	UL Designation (File no. E174288)
- Good thermal & electrical properties - Used in general purpose rotating machines such as motors.	- Good Mechanical strength and adhesion to copper - Good Hydrolysis and Oil resistance - Used in oil filled transformers, loco transformers, chokes, coils etc.		- Bondable coating with excellent mechanical properties - Used primarily in large transformers particularly where short circuit resistance and mechanical strength is required. - Good Mechanical strength and adhesion to copper. - Oil resistance - Used in oil filled transformers, loco transformers, chokes, coils etc.	Characteristics

Note :

△ Customised solutions can also be offered

Specification	IEC 60317-28	IEC 60317-29 / NEMA MW36C	IEC 60317-47 / NEMA MW20C	IEC 60317-58 / NEMA MW84C
Enamel Base Coat	Polyesterimide	Polyesterimide	Polyimide	Polyamide-imide
Enamel Top Coat	N/A	Polyamide-imide	N/A	N/A
Thermal Class	180	200	240	220
Size Range	Cross sectional area 2-75 mm² Thickness 0.8-5.5 mm Width 2-14 mm			
Insulation Thickness	Grade 1 / 2 as per IEC Heavy / Quadruple as per NEMA Customised solutions also available			
UL Designation (File no. E174288)	N/A	Preci-11	N/A	N/A
Characteristics	- Overall good thermal, electrical, mechanical and chemical properties - Used in large machines such as generators, motors, dry type transformers etc.	- High thermal, electrical, mechanical and chemical properties. - Excellent heatshock and burnout properties - Used in large machines such as generators, motors, HV motors, dry type transformers, motors for Hybrid/Electric vehicles.	- Very high thermal, electrical, mechanical and chemical properties. - Used in special electrical machines of different types,high performance motors for Hybrid/Electric vehicles.	- Very high thermal, electrical, mechanical and chemical properties. - Used in special electrical machines of different types, high performance motors for Hybrid/Electric vehicles.

Note :

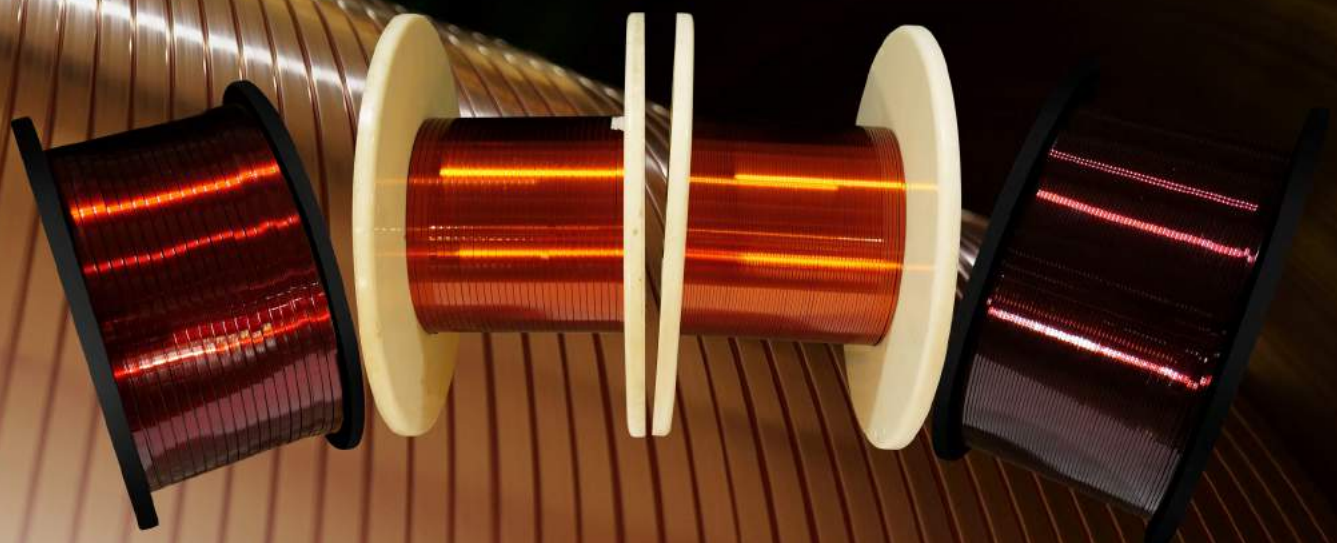
△ Customised solutions can also be offered

