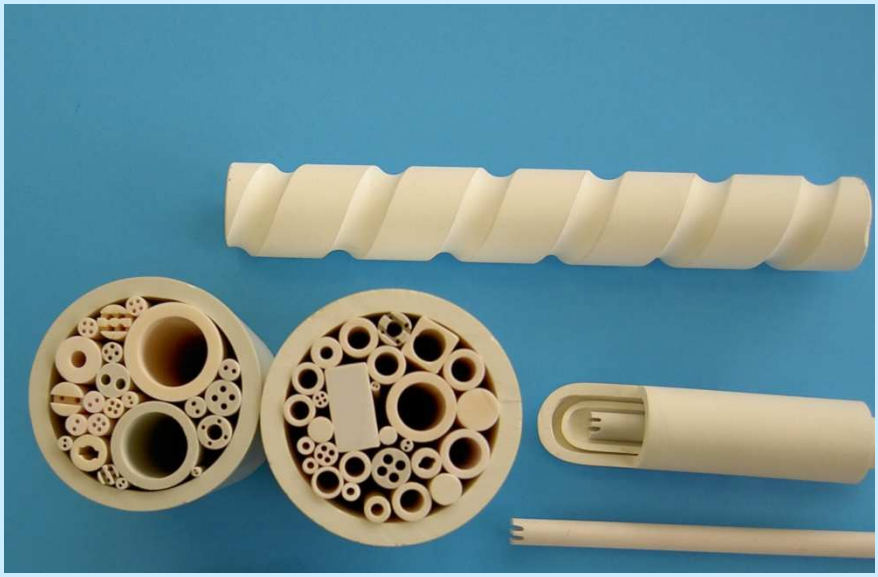
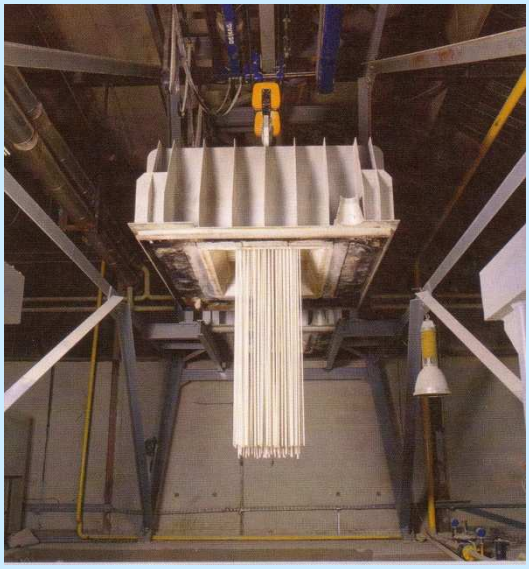
CERAMIC TUBES AND INSULATORS





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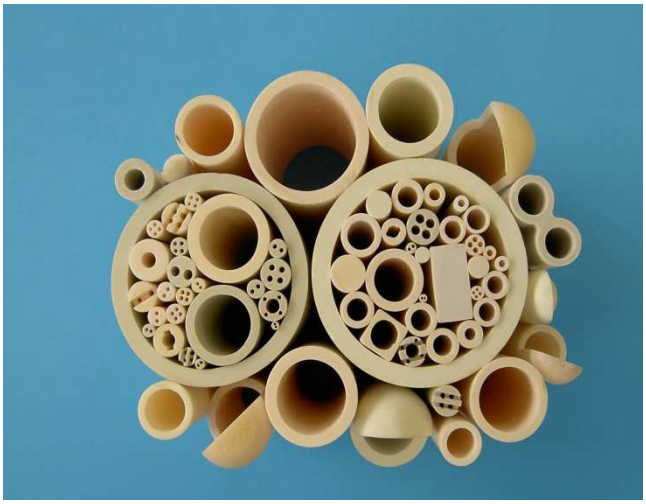
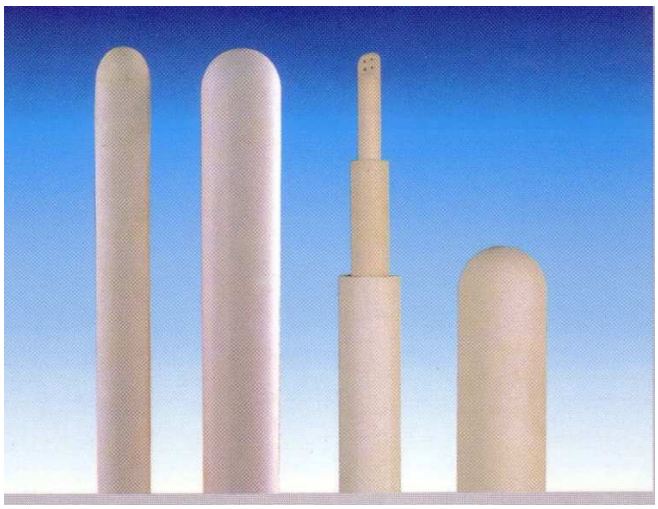
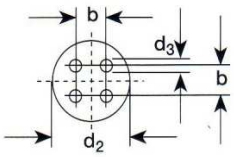




