

## Flat heating elements

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### Basic values:

| Parameter        | Value            |
|------------------|------------------|
| Dimensions       | 14 x 14 x 4.5 mm |
| Heated area      | 14 x 14 x 4.5 mm |
| T <sub>max</sub> | 500 °C           |

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### Details of Standard:

#### Description

With the heating elements of the type CLB, highest surface performances and heating rates are achievable. The design in relation to Art. No. FLE 100 303 has a rated power of more than 230 W - with only 14 mm x 14 mm of base area! With this output capacity, the heating element can heat at more than 150 K/s. In this case, it is especially important to use appropriate control technology where the control speed can keep up with the heating element. Our control engineering experts will gladly advise you on this.

\* The actual power depends on resistance, temperature and voltage.

| Parameter             | Value       |             |
|-----------------------|-------------|-------------|
| Article no.           | FLE 100 034 | FLE 100 303 |
| Resistance @ 20 °C    | 15 Ω ±25 %  | 10 Ω ±25 %  |
| Nominal voltage       | 48 V        | 48 V        |
| Nominal power @ 20 °C | 153.6 W*    | 230.4 W*    |

## Basic Material

| Parameter                                           | Scale unit                       | Si <sub>3</sub> N <sub>4</sub> |
|-----------------------------------------------------|----------------------------------|--------------------------------|
| max. temperature (T <sub>max</sub> )                | °C                               | 1 000                          |
| thermal conductivity (l)                            | W/mK                             | 40                             |
| temperature shock resistance (ΔT)                   | K                                | 500                            |
| emissivity (1 100 °C) (ε)                           | -                                | 0.96                           |
| Young's modulus (E)                                 | GPa                              | 320                            |
| bending strength (δ <sub>BB</sub> )                 | MPa                              | 400                            |
| compressive strength (δ <sub>D</sub> )              | MPa                              | 2 000                          |
| coefficient of thermal expansion (α)                | 10 <sup>-6</sup> K <sup>-1</sup> | 3                              |
| density (g)                                         | g/cm <sup>3</sup>                | 3.21                           |
| specific heat (c <sub>p</sub> )                     | J/kgK                            | 750                            |
| porosity (100 - % t.D.)                             | %                                | 0                              |
| critical stress intensity factor (K <sub>IC</sub> ) | MPa m <sup>1/2</sup>             | 6                              |
| Weibull - modulus (m)                               | -                                | 7.9                            |

The thermal shock resistance depends on the geometric shape of the heater.

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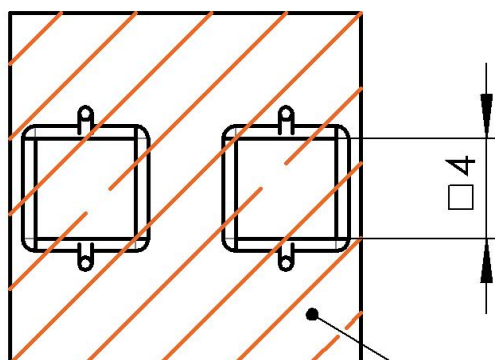
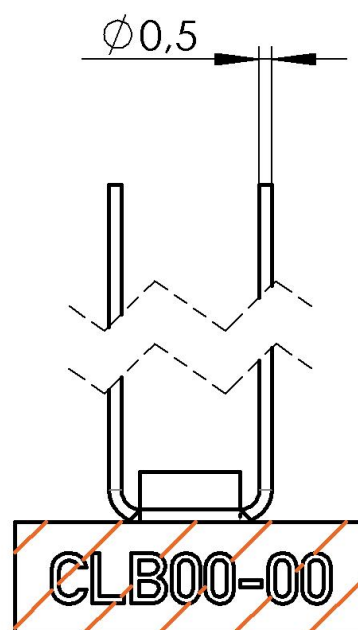
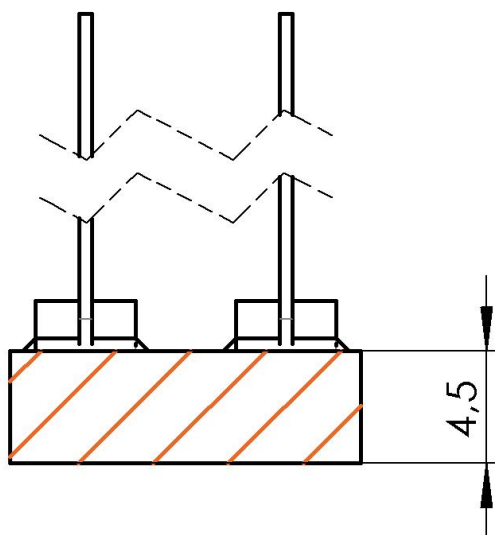
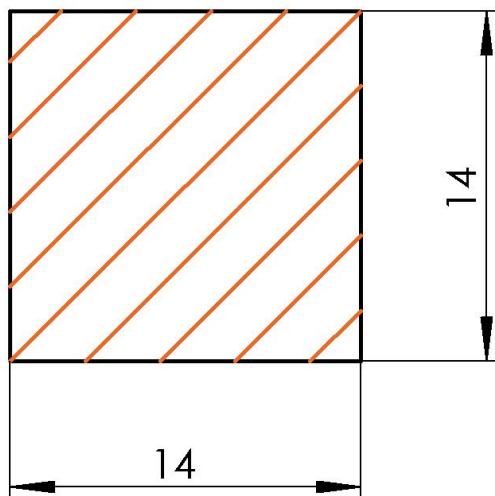
## Electrical parameters

| Parameter             | Scale unit   | Si <sub>3</sub> N <sub>4</sub>              |
|-----------------------|--------------|---------------------------------------------|
| resistivity           | Ω cm         | 5 · 10 <sup>-3</sup> - 5 · 10 <sup>-1</sup> |
| isolation resistivity | Ω mm (20 °C) | 10 <sup>13</sup>                            |
| dielectric strength   | kV/mm        | 25                                          |

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## Emission spectrum

Fully ceramic heating elements are long-wave infrared heaters with a maximum emission of 5 to 10 μm and a radiation coefficient of ε > 0.9.



max. 500 °C