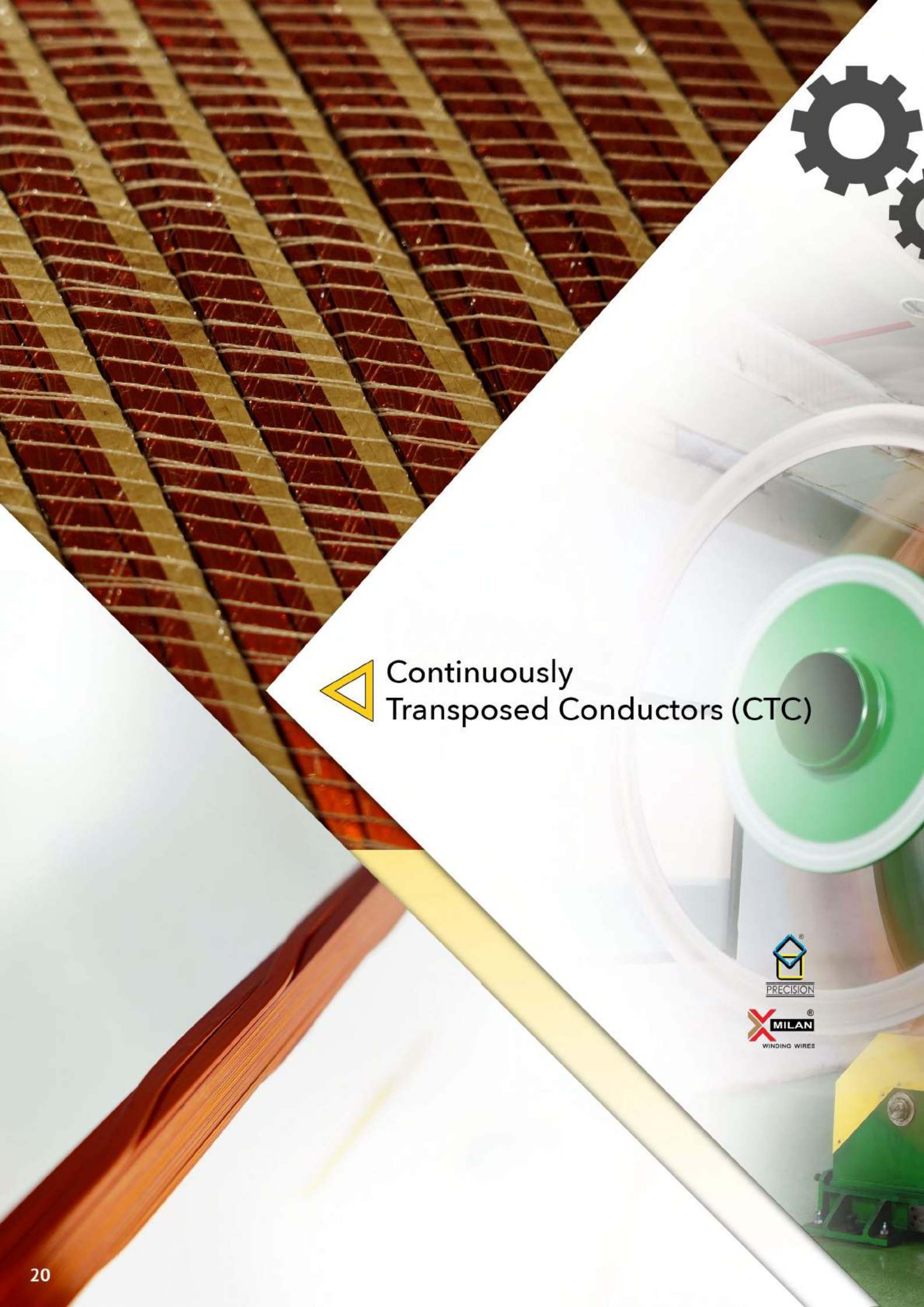
DELIVERY SPOOLS

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	200	18	38	120	15	5	50-60
500 **	300	240	18	38	120	15	–	90-100

* Wooden Spools Returnable / Non Returnable Type
** Plastic Spools Returnable / Non Returnable Type





Continuously Transposed Conductors (CTC)

PRECISION

MILAN®
WINDING WIRES

Technical Details

WHAT IS TRANSPOSING ?

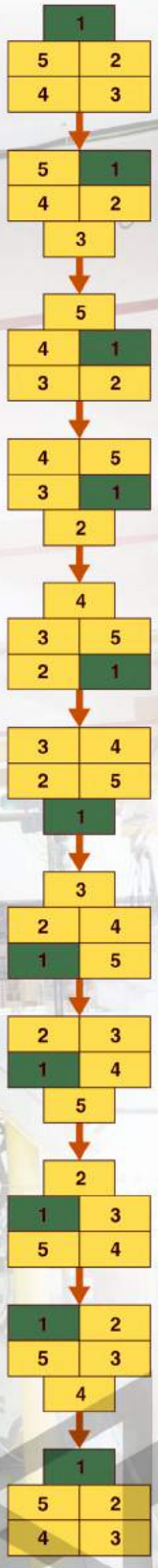
The enamelled conductors within CTC are arranged in two parallel stacks, one stack having one more conductor than the other.
The conductors are continuously transposed by machine action moving them from position to position in discrete steps :

Step 1 : Conductor 1 is moved from the top of the left hand stack to the top of right hand stack.

