CeramTec

MATERIAL DATA

MACHINERY

Advanced Ceramics for
Thermocouples, RTDs and
Special Applications

# Tubes & Insulators

THE CERAMIC EXPERTS

# Advanced Ceramic materials

*CeramTec manufactures tubes with different diameters and a standard maximum length of 2200 mm (greater upon request).*

Mostly drawn to meet specific customer requirements our manufactured protection tubes and insulators are primarily used within the industry of temperature measurement and control technology. CeramTec manufactures ceramic tubes for a wide range of applications. Technical ceramics manufactured by us meet the most stringent specifications and high accuracy standards.

With more than a century of experience in development and production to draw upon, CeramTec has established itself as one of the world's top companies in the field of advanced ceramics. The current portfolio consists of many different products, servicing the electrical and mechanical industries with a variety of ceramic materials.

**PORMULIT® C 530** is a porous material composed of aluminum oxide and silicon oxide ($Al_2Or$-$SiO_2$). It offers excellent thermal shock resistance and is widely used in applications involving high temperature gradients, as well as for pyrometer protection sleeves.

**DIMULIT® C 610** is a composite material based on aluminium oxide and silicon oxide ($Al_2Or$-$SiO_2$). The material is defined by its mineralogical raw material mixture; the proportion of $Al_2O_3$ and $SiO_2$ with other additives and the resultant component after sintering. These compounds provide high strength, good thermal shock resistance and high temperature resistance.

**RUBALIT® C 799** is a highly dense technical oxide ceramic characterized by high hardness and strength, combined with excellent temperature stability. Its high corrosion and wear resistance make the material ideal for use in a wide range of chemical applications.

| Materials* | | | | |
|---|---|---|---|---|
| **PORMULIT® C 530** | Silicate / $Al_2O_3$ | 70.0% $Al_2O_3$ | Porous | Max. 1500°C |
| **DIMULIT® C 610** | Mullite / $Al_2O_3$ | 60.0% $Al_2O_3$ | Dense | Max. 1400°C |
| **RUBALIT® C 799** | Aluminum Oxide | 99.7% $Al_2O_3$ | Dense | Max. 1700°C |

**PORMULIT® C 530**

- Manufactured in accordance with DIN VDE 0335
- Suitable for operating temperatures up to 1400 °C
- Good temperature stability and adequate chemical resistance
- Excellent thermal shock resistance
- High resistance to chemical attack
- High electrical insulation
- Refractory material suitable for custom forming and moulding

**DIMULIT® C 610**

- In accordance with standards DIN VDE 0335
- Suitable for operating temperatures of less than 1400 °C
- Very good temperature stability and chemical resistance
- Low thermal expansion
- Good thermal shock resistance
- Good mechanical strength
- Economical material for use on temperature measurement applications

**RUBALIT® C 799**

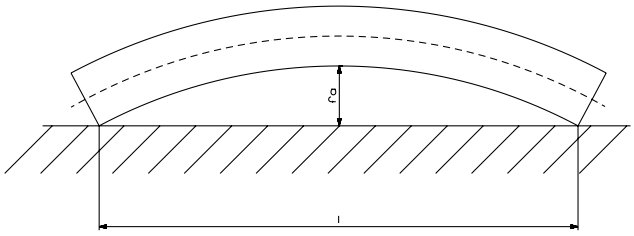
- In accordance with DIN VDE 0335
- Suitable for operating temperatures up to 1700 °C
- Recommended for extremely corrosive environments
- High mechanical strength
- High electrical resistivity
- $Al_2O_3$ content > 99.7%

# Manufacturing Tolerances Data

The manufacturing tolerances of CeramTec are in accordance with DIN 40 680. The table on this page indicates CeramTec's standard tolerances for unground ceramic tubes (mm). Tighter tolerances are subject to individual agreement.

