

# Fiber-insulated wires

## VTV TX FL

- **Enameled flat copper wire insulated with a combination of mixed glass/polyester fibers and glass yarn**
- **Winding wire with excellent mechanical, thermal properties**
- **Temperature Index 180**

### General description

VTV TX FL wires are THERMEX®220 enameled wires of rectangular cross section which are insulated with a varnish impregnated covering of mixed glass/polyester yarn (inner layer) and glass yarn (outer layer). They can be supplied in a un-cured thermal adhesive version (V 180 K), or cured version (V 180).

### Application

- Stator and rotor windings for motors.
- Production of Roebel bars for generator stators.

### Conventional Types

Enameled flat copper wires, insulated with:

- 2 fine or reinforced impregnated covering layers

Cross section: 2 to 80 mm<sup>2</sup>  
 Width: 2 to 22 mm  
 Thickness: 1 to 6 mm.

The standard dimensions of the conductors (nominal dimension), the overall dimensions and the tolerances comply with the IEC standard 60317-0-2. Other standards or specifications are available upon request.

### Standards

There are no particular existing IEC standards for VTV-covered flat wires at today. 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

### Build Criteria Rectangular Wire

Bare conductor Width w	Max. increase in dimension (mm)	
	Fiber covering over Grade 2 enameled conductor	
	<b>VTV</b> (cured version)	
	<b>Fine</b>	<b>Reinforced</b>
w ≥ 2 mm	0.37 to 0.42	0.41 to 0.46

Bare conductor Width w	Max. increase in dimension (mm)			
	Fiber covering over Grade 2 enameled conductor			
	<b>VTV K</b> (thermal adhesive version)			
	<b>Fine</b>		<b>Reinforced</b>	
	Supply state	After pressing	Supply state	After pressing
w ≥ 2 mm	0.37 to 0.42	0.32 to 0.37	0.41 to 0.46	0.36 to 0.41

### Advantages

- Excellent thermal bonding properties
- Excellent mechanical properties (adhesion, flexibility)
- Enamel avoids the formation of "air bubbles" after using

### Processing Instructions

No special 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:

Shape of the wires: FL for flat  
 Description of the insulation: TX220 G2, VTV V180 Fine  
 Nominal dimension in mm: 2.24 x 5.00 mm  
 Reel type: e.g.: DIN 500

Example of complete order:

2000 Kg FL TX220 G2 VTV V180 F 2.24 x 5.00mm D500

	<b>TX220 G2 VTV V180 (K) Fine or Reinforced</b>		<b>Test standard</b>
<b>Mechanical properties</b>			
Elongation at break / thickness up to 2.5 mm	%	≥ 30	IEC 60851-3 test 6
Elongation at break / thickness above 2.5 mm	%	≥ 32	IEC 60851-3 test 6
Springiness /diameter above 1.60 mm	°	≤ 5.5	IEC60851-3 test 7
Flexibility Flatwise bent on mandrel Ø 9 x thickness		no cracks	IEC60851-3 test 8
Flexibility if width up to 10 mm Edgewise bent on mandrel Ø 6 x width		no cracks	IEC60851-3 test 8
Flexibility if width above 10 mm Edgewise bent on mandrel Ø 7 x width		no cracks	IEC60851-3 test 8
Adherence after elongation	20 %	no loss of adhesion	IEC60851-3 test 8
Shear strength (for V180K only)	N/mm <sup>2</sup>	≥ 4	Delle test 1.47.14
<b>Electrical properties</b>			
Breakdown voltage after bending	V	≥ 2400	IEC60851-5 test 13
<b>Thermal properties</b>			
Heat shock 30 min / 200 °C if width up to 10 mm Edgewise mandrel Ø 8 x width		no cracks	IEC60851-6 test 9
Heat shock 30 min / 200 °C if width above 10 mm Edgewise mandrel Ø 9 x width		no cracks	IEC60851-6 test 9
Thermal endurance	TI	180	NEMA MW 1000

**Appearance**

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

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