Step 2 : The right hand stack is moved down one conductor thickness in relation to the left hand stack.

Step 3 : Conductor 3 is moved from bottom of right hand stack to the bottom of left hand stack.

Step 4 : The left hand stack is moved up one conductor thickness in relation to the right hand stack.



At the end of four transposing steps, as shown in the figure, the conductors have returned to the original geometry, but each conductor advanced one position clock-wise.

INTRODUCTION OF PRECITRANS™1 CTC :

PWIL is proud to present the PRECITRANS™1 family of CTC comprising the following :

Sr. No.	Description	Type of Enamel Insulation and Thermal Class °C	Type of Insulating Paper
1.	PRECITRANS-PVA™1	PVA, Class 120	Kraft, Thermally Upgraded, Crepe, Nomex,™ Aramid or others as per Customer request.
	Remarks	Suitable for large Oil Filled Power and Distribution Transformers	
	Advantages	• Improved transformer performance by reducing eddy current losses. • Considerable increase in space factor due to very small thickness of single conductor insulation. • Uniform temperature distribution throughout winding.	
2.	PRECITRANS-BOND™1	PVA + Epoxy, Class 120 (The epoxy coating is cured to B-stage and is tack free)	Kraft, Thermally Upgraded, Crepe, Nomex,™ Aramid or others as per Customer request.
	Remarks	Suitable for large Oil Filled Power and Distribution Transformers	
	Advantages	• Improved transformer performance against unstable electrical network and short circuit risks. • Exceptional bond between Enamelled rectangular wires offers increased strength. • Increased short circuit forces resistance due to conductor bonded like a solid beam. • Excellent B-Stage storage stability. • Strands bonding during drying process, hence no special treatment necessary at users end. • Epoxy resin coating cure in the same process as paper drying at 100-120°C. • Best hot transformer oil resistance. • Each insulated conductor has improved insulation due to Epoxy. • Tack free and dust-free surface of insulated conductor for easy handling of Strips without powder residue. • No pollution since B-stage Epoxy is free from harmful solvents. • Small thickness of Epoxy bond coat needed (0.020-0.050 mm) • Better sliding amongst the strands, improving CTC windability. • A bond coat with low insulation thickness or only on the radial sides of the conductor can also be provided as per customer requirements.	
3.	PRECITRANS-200™1	Polyesterimide + Polyamideimide Class 200	Nomex,™ Aramid or others as per Customer request.
	Remarks	For dry type Transformers requiring high temperature resistance	
	Advantages	• High Temperature Resistance. • Improved transformer performance by reducing eddy current losses. • Considerable increase in space factor due to very small thickness of single conductor insulation. • Uniform temperature distribution throughout winding. • Increased short circuit force resistance, particularly with epoxy bond coat insulation.	
4.	PRECITRANS-CORDEX /MESH	PVA, Class-120 or PVA+Epoxy, Class 120 (The Epoxy Coating is cured to B-stage and is tack free	Paperless
	Remarks	The CTC design is generally considered for Helical winding especially for Low Voltage Winding.	
	Advantages	• No Bulging of paper • CTC Free from oil pocket among the windings. • Better Space factor of the winding allowed by reduction of all ducts. • Better cooling efficiencies.	

Remarks :

(a) The copper rod used is Electrolytic Tough Pitch (ETP) or Oxygen Free Copper with high conductivity, for controlled low losses in electrical machines.

(b) The number of strands includes all numbers between 5 to72; odd numbers give higher cross section area in CTC. Paper tapes up to 24 wrapping is applied as external insulation over the transposed conductor bunch.

