Alumina tube and crucible care

Issued 24 October 2026. Heating rates, insertion, cleaning and maximum temperatures as published by the makers and standards named on each line. Each figure is that source's, for its own equipment or ware. Run the program approved for your part, furnace and load.

Heating and cooling rates

Maker	Applies to	Limit
Carbolite Gero	Optional ceramic work tubes in the TF range	**5 °C/min**
Carbolite Gero	Ceramic work tubes, heating or cooling (TZF manual)	**400 ÷ ID in mm, °C/min**
Nabertherm	C 799 and C 610 work tubes below 120 mm OD / from 120 mm	**300 K/h / 200 K/h (5 / 3.3 K/min)**
Deltech	Any ceramic process tube	**100 °C/h (1.7 °C/min)**
Deltech (McDanel sheet)	Ceramic furnace tubes, to reduce the risk	**60 °C/h (1 °C/min)**
CoorsTek	High-alumina labware, heating or cooling	**150 °C/h (2.5 °C/min)**
Almath	Larger alumina crucibles, heating and cooling	**5 °C/min**

Carbolite: maximum heating or cooling rate in °C/min = 400 ÷ tube inner diameter in mm. Ceramic tubes are more brittle below 900 °C, so push loads in slowly.

Deltech: gradients are worst where the tube passes through the furnace wall; fix the tube at one end only. Carbolite: tubes that extend beyond the heated zone are more at risk. End plugs or radiation shields cut the gradient.

Protection tubes into a hot furnace

Dry the tube first. Thermo-Kinetics pre-heats ceramic tubes to about 400 °C to drive off moisture.

WIKA: pre-heat C 799 tubes before installation, then insert them slowly. Bending forces on horizontal C 799 tubes are damaging, so support them.

C 799 tube, OD × ID (mm)	DIN 43724 test insertion rate
10×6	**100 cm/min**
15×10	**50 cm/min**
24×18	**1 cm/min**

Insertion rate in the DIN 43724 thermal shock test (furnace at the tube's maximum continuous temperature), as tabled by Morgan Haldenwanger. A test condition, not an installation speed.

Crucibles: heating and handling

- CoorsTek: high-alumina labware at no more than 150 °C per hour, heating or cooling. Use an oven or hot plate as an intermediate step, and never set hot ware on a cold surface.
- Almath: pre-heat larger crucibles and heat and cool them at no more than 5 °C/min; small ones usually take faster rates.
- Almath: stand the crucible on a plate of the same material, at least 25 mm (better 50 mm) from the heating elements.
- Almath: leave room for the charge to expand, and don't stack crucibles inside each other.

Cleaning a crucible

1. Let the crucible cool under your process instructions. Identify the previous charge and residue before handling it or adding water.
2. Check the wall, base and rim for cracks or chips. Keep a damaged crucible out of the next heating run (Almath).
3. Loose residue that tolerates water: mild soap, remove the loose solids, rinse with water (Iowa State TGA procedure).
4. Organic residue: NETZSCH discusses furnace burn-off, and warns that oxide fillers can react with alumina.
5. Metal residue: identify the metal and use a laboratory-approved method for it. Don't choose an acid from appearance alone.
6. Fused deposits: some oxide deposits react with the ceramic and can't be removed (NETZSCH). Replace the crucible.
7. No HF: it attacks alumina. Don't copy a method written for platinum pans (NETZSCH).
8. Record the previous contents, cleaning method and inspection. Run a blank before the next sample if your method calls for one.

Maximum temperature by grade

Grade or part	°C	Whose figure
GY Alumina corundum, 99% Al_2O_3 and up	**1,600–1,800**	GY Alumina material table; confirmed per part
GY Alumina high-alumina ceramic, >85% Al_2O_3	**1,300–1,450**	GY Alumina material table; confirmed per part
Class C 799 (alumina, >99% Al_2O_3)	**1,400–1,700**	Brevier, DIN EN 60672: max. use temperature
Class C 795 (alumina, 95–99% Al_2O_3)	**1,400–1,500**	Brevier, DIN EN 60672: max. use temperature
Class C 786 (alumina, 86–95% Al_2O_3)	**1,400**	Brevier, DIN EN 60672: max. use temperature
Class C 610 (mullite, 50–65% Al_2O_3)	**1,200**	Brevier, DIN EN 60672: max. use temperature
C 799 protection tube, continuous	**1,600**	DIN 43724 table (Morgan)
C 610 protection tube, continuous	**1,400**	DIN 43724 table (Morgan)
C 530 protection tube, continuous	**1,350**	DIN 43724 table (Morgan)
C 799 with alkali vapour or melting glass	**1,500**	DIN 43724 guideline (Morgan)
C 799 furnace work tube in air / under vacuum	**1,800 / 1,400**	Nabertherm
Alumina tube, maximum / vacuum only below	**1,800 / 1,500**	MTI
Melting point of aluminium oxide	**2,054**	ILO/WHO ICSC 0351

Each figure is the named source's for its own material, part or test. Our parts are C799 alumina (99.5% Al_2O_3) as standard. In air our tubes are used up to 1,750 °C hanging vertically and 1,650 °C lying horizontally, and our crucibles up to 1,650 °C.

Full guides with every source linked: Thermal shock guide / Crucible cleaning guide / Maximum temperature guide / All free tools and charts

Sources: Carbolite Gero: TF tube furnace range data sheet · Carbolite Gero: TZF 12/38/850 operating instructions, section 4.6 (ceramic work tubes), from carbolite.com downloads · Nabertherm: Laboratory Furnaces catalogue, working tubes table (pages 56–57) · Deltech Furnaces: furnace ramp rates · Deltech Furnaces: About ceramic furnace tubes (adapted from a McDanel application sheet) · CoorsTek: Labware catalog (high-alumina labware heating and cooling rate) · Almath Crucibles: alumina crucible instructions, handling with care · WIKA data sheet TE 65.80, thermocouples with ceramic protection tube · Thermo-Kinetics: Protection Tubes catalogue (ceramic tubes, moisture and preheating) · Morgan Advanced Materials Haldenwanger: Ceramic tubes brochure (working temperatures; DIN 43724 sheath tube table, pages 12–13) · NETZSCH: Recommendations for Cleaning Al_2O_3 and Pt Crucibles · Iowa State University: TGA alumina crucible cleaning procedure · Brevier Technische Keramik (Verband der Keramischen Industrie), Table 41: properties by DIN EN 60672 class · MTI Corporation: setup and use tips for tubes and vacuum flanges · ILO/WHO International Chemical Safety Card 0351: aluminium oxide (melting point).