



## ESL ELECTROSCIENCE

CERAMIC TAPES &  
THICK-FILM MATERIALS

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# INSULATING COMPOSITION

# 4931

**HOS Heaters on Steel<sup>®</sup> • COS Circuits on Steel<sup>®</sup> • TFOS Thick Film on Steel<sup>®</sup>**

**RoHS Compliant\***

Dielectric composition ESL 4931 is designed to insulate unabraded, unoxidised, ferritic steels. 4931 is non-porous and its TCE closely matches that of 430 S17 grade stainless steel. Three separately fired layers of 4931, having a minimum total thickness of 80 µm, provide excellent breakdown voltage between top conductive prints and the steel base. It is essential that the steel is only handled using protective gloves at all times in clean room conditions. ESL 9695 and 9501-CH terminations and ESL 29xxx resistors are recommended for use as the heating elements. 4931 is recommended as an 850°C overglaze. These materials are also useful in other TFOS (Thick Film on Steel)<sup>®</sup> applications.

## PASTE DATA

<b>Rheology:</b>	Thixotropic, screen-printable paste
<b>Viscosity:</b> (Brookfield RVT, 10 rpm, ABZ spindle, 25.5 ± 0.5 °C)	120 ± 20 Pa.s
<b>Colour:</b>	Green
<b>Shelf Life (20 - 25 °C):</b>	6 months

## PROCESSING

<b>Screen Mesh, Emulsion:</b>	165 S/S, 0 µm
<b>Levelling Time:</b>	5 - 10 min
<b>Drying Time (at 125 °C):</b> (dependent on substrate volume)	> 15 min
<b>Firing Temperature Range:</b>	850°C - 930 °C in air
	Optimum: 850 °C
	Time at peak: 10 min
<b>Total Firing Cycle:</b>	1 hour
<b>Substrate for Calibration:</b>	Unabraded, unoxidised 430 S17 122.5 mm diameter x 1.2 mm
<b>Thinner:</b>	ESL 401

ESL Europe 4931 0902-A

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See Caution and Disclaimer on other side.

## TYPICAL PROPERTIES

### **Fired Thickness:**

(of at least 3 layers between 9695 and 430 S17 stainless steel measured using an Elcometer 345 thickness gauge)

> 80  $\mu\text{m}$

### **Approximate Coverage:**

(80  $\mu\text{m}$  thickness)

40  $\text{cm}^2 / \text{g}$

### **Breakdown Voltage:**

(measured on a 88 mm diameter 9695 print on a 108 mm diameter area of dielectric at 25°C in air using a standard Clare Flash Tester)

5/5  $\geq 1800 \text{ V AC}$

### **Insulation Resistance:**

(measured on a 88 mm diameter 9695 print on a 108 mm diameter area of dielectric using 500 VDC at 25 °C in air)

>  $10^9 \Omega$

A wide range of ESL materials are compatible with 4931 permitting the fabrication of other COS (Circuits on Steel)<sup>®</sup>.

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\*None of the six substances referred to in the RoHS Directive (2002/95/EC) are used in the formulation of this product.

**CAUTION:** Proper industrial safety precautions should be exercised in using these products. Use with adequate ventilation. Avoid prolonged contact with skin or inhalation of any vapours emitted during use or heating of these compositions. The use of safety eye goggles, gloves or hand protection creams is recommended. Wash hands or skin thoroughly with soap and water after using these products. Do not eat or smoke in areas where these materials are used. Refer to appropriate MSDS sheet.

**DISCLAIMER:** The product information and recommendations contained herein are based on data obtained by tests we believe to be accurate, but the accuracy and completeness thereof is not guaranteed. No warranty is expressed or implied regarding the accuracy of these data, the results obtained from the use hereof, or that any such use will not infringe any patent. ElectroScience assumes no liability for any injury, loss, or damage, direct or consequential, arising out of its use by others. This information is furnished upon the condition that the person receiving it shall make his own tests to determine the suitability thereof for his particular use, before using it. User assumes all risk and liability whatsoever in connection with his intended use. ElectroScience's only obligation shall be to replace such quantity of the product proved defective.

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