(c) Besides fully annealed copper conductor, PRECITRANS CTC is available with copper conductor with controlled proof stress, for increased mechanical strength for Transformer Winding Standard Proof Stress Grade are as under:

CONTROLLED PROOF STRESS CTC REF. STANDARD BS 1432		
Grade	Rp (0.1%) MPa	Rp (0.2%) values can be provided on request
CPR 1	140-200	
CPR 2	170-220	
CPR 3	220-260	
FULLY ANNEALED		
Annealed	60-100	Standared

PRECITRANS CTC CURRENT MANUFACTURING RANGE :

CONSTRUCTION DETAILS	
No of Single conductors (Strands) in CTC	5 to 72
Min. dimensions of conductor (mm)	Thickness : 0.90 Width: 3.00
Max. dimensions of the single conductor (mm)	Thickness : 3.00 Width : 11.50
Width to thickness ratio (Preferred) for Single Conductor	From 2.6 min. to 6.0 max.
Height to Width ratio (Preferred) of CTC	Preferred height to width ratio of CTC will be intimated during contract review stage
Inter column separator	0.1 mm thick Other options on request
Packaging on Wooden/Steel drums	250-6000 Kg With/without separators (Refer Delivery Spools)

ENAMELLED RECTANGULAR WINDING WIRES USED IN CTC :

Enamelled Rectangular Winding Wires are one of the key ingredients of CTC. Wire Enamel being a critical input of Enamelled Rectangular Winding Wires is carefully chosen to give the desired properties like abrasion resistance, transformer oil resistance, temperature resistance, dielectric strength, etc.

Please refer to the following table for guidelines regarding Enamel Selection and increase in dimensions due to Enamel insulation.

Designation	Enamel Insulation and Class	Grade / Thickness of Insulation	Increase in Dimensions (mm) due to Insulation
PRECITRANS-PVA	Poly Vinyl Formal, Class 120	-	0.08 ± 0.02 0.10 ± 0.02 0.12 ± 0.02
PRECITRANS-BOND	Poly Vinyl Formal, Class 120 + B-stage cured Epoxy	-	0.12 ± 0.03 0.14 ± 0.03 0.16 ± 0.03
PRECITRANS-200	Polyesterimide + Polyamide-imide	1 2	0.085 ± 0.025 0.145 ± 0.025

Note : The above increase in dimensions can be used as a guideline. Specific requirements can be executed as per Customer request.

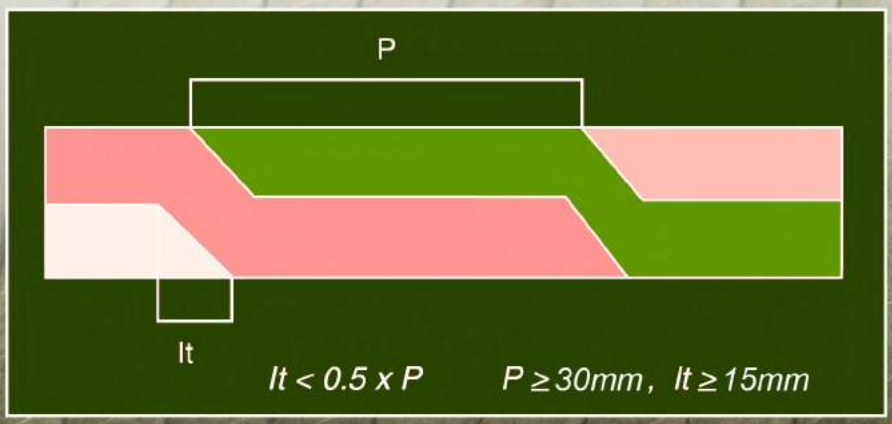
DEFINITIONS :

TRANSPOSING PITCH :

Transposing pitch "P" is the distance between two transposing.

TRANSPOSING LENGTH :

Transposing length "lt" is the length measured on the CTC between two points where the stand goes from one side to the other side of the CTC stack. The transposing length is generally less than 50% of the Transposing Pitch "P".



MINIMUM WINDING DIAMETER AND TRANSPOSING PITCH:

The first property to be satisfied during the manufacture and use of the CTC is the windability on the transformers core.

Generally the length in which there is a complete transposing of one strand (called stranding pitch) should be less than the circumference of the transformer core.

The requirement is due to the flexibility of the CTC in order to avoid any damage of the CTC structure.

Minimum Winding Diameter is in relationship with the dimensional characteristics and the Stranding Pitch by the following formulae:

Stranding Pitch = π x Winding Diameter
Transposing Pitch = Stranding Pitch / n
Transposing Factor = Transposing Pitch / b

If the Transposing Factor is <6, it can be difficult to produce CTC for strand width more than 6 mm as the pitch may be too short. If the number of strands are more, the pitch must be short but not too short so that the Transposing Factor is below 5.

