Fiber-insulated wires

Silix® enameled flat

- **Enameled flat copper wire insulated with glass yarn**
- **Winding wire with excellent thermal and chemical resistance**
- **Temperature Index 180 or 200**

General description
THERMEX® 220 flat wires meet the requirements of IEC 60317-58 (nema MW 84-C). The enameled flat copper wire is insulated with a single or double covering of glass-yarn fibers (SILIX®), available in three different versions:

V180: impregnated with modified polyesterimide varnish.

V180K: impregnated with modified polesterimide varnish in a thermal-adhesive version.

VSi: impregnated with silicone-based varnish.

Silicone impregnation is not available in the thermal-adhesive version.

Users should consider that a silicone impregnation gives a lower level of adhesion than polyesterimide impregnations (see IEC 60317-33 standards).

Application
Windings for transformers, generators or motors.

Conventional Types
Covered enameled copper wires THERMEX® 220 Grade 2, insulated with:

- 1 fine or reinforced impregnated covering layer (1 x)
- 2 fine or reinforced impregnated covering layers (2 x)
- coating varnishes: modified polyesterimide, silicone, 'B'-Staged varnish

Cross section: 2 to 80 mm2
Width: 2,00 to 22,00 mm
Thickness: 1,00 to 6,00 mm

The standard dimensions of the conductors (nominal dimension), the tolerances and the overall dimensions of the enameled wire comply with the IEC standard 60317-0-2.

Build Criteria Rectangular Wire
Standards
SILIX®-covered enameled flat copper wires meet the requirements of IEC Publications 60317-0-4, 60317-31 (TI 180) and 60317-33 (TI 200).

Bare conductor Width W (mm)	Max. increase in Dimension (mm)			
	Glass fiber covering over grade 2 enameled conductor			
	Single covering 1Silix		Double covering 2Silix	
	Fine	Reinforced	Fine	Reinforced
2.00 ≤ w ≤ 3.40	0.23 to 0.32	0.24 to 0.37	0.31 to 0.40	0.32 to 0.42
3.40 < w ≤ 5.00	0.23 to 0.32	0.24 to 0.37	0.31 to 0.40	0.35 to 0.47
W > 5.00	0.23 to 0.32	0.24 to 0.37	0.31 to 0.42	0.40 to 0.52

The test methods are based on IEC Publication 60851:

60851-1 General
60851-2 Definition of dimensions
60851-3 Mechanical properties
60851-4 Chemical properties
60851-5 Electrical properties
60851-6 Thermal properties

Advantages
- Good resistance to impregnating varnish solvents
- Excellent resistance to high temperatures in continuous mode, according to the type of impregnation used.

Processing Instructions
The nature of the insulation calls for some precautions. For the items with a thermal adhesive bond-coat (K), the storage time is limited to 1 year at room temperature and 60 % relative humidity.

Order Data
Quantity, Designation, Supply Form e.g.:

The designation shall comprise:

For rectangular shape wire:	FL
Nominal dimension in mm:	2.24 x 5.00 mm
Conductor material:	Cu
Designation of the insulation:	Thermex 220 2Silix V180 Fine
Reel type: e.g.:	DIN 500

Example of complete order:

2000 kg FL TX220 G2 2Silix V180 F 2.24x5.00mm D500

		TX220 G2 1 or 2Silix V180 (K)	TX220 G2 1 or 2Silix VSi	Test standard
Mechanical properties				
Elongation at break / thickness up to 2.5 mm	%	≥ 30	≥ 30	IEC 60851-3 test 6
Elongation at break / thickness above 2.5 mm	%	≥ 32	≥ 32	IEC 60851-3 test 6
Springiness /diameter above 1.60 mm	°	≤ 5.5	≤ 5.5	IEC60851-3 test 7
Flexibility Flatwise bent on mandrel Ø 10 x thickness		no cracks	no cracks	IEC60851-3 test 8
Flexibility if width up to 10 mm Edgewise bent on mandrel Ø 7 x width		no cracks	no cracks	IEC60851-3 test 8
Flexibility if width above 10 mm Edgewise bent on mandrel Ø 8 x width		no cracks	no cracks	IEC60851-3 test 8
Adherence after elongation	10 %	no loss of adhesion	no loss of adhesion	IEC60851-3 test 8
Shear strength (for V180K only)	N/mm^2	≥ 3	na	Delle test 1.47.14
Electrical properties				
Breakdown voltage after bending 1Silix	V	≥ 2200	≥ 2200	IEC60851-5 test 13
Breakdown voltage after bending 2Silix	V	≥ 2400	≥ 2400	IEC60851-5 test 13
Thermal properties				
Heatshock 30 min / 180 °C if width up to 10 mm Edgewise mandrel Ø 9xwidth		no cracks		IEC60851-6 test 9
Heatshock 30 min / 200 °C if width up to 10 mm Edgewise mandrel Ø 9xwidth			no cracks	IEC60851-6 test 9
Heatshock 30 min / 180 °C if width above 10 mm Edgewise mandrel Ø 10xwidth		no cracks		IEC60851-6 test 9
Heatshock 30 min / 200 °C if width above 10 mm Edgewise mandrel Ø 10xwidth			no cracks	IEC60851-6 test 9
Thermal endurance	TI	180	200	NEMA MW 1000

Appearance
Slight color variations are raw material or process-related and have no influence on the technical properties of the wire