

# Fibre-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 enameled wires of rectangular cross section are insulated with a single or double covering of glass-yarn fibres (SILIX®), available in three different versions:

**V180:** impregnated with modified polyesterimide varnish.

**V180K:** impregnated with modified polyesterimide 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 mm<sup>2</sup>  
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 Dimensions (mm)			
	Glass Fibre Covering over Grade 2 enameled Conductor			
	Single Covering		Double Covering	
	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
<b>Mechanical properties</b>				
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 <sup>2</sup>	≥ 3	na	Delle test 1.47.14
<b>Electrical properties</b>				
Breakdown voltage after bending 1Silix	V	≥ 2200	≥ 2200	IEC60851-5 test 13
Breakdown voltage after bending 2Silix	V	≥ 2400	≥ 2400	IEC60851-5 test 13
<b>Thermal properties</b>				
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	Tl	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

The product properties set forth in this data sheet are based on the results of testing of typical material produced by the company Delle Fil SAS. Some variation in product properties is typical. Comments or suggestions relating to any subject other than product properties are offered only to call the end-user's or other person's attention to considerations which may be relevant in the independent determination of the use and/or manner of use of product. Delle Fil SAS does not claim or warrant that the use of its product will have the results described in this data sheet or that the information provided is complete, accurate or useful. The user should test the product to determine its properties and its suitability for the intended use. Delle Fil SAS expressly disclaims any liability for any damage, harm, injury, cost or expense to any person resulting directly or indirectly from that person's reliance on any information contained in this data sheet. Nothing contained in this data sheet constitutes representation or warranty as to any matter whatsoever. Delle Fil SAS makes no warranties whatsoever in this data sheet, expressed or implied, including any implied warranty or fitness for a particular use or purpose. Delle Fil SAS shall in no event be liable for incidental, exemplary, punitive or consequential damages.