CTC DIMENSIONS

CTC DIMENSIONAL DATA

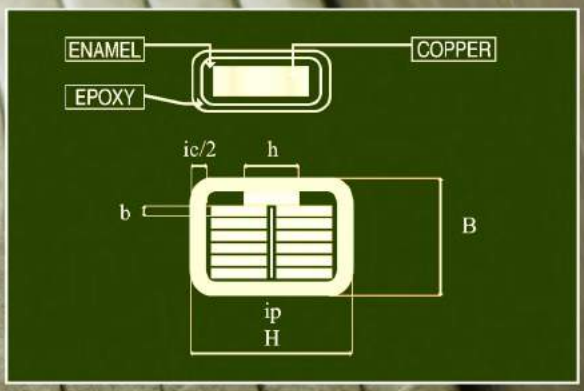
Calculation of the cable outer dimensions

Maximum dimension in axial direction :

$$H = 2\text{x}(h + i\text{E}) + ip + ic + Kh$$

Maximum dimension in radial direction

$$B = \left[\left(\frac{n+1}{2}\right)\text{x}(\text{b} + i\text{E})\right] + ic + Kb$$



Where :

H = Axial cable dimension
B = Radial cable dimension
h = Axial strand dimension
b = Radial strand dimension
Kh = Maximum plus tolerance 0.10 mm for axial dimension
Kb = Maximum plus tolerance for radial dimension (values in table)
n = Number of strands in the cable
iE = Increase in dimensions due to enamel
ip = Thickness of separator between the strands stacks.
ic = Paper covering (in case of cable without paper ic/2 is the thickness of the plastic wire/mesh tape)

Table : Kb values

Numbers of strands	s/h ≥ 9 & b < 1.65	Other cases
Upto 21	0.2	0.35
23-29	0.35	0.5
31-49	0.5	1.1
51 and above	0.8	1.35

S = Transposing distance (Transposing pitch), distance between two transpostions.

External dimensions are tested under pressure of 1N/mm^2 or the value required by the customer.

INTERCOLUMN SEPARATOR :

An intercolumn separator between the two stacks of CTC conductors is inserted, for all stack heights more than 10 mm, unless otherwise agreed to with the user.

The standard paper thickness for this is 0.100-0.110 mm thick.

Intercolumn paper is generally inserted if :

$$W = \frac{(n-3)\ X\ (b+E)}{2} > 10 \text{ for PRECITRANS-PVA CTC or } > 25 \text{ for PRECITRANS-BOND CTC}$$

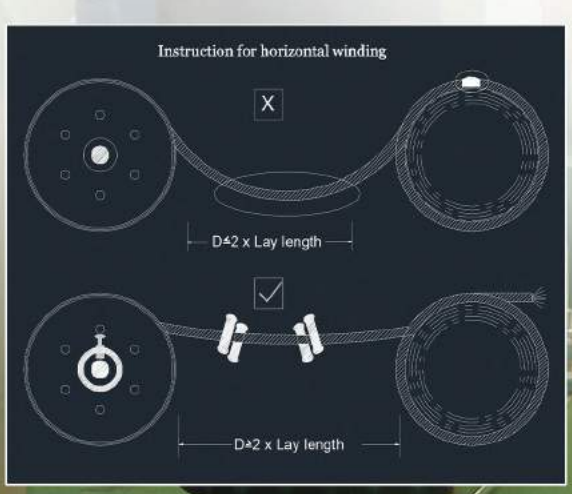
Standard thickness of intercolumn separator paper, besides 0.100 mm, are 0.20, 0.30, and 0.40 mm

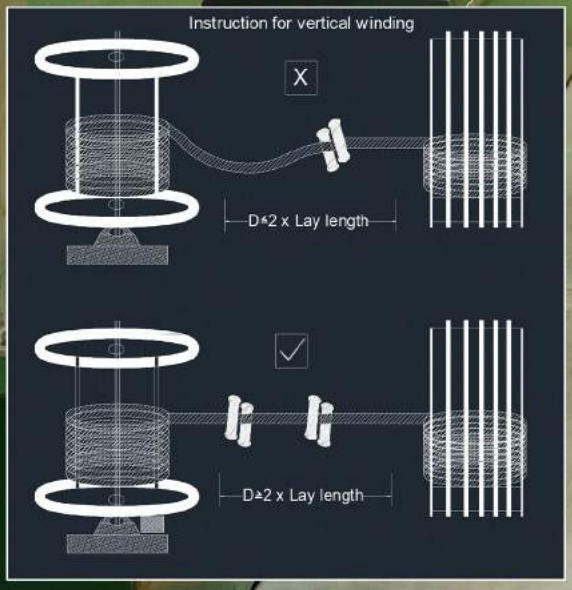
PAPER ARRANGEMENT :

Transposed Enamelled Conductors / Strands are wrapped with multiple layers of oil resistant Kraft and/or other special papers to give high dielectric and mechanical strength to the CTC. The paper rolls can be slitted into required width tapes.

