

## UHV-COMPATIBLE WIRE AND THERMOCOUPLES KW3, KW6, KW9 and KTK

### GENERAL CHARACTERISTICS OF POLYIMIDE INSULATED WIRE.

Polyimide has excellent dielectric and mechanical properties. It has good resistance to abrasion and is flexible at high and low temperatures. The outgassing performance is excellent and it loses adsorbed gas quickly during bakeout.

Polyimide covered wire is available in two basic forms: enamelled and film-wrapped. The enamelled wire has a thin coating and has the advantage of being radiation-resistant. The film-wrapped wire has much thicker insulation and is more suitable in applications where the wire is subjected to movement.

Polyimide is naturally gold to pale brown in the range of thicknesses used: no organic dyes are added. All products of this type are supplied cleaned for UHV use.

#### Common Data - all types

- ◆ Minimum bend radius 2mm
- ◆ Bakeable to 200°C. The insulation will remain intact up to 260°C but the outgassing performance may be permanently degraded.
- ◆ Minimum temperature <math> < 4.2^{\circ}\text{K}</math>. If used below 80°K the wire must not be allowed to flex, stretch or twist.
- ◆ Outgassing products CO and H<sub>2</sub>, <math> < 1 \times 10^{-12}</math> mBar litres sec<sup>-1</sup> metre<sup>-1</sup> at 70°C after a 12 hour bake at 200°C.

#### KW3

- ◆ Polyimide enamelled OFHC copper wire. 10 metre length.
- ◆ Wire diameter 0.295mm, overall 0.314 to 0.331mm
- ◆ Resistance 0.25 ohm metre<sup>-1</sup> at 20°C.
- ◆ Voltage rating 250V RMS.
- ◆ Withstands gamma irradiation > 1 x 10<sup>10</sup> Rad.

#### KW9

- ◆ Silver-plated OFHC copper wire with two wrapped helical films of polyimide. The polyimide is sealed to itself with a fluorinated ethylene copolymer. 10 metre length.
- ◆ Wire diameter 0.9mm, overall 1.10 to 1.17mm.
- ◆ Resistance 0.027 ohm metre<sup>-1</sup> at 20 °C.
- ◆ Voltage rating 600V RMS

#### KW6

- ◆ Silver-plated OFHC copper wire with two wrapped helical films of polyimide. The polyimide is sealed to itself with a fluorinated ethylene copolymer. 10 metre length.
- ◆ Wire diameter 0.6mm, overall 0.81 to 0.87mm.
- ◆ Resistance 0.06 ohm metre<sup>-1</sup> at 20 °C.
- ◆ Voltage rating 600V RMS

#### KTK

- ◆ Chromel/Alumel type K thermocouple with a wrapped helical film of polyimide on each wire. The polyimide is sealed to itself with a fluorinated ethylene copolymer. The thermocouple junction is exposed. Wires are twisted. Length 2 metres.
- ◆ Wire diameters 0.2mm, overall 0.4mm.
- ◆ Tolerance. Deviation <math> < 1^{\circ}</math> over -40°C to +230°C from BS4937 standard table.

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## APPLICATION INFORMATION

### Stripping.

Use of a rotary high speed stripper is recommended for all polyimide insulated wire. Thermal strippers are not suitable.

Film-wrapped wire may be stripped by rolling the wire under a sharp knife and removing the free cylinder of insulation. Care should be taken to avoid damage to the wire.

Lacquered wire may be stripped by abrading with silicon carbide paper.

### Use of Thermocouples

The thermocouple junction is exposed. Ensure that contact with any conducting surface does not present a source of error to any measuring or control device connected to the thermocouple. Most control equipment will be affected by any common mode voltage on the thermocouple so it is often necessary to isolate the junction. Alumina ceramic beads or plates are convenient for this purpose because they have high thermal conductivity and good electrical insulation properties.

Because the wires are identical in appearance they must be identified by other means. When the thermocouple junction is heated a positive voltage is generated on the Chromel wire with respect to the Alumel wire. The voltage is about  $40\mu\text{V } ^\circ\text{C}^{-1}$  so that a temperature increase of a many tens of degrees will be necessary for positive identification with a voltmeter. Alternatively, since Alumel is weakly magnetic it may be identified with a small permanent magnet.

Connect the thermocouple to the controller with compatible, screened or twisted wires. It is generally not worthwhile using a compatible-material feedthrough, due to the practical difficulty involved in making a joint on the vacuum side with entirely compatible materials. Ensure that the feedthrough pins used are as close together as is practical so that they are at the same temperature. This will cause the voltages generated by the additional, unwanted thermocouples at each end of the feedthrough pins to be small and to cancel each other. The typical error with these precautions taken is less than  $2^\circ\text{C}$ .

Avoid using spare pins on a multi-way feedthrough carrying high currents as these will heat the entire feedthrough and contribute to measurement errors. Large alternating voltages close to the thermocouple wires may affect the measuring device.

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Ordering information:	<b>KW3</b>	<b>0.3mm copper wire, polyimide-enamelled, 10m</b>
	<b>KW6</b>	<b>0.6mm copper wire, polyimide-wrapped, 10m</b>
	<b>KW9</b>	<b>0.9mm copper wire, polyimide-wrapped, 10m</b>
	<b>KTK</b>	<b>Type K thermocouple, polyimide-wrapped, 2m</b>

Longer lengths are available to special order

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