



# ESL ELECTRO-SCIENCE

CERAMIC TAPES &  
THICK-FILM MATERIALS

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## INSULATING COMPOSITION

# 4924

**HOS Heaters on Steel® • COS Circuits on Steel® • TFOS Thick Film on Steel®**

### Cadmium, Lead, Nickel and Barium-Free\*

ESL 4924 is a dielectric composition designed to insulate unabraded, unoxidized, ferritic steels. The 4924 is non-porous and its TCE closely matches that of BS970/1449 Type 430-S17 or AISI Type 430 stainless steel. Three separately fired layers of 4924, having a total minimum thickness of 80 micrometers, provide excellent breakdown voltage between top conductive prints and the stainless steel base. It is essential that the stainless steel is only handled using protective gloves and that all printing is carried out in clean room conditions. With ESL 9695 or 9501-CH terminations and 29XXX Series resistors used as heating elements 4924 is recommended as an 850°C firing overglaze. These materials are also useful in other TFOS (Thick Film on Steel)® applications.

#### PASTE DATA

<b>RHEOLOGY:</b>	Thixotropic, screen printable paste
<b>VISCOSITY:</b> (Brookfield RVT, ABZ Spindle, 10 rpm, 25.5°C ± 0.5°C)	120 ± 20 Pa·s
<b>COLOR:</b>	Dark blue
<b>SHELF LIFE:</b> (25 °C)	6 months

#### PROCESSING

<b>SCREEN MESH/EMULSION:</b>	165 S/S, 0.0 µm
<b>LEVELING TIME:</b>	5-10 minutes
<b>DRYING AT 125 °C:</b> (Depending upon substrate volume)	> 15 minutes
<b>FIRING TEMPERATURE:</b>	850 °C to 930 °C
<b>OPTIMUM:</b>	850 °C
<b>TIME AT PEAK:</b>	10 minutes

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See Caution and Disclaimer on other side.

**SUBSTRATE FOR CALIBRATION:**

Unabraded, unoxidized 430 S17 stainless steel  
122.5 mm diameter x 1.2 mm

**THINNER:**

ESL 401

**TYPICAL PROPERTIES**

**FIRED THICKNESS:**

(At least 3 layers between 9695 and 430 S 17 stainless steel,  
measured using an Elcometer 345 thickness gauge)

> 80 μm

**BREAKDOWN VOLTAGE:**

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

>1800 VAC

**APPROXIMATE COVERAGE:** (80 μm thickness)

40 cm<sup>2</sup>/g

**INSULATION RESISTANCE:**

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

After storage at 93 % ± 2 % RH, 25 °C ± 2 °C for 48 hours

> 10<sup>9</sup> Ω

At 300 °C

> 10<sup>9</sup> Ω

A wide range of ESL materials are compatible with 4924 permitting the fabrication of other COS (Circuits on Steel)<sup>®</sup>.

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\* Complies with RoHS, ELV, WEEE and CHIP 3 EC directives

**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 vapors 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.

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