WINDING GUIDELINES FOR PRECITRANS CTC :

For optimal performance of CTC during the winding it is necessary to follow certain basic precautions.



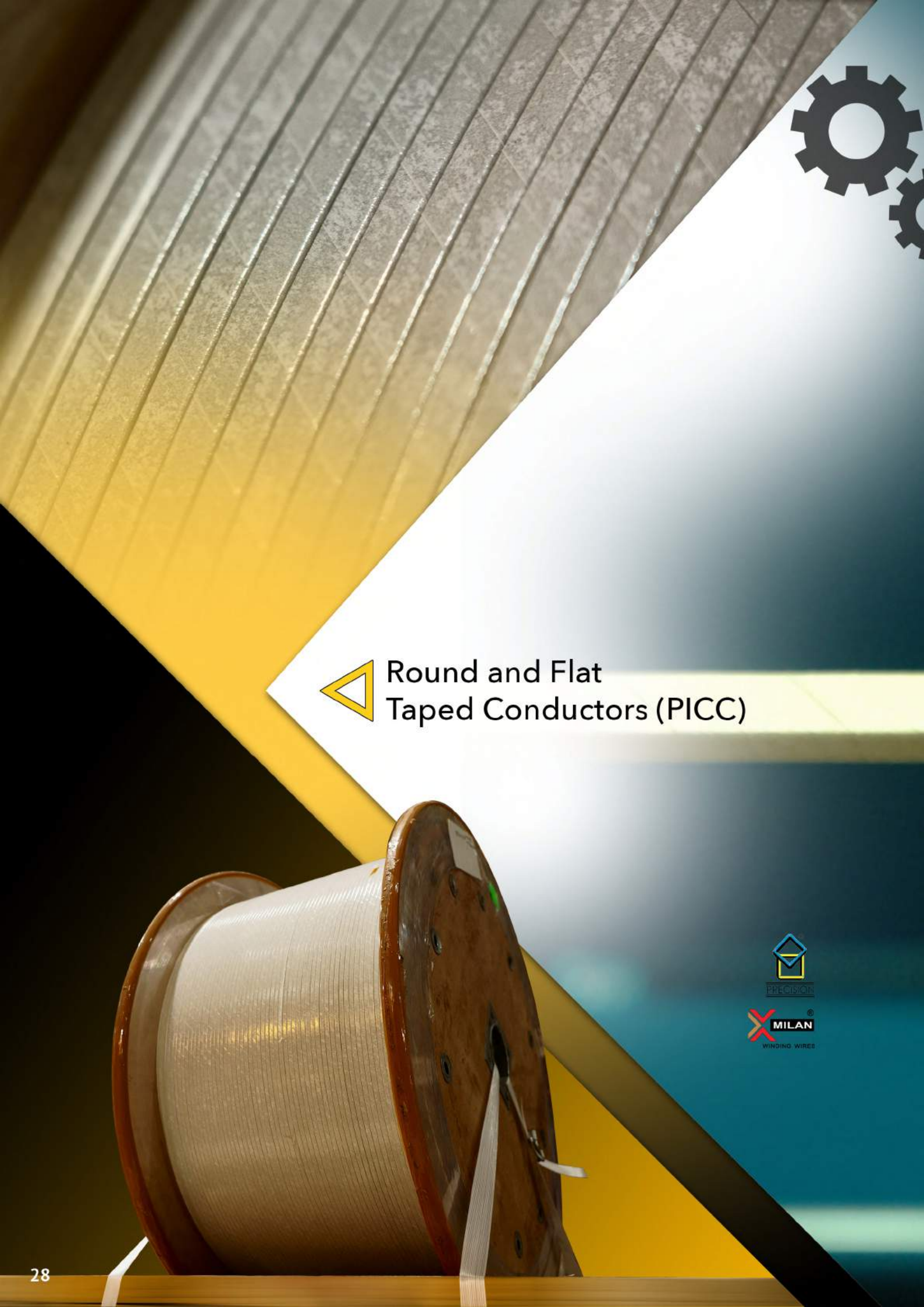


- Before starting winding, unlock the bottom end of secured CTC (remove the clamp).
- Ensure distance between of at least 2 x stranding pitch.
- Provide 2 sets of guide rollers with adjustable flanges at equal distance as shown, to avoid tilting/sagging/collapse of conductor.
- Use a pneumatic brake system to avoid tension inconsistency during winding.
- Complete at least 4 turns on the former and then secure/fix/bend the CTC starting end on the core. Do not secure the starting end before this as it can lead to bulging of CTC.
- Epoxy bonding cycle/instructions can be provided on request.