| Length mm | Straightness Tolerances [Fa] in mm |
|---|---|
| up to 30 | +/- 0.15 |
| over 30 to 40 | +/- 0.20 |
| over 40 to 50 | +/- 0.25 |
| over 50 to 60 | +/- 0.30 |
| over 60 to 70 | +/- 0.35 |
| over 70 to 80 | +/- 0.40 |
| over 80 to 90 | +/- 0.45 |
| over 90 to 100 | +/- 0.50 |
| over 100 to 110 | +/- 0.55 |
| over 110 to 125 | +/- 0.60 |
| over 125 to 140 | +/- 0.70 |
| over 140 to 155 | +/- 0.80 |
| over 155 to 170 | +/- 0.85 |
| over 170 to 185 | +/- 0.90 |
| over 185 to 200 | +/- 1.00 |
| over 200 to 250 | +/- 1.25 |
| over 250 to 300 | +/- 1.50 |
| over 300 to 350 | +/- 1.75 |
| over 350 to 400 | +/- 2.00 |
| over 400 to 450 | +/- 2.25 |
| over 450 to 500 | +/- 2.50 |
| over 500 to 600 | +/- 3.00 |
| over 600 to 700 | +/- 3.50 |
| over 700 to 800 | +/- 4.00 |
| over 800 to 900 | +/- 4.50 |
| over 900 to 1.000 | +/- 5.00 |
| over 1.000 | +/- 0.5% x length |

| Diameter mm | Diameter Tolerances in mm |
|---|---|
| up to 4,0 | +/- 0.15 |
| over 4 to 6 | +/- 0.20 |
| over 6 to 8 | +/- 0.25 |
| over 8 to 10 | +/- 0.30 |
| over 10 to 13 | +/- 0.35 |
| over 13 to 16 | +/- 0.40 |
| over 16 to 20 | +/- 0.45 |
| over 20 to 25 | +/- 0.55 |
| over 25 to 30 | +/- 0.55 |
| over 30 to 35 | +/- 1.30 |
| over 35 to 40 | +/- 1.33 |
| over 40 to 45 | +/- 1.35 |
| over 45 to 50 | +/- 1.65 |




*Over 1.000 +/- 0.5% x length (mm).*

*Standard Pyrometric Tubes, Insulating Rods and Tubes*

### Camber

The standard camber of ceramic tubes in accordance with DIN 40 680 is 0.5 % of the total length. Modern production methods, as well as continuous in-process control, enable CeramTec to exceed the standard camber values.

### Extruded ceramic sheaths and tubes

Various forms and shapes of extruded parts are available from CeramTec's product range. Different customer requirements demand varied tools designed for their specific applications. Ceramic insulating rods for thermocouples in accordance with EN 50113 are available with and without slots.

## Rubalit Two Bore Insulators

| No. of bores | | ØID | | ØOD |
|---|---|---|---|---|
| 2 | x | 0.2 | x | 1 |
| 2 | x | 0.3 | x | 1 |
| 2 | x | 0.33 | x | 1.15 |
| 2 | x | 0.3 | x | 1.2 |
| 2 | x | 0.35 | x | 1.2 |
| | x | 0.3 | x | 1.4 |
| 2 | x | 0.4 | x | 1.5 |
| 2 | x | 0.45 | x | 1.55 |
| 2 | x | 0.33 | x | 1.6 |
| 2 | x | 0.4 | x | 1.6 |
| 2 | x | 0.45 | x | 1.7 |
| 2 | x | 0.33 | x | 1.8 |
| 2 | x | 0.7 | x | 2 |
| 2 | x | 0.5 | x | 2.2 |
| 2 | x | 0.7 | x | 2.2 |
| 2 | x | 0.7 | x | 2.3 / 1.4 |
| 2 | x | 0.7 | x | 2.5 |
| 2 | x | 0.5 | x | 2.6 |
| 2 | x | 0.8 | x | 2.7 |
| 2 | x | 0.7 | x | 2.8 |
| 2 | x | 0.8 | x | 2.8 |
| 2 | x | 0.7 | x | 3.0 / 1.5 |
| 2 | x | 0.8 | x | 3 |
| 2 | x | 0.8 | x | 3.0 / 1.5 |
| 2 | x | 0.8 | x | 3 |
| 2 | x | 0.8 | x | 3.0 / 1.5 |
| 2 | x | 1 | x | 3.0 / 2.0 |
| 2 | x | 1 | x | 3.2 |
| 2 | x | 0.8 | x | 3.5 |
| 2 | x | 1 | x | 3.5 |
| 2 | x | 0.8 | x | 4 |
| 2 | x | 1 | x | 4 |
| 2 | x | 1 | x | 4.0 / 2.7 |
| 2 | x | 1.2 | x | 4 |
| 2 | x | 1.2 | x | 4.5 |
| 2 | x | 1.2 | x | 4.5 / 2.75 |
| 2 | x | 1.5 | x | 4.5 |
| 2 | x | 1.3 | x | 4.8 |
| 2 | x | 1.2 | x | 5 |
| 2 | x | 1.5 | x | 5 |
| 2 | x | 1.2 | x | 5.5 |
| 2 | x | 1.8 | x | 6 |
| 2 | x | 2 | x | 6 |
| 2 | x | 1.6 | x | 8 |
| 2 | x | 1.5 | x | 8.5 |
| 2 | x | 1.8 | x | 8.5 |
| 2 | x | 0.15 | x | 0.75 |
| 2 | x | 0.38 | x | 1 |
| 2 | x | 0.45 | x | 1.5 |
| 2 | x | 0.8 | x | 5 |
| 2 | x | 1.5 | x | 5.5 |
| 2 | x | 1.8 | x | 5.5 |
| 2 | x | 1.5 | x | 8 |
| 2 | x | 0.8 | x | 2.3 / 1.4 |

