

# Technical Information

## VETRELAM<sup>â</sup> 402

Slot insulation laminates, sheets, strips, channel sections.

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**MATERIAL** A laminate reinforced with glass fabric, epoxy resin and aromatic polyamide fibre paper (PA).

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**GENERAL PROPERTIES** Good mechanical, electrical and thermal properties.

The mechanical strength of the material is supplied by the fibre-glass reinforced outer layers. The single, tough PA-paper layer substantially reduces the compressive and shear stresses caused by deformation.

This Vetrelam is a practically deformation-free insulating material, with good electrical, dielectrical, tracking resistant and thermal properties. It is odourless and extensively resistant to solvents.

Temperature class F - H

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**APPLICATION** Thin insulating material especially for use as slot insulation, slot liners, insulation between layers or conductors.

It is generally used for applications requiring high mechanical strength, thermal stability and security against electrical discharge.

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**SUPPLY**

**Channels and other sections**

The most common configurations are L- and U-Channels. Micafil 's own manufacturing technology does not limit the length. Any other geometry of sections is possible to meet individual customer requirements.

**Straightness and deflection**

Admissible tolerance 1 mm/m on an even surface. When checking with a straight edge (full length of component), slight pressure is acceptable provided, it does not cause distortion.

**Flatness and twist**

Waviness and/or twist of strips and channel sections is acceptable as long as they revert to flatness under their own weight or under slight pressure, when lying on an even surface (provided this does not cause further distortion).

**Surface**

Slot insulation components are normally supplied machined to drawing specifications. "As pressed" surfaces do not require varnishing.

**Testing of slot insulation**

In order to ensure maximum security against slot insulation failures, specimens of material and finished components are tested at regular intervals.

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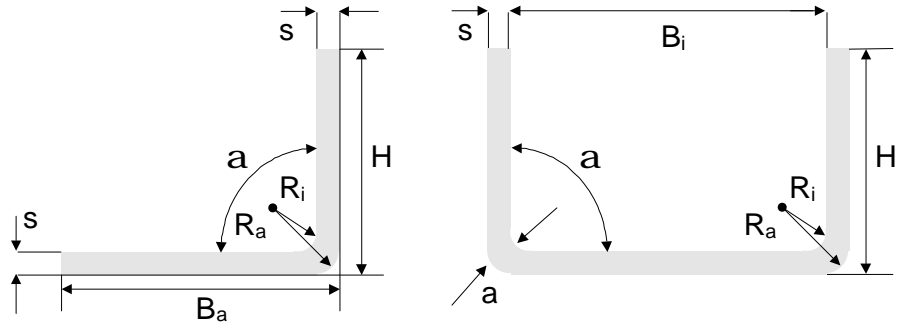
<b>STANDARDS</b>	VETRELAM 402 is not covered by any national or international standard specifications at the present time.
<b>MACHINABILITY</b>	VETRELAM 402 is easily sawn, parted and drilled. Material up to 1,5 mm thickness can be punched or stamped. Since glass fibre materials subject machining tools to considerable wear, very sharp hard metal tools or preferably diamond tools should be used. The material can be machined dry using a dust and chip vacuum extractor, or wet with a suitable cooling liquid.
<b>MACHINED PARTS</b>	Fabricated and styled according to customer's drawings. Optionally varnished (standard: clear).

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## DIMENSIONS

**Table 1: Standard Dimensions and Tolerances**

			L-sections		U-sections	
			Standard dimensions	Tolerance	Standard dimensions	Tolerance
Length	L	mm	≤12'000	± 1	≤12'000	± 1
Breadth	B	mm	20 - 250	± 0,1	15 - 50	± 0,1
Height	H	mm	5 - 50	± 0,1	5 - 150	± 0,1
Wall thickness	s	mm	0,5 - 2,5	± 0,1	0,5 - 2,5	± 0,1
Wall thickness a (curved part)	a	mm	a = s	+0,1/-0,2	a = s	+0,1/-0,2
Inside radius	R <sub>i</sub>	mm	3	± 0,2	1	± 0,2
Outside radius	R <sub>a</sub>	mm	R <sub>a</sub> = R <sub>i</sub> +s	+0,4/-0	R <sub>a</sub> = R <sub>i</sub> +s	+0,4/-0
Angle	α	°	90	± 2	90	± 2



**Table 2: Perpendicular test voltage application ⊥**

The test voltage at 50 Hz, 1 minute, is applied in perpendicular direction. The voltage level considers the shape and the surface of the slot insulation as well as the necessary flashover distances				
Test voltage 50 Hz, 1 Min	Thickness s in mm <sup>1)</sup>			
	≥ 0,5 - < 1,0	≥ 1,0 - < 1,2	≥ 1,2 - < 1,5	≥ 1,5 - < 2,0
L – Channel	10 kV * s	10 kV	12 kV	14 kV
U – Channel	9 kV * s	9 kV	10 kV	12 kV

<sup>1)</sup> For very short edges (one-sided) H = 3 to 10 mm, the test voltage should be reduced to 80% of flashover voltage. No side electrodes are used for this test.

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	Properties		Standards	Units	Values
<b>Composition</b>	Resin: Epoxy resin (EP)				
	Support: Glass fabric		ISO 1172	Mass %	50 ± 5
	Support: PA-fibrepaper *)				1 Lage (a)
	Bulk density		ISO 1183	g/cm <sup>3</sup>	1,50 - 1,75
	*) Nomex® 410 (a) Standard: 1 layer up to PA-paper thickness 0,51 mm; more layers possible				
<b>Electrical properties</b>	Electric strength ⊥	23 °C	IEC 243	kV/mm	20 - 35
	50 Hz, 1 Min., h = 1 mm	90 °C			
	Surface resistivity		IEC 93	MΩ	105 - 109
	Volume resistivity		IEC 93	MΩ · cm	106 - 109
	Dissipation factor tan δ	23 °C	IEC 250	-	0,04 - 0,08
	50 Hz	90 °C			
Relative permittivity ε <sub>r</sub>	23 °C	IEC 250	-	4,0 - 5,0	
50 Hz	90 °C				
	Comparative tracking index		IEC 112	CTI	200
<b>Mechanical properties</b>	Tensile strength		ISO 527	N/mm <sup>2</sup>	> 200
	Flexural strength		ISO 178	N/mm <sup>2</sup>	> 250
<b>Thermal properties</b>	Temperature class		IEC 85		F - H
	Linear thermal expansion (20 - 100°C)		DIN 52328	K <sup>-1</sup>	15 - 20 * 10 <sup>-6</sup>
	Thermal conductivity (20 - 100°C)	⊥	VDE 0304 T1	W/m K	0,25 - 0,35
	⊥ perpendicular to layers    parallel to layers				

*These properties have been determined by the above shown methods. The data given are valid for standard test specimen only.*

*Unless otherwise specified, all data were measured at ambient temperature. The contents of this publication are based on our present experience. They are an indication for application of our products without any liability for us. Notice of legal requirements and existing patent rights has to be taken.*

*Due to the many application and manufacturing process possibilities, we cannot give any warranty for the technical results in individual cases.*



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