DELIVERY SPOOLS

Dimensions of Drums (All dimensions in mm)

Spool Type	Flange Diameter	Barrel Diameter	Bore Diameter	Overall Width	Traverse	Capacity in Kgs.
P 650	950	700	82	660	560	650
P 900	1100	800	82	660	560	990
P 1250	1250	925	82	660	560	1250
P 1750	1350	900	82	660	560	1750
P 2200	1350	925	82	900	770	2200
P 2900	1425	900	82	900	770	2900
P 3500	1550	900	82	900	770	3500
P 4000	1750	1150	82	900	770	4000
P 6000W	2000	1350	82	1110	900	6000
P 6000S	2000	1200	82	1110	900	6000



Round and Flat Taped Conductors (PICC)

Upto 8 Bunch

Technical Details

PWIL is proud to present various types of Rectangular Taped Conductors as below

Rectangular / Single / Bunched proof stressed Paper Covered Copper Conductors	
a) Bare Width	3 to 25 mm
b) Bare Thickness	1 to 10 mm
c) Cross Section Area	5 to 120 mm^2
d) Periphery of Rectangular Conductor	50 mm Max
e) Width / Thickness Ratio	1 : 9
f) Insulation Thickness	0.3 to 6 mm
g) Number of Layers	1 to 40

Sr. No.	DESCRIPTION	
1.	**Kraft Paper Insulated Rectangular Copper Conductors Single, Double Bunched / Triple Bunched, Quadruple Conductors, (Radial / Axial Bunched) as per IEC 60317-27 or as per customer specifications.**	
	a.	Regular Kraft Paper Insulation - It is a cellulosic Paper, as per IEC 554-3-5, and available in thickness from 50 Micron to 125 Micron, used widely for conductor insulation in Oil filled Transformers.
	b.	Thermally Upgraded Paper - with Thermal Class E (120 Deg.C) as per IEC 554-3-5, available in thickness from 50 Micron to 125 Micron.
	c.	Diamond Dotted Epoxy Paper in various thickness, which improves thermal properties.
2.	**Nomex™/ Aramid Paper Insulated Rectangular Copper Conductors Single, Double Bunched/ Triple Bunched, Quadruple Conductors, (Radial / Axial Bunched) as per IEC 60317-27 or as per customer specifications.**	
	a.	**Nomex 410 :** This is a 220 Aramid based Calendered paper which offers high dielectric strength, mechanical toughness, flexibility and resilience.
	b.	Other Aramid paper options also can be used
		Rectangular Conductors with this type of Nomex/Aramid paper insulation is used in Electrical Motors, Generators Traction Equipments and Transformer Windings, due to high temperature index, excellent chemical resistance and outstanding overall insulating properties.
	Non Flammability of Nomex™ Paper allows its use , where there are high Fire Risks.	
3.	**Enamel + Kraft / Nomex Paper Insulated Rectangular Copper Conductors Single, Double Bunched / Triple Bunched, Quadruple Conductors, (Radial / Axial Bunched) as per IEC 60317-27 or as per customer specifications.**	
	a.	Rectangular Conductors with this type of (Kraft / Nomex paper) Insulation is used in High Voltage Electrical Motors, Generators and Transformer Windings so as to provide outstanding overall insulating properties.
4.	**MICA Tape Insulated / Enamel + MICA Tape Insulated Rectangular Copper Conductors (Single Conductor) as per IEC 60317-27 or as per customer specifications.**	
	a.	Insulation used in such type is MICA / Polyster Insulation.
		MICA Paper is a type of Paper composed only of small strips of MICA with no admixture or bonding material (100% MICA).
		MICA - POLYESTER compounds generally comprise MICA Paper on which a Polyester film Coat (PETP) is spread using an Epoxy resin.
		The above materials are of Thermal Class 150°C and are used as insulation for High Voltage Motors / Generators Windings.

DELIVERY SPOOLS

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

Notes :