## Rubalit Four Bore Insulators

| No. of bores | | ØID | | ØOD |
|---|---|---|---|---|
| 4 | x | 0.55 / 0.48 | x | 2 |
| 4 | x | 0.5 | x | 2.2 |
| 4 | x | 0.55 | x | 2.2 |
| 4 | x | 0.6 | x | 2.6 |
| 4 | x | 0.8 | x | 2.6 |
| 4 | x | 0.7 | x | 2.8 |
| 4 | x | 0.8 | x | 2.8 |
| 4 | x | 0.7 | x | 3 |
| 4 | x | 0.8 | x | 3 |
| 4 | x | 0.8 | x | 3.2 |
| 4 | x | 0.8 | x | 3.5 |
| 4 | x | 1 | x | 3.5 |
| 4 | x | 0.7 | x | 3.8 |
| 4 | x | 0.7 | x | 4 |
| 4 | x | 0.8 | x | 4 |
| 4 | x | 1 | x | 4 |
| 4 | x | 1.2 | x | 4 |
| 4 | x | 0.7 | x | 4.5 |
| 4 | x | 1 | x | 4.5 |
| 4 | x | 1.2 | x | 4.5 |
| 4 | x | 1.2 | x | 4.5 |
| 4 | x | 0.7 | x | 4.6 |
| 4 | x | 1.5 | x | 4.8 |
| 4 | x | 1 | x | 5 |
| 4 | x | 1.2 | x | 4.5 |
| 4 | x | 1.2 | x | 4.5 |
| 4 | x | 0.7 | x | 4.6 |
| 4 | x | 1.5 | x | 4.8 |
| 4 | x | 1 | x | 5 |
| 4 | x | 1.2 | x | 5 |
| 4 | x | 1.5 | x | 5 |
| 4 | x | 1.2 | x | 5.2 |
| 4 | x | 1.2 | x | 5.5 |
| 4 | x | 1.5 | x | 5.5 |
| 4 | x | 1.3 | x | 5.8 |
| 4 | x | 1.3 | x | 5.8 |
| 4 | x | 1.8 | x | 5.8 |
| 4 | x | 1.2 | x | 6 |
| 4 | x | 1.5 | x | 6 |
| 4 | x | 1.6 | x | 6 |
| 4 | x | 1.5 | x | 6.5 |
| 4 | x | 1.8 | x | 6.5 |
| 4 | x | 1.8 | x | 8 |
| 4 | x | 2 | x | 8 |
| 4 | x | 2.2 | x | 8 |
| 4 | x | 2.5 | x | 8 |
| 4 | x | 1.5 | x | 8.5 |
| 4 | x | 1.8 | x | 8.5 |
| 4 | x | 2.5 | x | 8.5 |
| 4 | x | 2.5 | x | 9 |
| 4 | x | 2.5 | x | 10 |
| 4 | x | 3 | x | 10 |
| 4 | x | 2.8 | x | 10.5 |

## Available sizes & lengths of DIMULIT® C 610 tubes

| DIMULIT® C 610 protection tube sizes & length up to | 2 Bore tubes size & length up to | 4 Bore tubes size & length up to | Both Ends open tubes size & length up to | Oval tubes size & length up to |
|---|---|---|---|---|
| 5 x 8 x 1100 | 2 x 0.5 x 2.2 x 1320 | 4 x 0.5 x 2.2 x 1320 | 1 x 2 x 1320 | 2 x 4 x 8 / 12 x 1320 |
| 5 x 8 x 1500 | 2 x 0.8 x 2.8 x 1320 | 4 x 0.8 x 3 x 1320 | 2 x 4 x 1320 | 2 x 2.5 x 4 / 7 x 50 |
| 6 x 10 x 600 | 2 x 1.2 x 4 x 1500 | 4 x 1 x 3.5 x 1320 | 4 x 6 x 1100 | 2 x 3.5 x 6.5 / 11.5 x 50 |
| 6 x 10 x 1500 | 2 x 1.2 x 4.5 x 1320 | 4 x 1.2 x 4.5 x 1500 | 5 x 8 x 1100 | |
| 7 x 10 x 530 | 2 x 1.5 x 4 x 1320 | 4 x 1.2 x 5 x 1320 | 10 x 16 x 2400 | |
| 7 x 10 x 740 | 2 x 2 x 6 x 1320 | 4 x 1.5 x 5 x 1320 | 30 x 40 x 1250 | |
| 7 x 10 x 1500 | 2 x 2.5 x 8.5 x 1320 | 4 x 1.5 x 8.5 x 2100 | As well as protection tube sizes | |
| 7 x 10 x 2030 | | 4 x 1.8 x 6.5 x 1320 | | |
| 8 x 12 x 1060 | | 4 x 2.2 x 8 x 1500 | | |
| 8 x 12 x 1500 | | 4 x 2.5 x 8.5 x 2100 | | |
| 9 x 13 x 1100 | | 4 x 2.8 x 10.5 x 50 | | |
| 9 x 13 x 1500 | | 4 x 1.2 x 4.5 x 1500 longitudinal grooves | | |
| 10 x 15 x 1100 | | 4 x 1.2 x 4.5 x 1500 longitudinal grooves | | |

*Six and more bore tubes are available on request.*

## Ceramic sheaths and tubes for thermo elements in accordance with EN 50113

| PORMULIT® C 530 | | DIMULIT® C 610 | | RUBALIT® C 799 | |
|---|---|---|---|---|---|
| Ø Inside | Ø Outside | Ø Inside | Ø Outside | Ø Inside | Ø Outside |
| - | - | 4 | 6 | 4 | 6 |
| - | - | 5 | 8 | 5 | 8 |
| - | - | 6 | 10 | 6 | 10 |
| 7 | 10 | 7 | 10 | 7 | 10 |
| - | - | 8 | 12 | 8 | 12 |
| - | - | 9 | 13 | 9 | 13 |
| 10 | 16 | 10 | 15 | 10 | 15 |
| - | - | 11 | 15 | 11 | 15 |
| 12 | 16 | 12 | 16 | 12 | 16 |
| - | - | 13 | 17 | 13 | 17 |
| 12 | 20 | 15 | 20 | 15 | 20 |
| - | - | - | - | 16 | 21 |
| 18 | 26 | 19 | 24 | 18 | 24 |
| - | - | - | - | 20 | 25 |

*Max. available standard length 2200 mm, greater upon request. All of the above tubes are available as closed one end (coe), open both ends (obe), customized geometries optional. Customized tolerance can be made on request.*

*Special tailormade geometries*

| RUBALIT® C 799 | | RUBALIT® C 799 | | DIMULIT® C 610 | |
|---|---|---|---|---|---|
| Ø Inside* | Ø Outside* | Ø Inside | Ø Outside | Ø Inside | Ø Outside |
| 6 / 10 | 12 / 16 | 6 | 13 | 6 | 13 |
| 10 / 10 | 15 / 15 | 6 | 15 | 6 | 15 |
| - | - | 8 | 17 | 8 | 17 |
| - | - | 9 | 20 | 9 | 20 |

** Dimensions refer to the rectangular tubes*

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THE CERAMIC EXPERTS

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