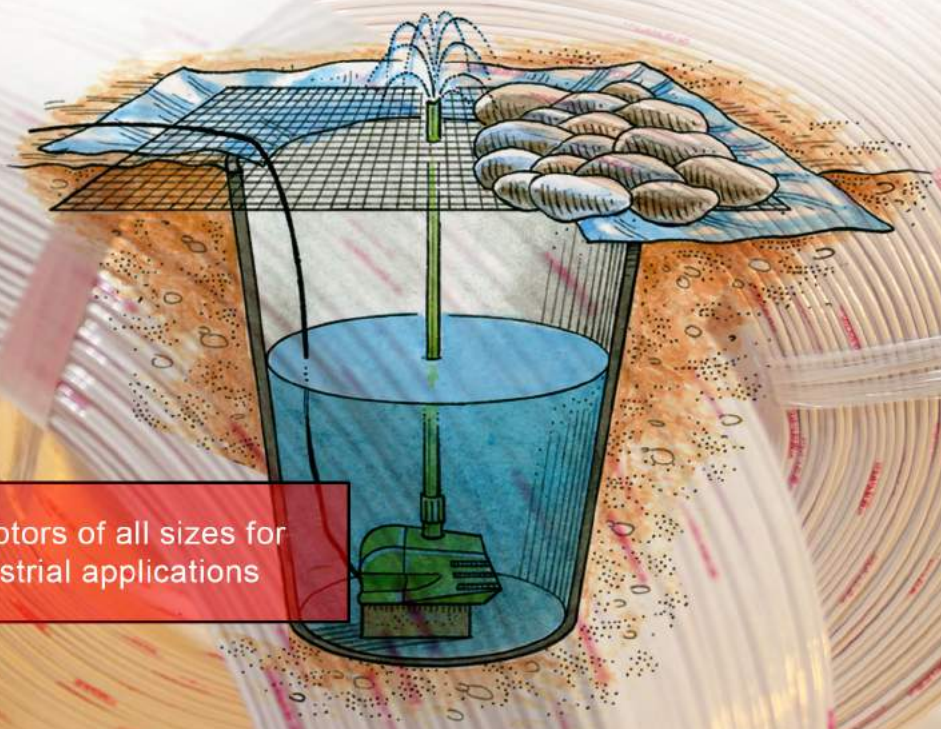
1. Catch hole for all drums will be 16mm.
2. * Rods of 16 mm diameter.
3. ** One additional hole of 18mm to be provided on flange at 290mm distance from centre.


MILAN-SUB
Submersible Winding Wires
PRECISION
MILAN
WINDING WIRES
MILAN-SUB
SUBMERSIBLE
WINDING WIRE
MILAN-SUB
SUBMERSIBLE
WINDING WIRE
PRECISION WIRES INDIA LTD

Technical Details

SIZE RANGE
0.4 - 2.0 mm

PWIL manufactures high quality submersible winding wires that are specially insulated with Polyester & Bi-axial Oriented Poly Propylene (BOPP) films to ensure that the wires are capable of withstanding high temperatures and mechanical abrasion. A state of the art plant as well as testing laboratory ensures a high quality end product.



APPLICATION

Used in submersible pumps/motors of all sizes for agricultural, domestic and industrial applications

SPECIAL SALIENT FEATURES

1. Electrolytic Tough Pitch High conductivity copper rods are used as raw materials to provide energy efficient solutions.
2. Less current leakage - No air gap between the films.
3. Each coil is checked for high voltage test, megger and dimensions.
4. Enhanced softness, smoothness, and easy windability.
5. Excellent flexibility and adherence, breakdown voltage and tear strength.

WORKING TEMPERATURE RANGE

Milan-Sub Submersible Winding Wires are suitable for temperatures upto 120°C for short periods of time and from 60°C to 120°C for longer periods during continuous operation.

GENERAL SPECIFICATION

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) (Approx. estimated)	Elongation Minimum %
0.4	0.004	0.2	0.8	136	1.477	24
0.5	0.005	0.2	0.9	87	2.155	25
0.6	0.006	0.2	1	60.92	2.98	26
0.7	0.007	0.2	1.1	44.78	3.946	28
0.8	0.008	0.2	1.2	34	5.055	28
0.9	0.009	0.2	1.3	27	6.299	29
1	0.01	0.2	1.4	22	7.684	30
1.1	0.011	0.2	1.5	18.15	9.209	30
1.2	0.012	0.2	1.6	15.26	10.874	31
1.13	0.013	0.2	1.7	12.98	12.679	32
1.14	0.014	0.2	1.8	11	14.89	32
1.5	0.015	0.25	2	9.74	16.99	32
1.6	0.016	0.25	2.1	9	19.228	32
1.7	0.017	0.25	2.2	7.6	21.605	32
1.8	0.018	0.25	2.3	7	24.122	32
1.9	0.019	0.25	2.4	6.07	26.78	32
2	0.02	0.25	2.5	5.46	29.576	33

**** Other sizes/insulation thickness are available on request.*

DELIVERY SPOOLS

Milan-Sub Submersible Winding Wires are offered in a standard packing of 1000 meters per coil. Other options including spool packing are available on request.

PRECISION

MILAN®
WINDING WIRES

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TEL : +91-22-24376281
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E-MAIL : marketing@pwil.net (for Round Wire)
marketingstrip@pwil.net (for Rectangular Wire)
export@pwil.net (for Exports/Overseas enquiries)
WEBSITE : www.precisionwires.com

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