PROPERTY	UNIT	ALUMINA CERAMIC			
Typical application		Tubes for thermoelements resistant to thermal stresses	-insulating tubes for thermoelements -Protection tubes -Insulating rods	-Protection tubes -Insulation rods	-Tubes for thermoelements -Protection tubes -Insulating rods -Tubes for chemical process applications
Type to DIN 40685		**C 530**	**C 610**	**C 795**	**C 799**
Al_2O_3 - content	%	78	62	95	99,7
Specific gravity	g/cm^3	2,5	2,7	3,68	3,82
Water absorption	%	8 - 12	0	0	0
Hardness	Mohs	6	8	9	9
Modulus of elasticity	GPa		100	280	300
Flexural strenght	N/mm^2	30	120	280	300
Coefficient of linear expansion **20-100 °C** **20-300 °C** **20-600 °C** **20-1000 °C**	x10 $^{-6}$/° C	 3,5 - 5 3,5 - 5 4 - 6 4 - 7	 5 – 6 5 – 6 5 – 7 5 - 7	 5 – 7 6 – 7,5 6 – 8 7 - 9	 5 – 7 6 – 8 7 – 8 7 - 9
Specific heat (20 – 100) °C	J/KgK	800 - 900	850 - 1050	850 - 1050	850 - 1050
Thermal conductivity	W/mK	1,4 - 2	4 - 6	16 - 28	19 – 30
Maximum thermal stress	K	350	150	140	150
Dialectric strenght	KV/mm		17	15	17
Max. Temp. use	°C	1500	1500	1550	1650
Chemical resistivity		satisfactory	good	good	very good
Thermal shock resistance		very good	medium to good	medium	medium

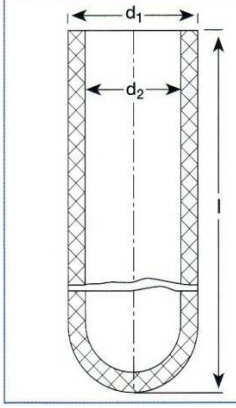
The maximum application temperature depends on the material. The application temperature is also influenced by the tube geometry, the diameter, the wall thickness and the method of application.

Measurements for ceramic tubes and insulators for thermoelements according to DIN 43724 and DIN 43725



Materials for insulation rods
C 610 or C 799
DIN EN 60672

4-bore insulation rods according to DIN 43725			Wire Ø	1-bore insulation rods according to DIN 43725			Wire Ø
Outer Ø (d_2) in mm	Bore Ø (d_3) in mm	Length in mm	Ø in mm	Outer Ø (d_1) in mm	Inner Ø in mm	Length in mm	Ø in mm
5.5	1.2	205 275 380 560 770	≤ 0.8	2.7 ± 0.2	1.7	10, 25, 50	1.0 and 1.38
				4.0 ± 0.3	2.0	10, 25, 50	1.38
8.5	1.5	1060 1460 2060	≤ 0.8	6.0 ± 0.3	4.0	10, 25, 50	3.0

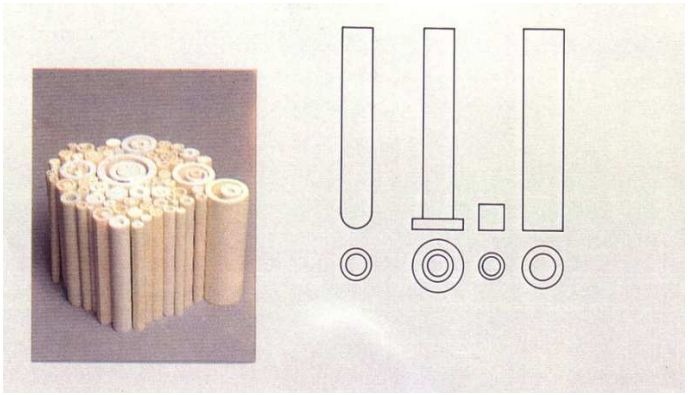


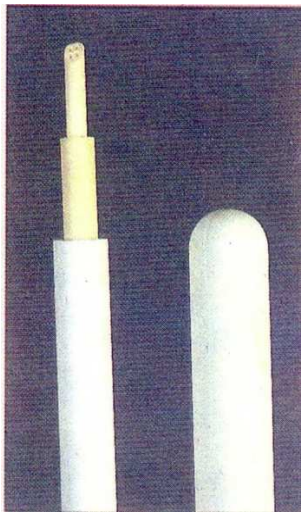
Ceramic tubes DIN 43724

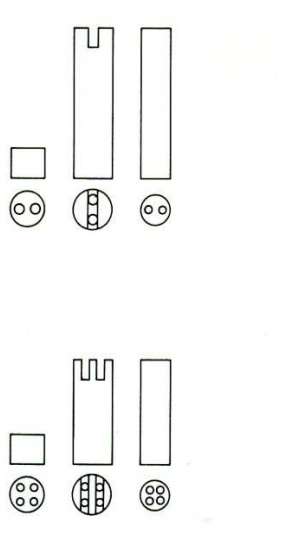
DIN EN 60672	Outer Ø (d_1) in mm	Inner Ø (d_2) in mm	Length (L) in mm	Thermal shock resistance	Permeability	Max. permissible continuous temp.
C 610	10	7	200, 270, 375, 530, 740, 1030, 1430, 2030	medium to good	gastight	1500 C
	15	11	530, 740, 1030, 1430, 2030			
	24	19	530, 740, 1030, 1430, 2030			
C 530	26	18	530, 740, 1030, 1430, 2030	very good	porous	1500 C
C 799	8	5	200, 270, 375, 530, 740, 1030, 1430, 2030	medium	gastight	1650 C
	10	6	200, 270, 375, 530, 740, 1030, 1430, 2030			
	15	10	530, 740, 1030, 1430, 2030			
	24	18	530, 740, 1030, 1430, 2030			

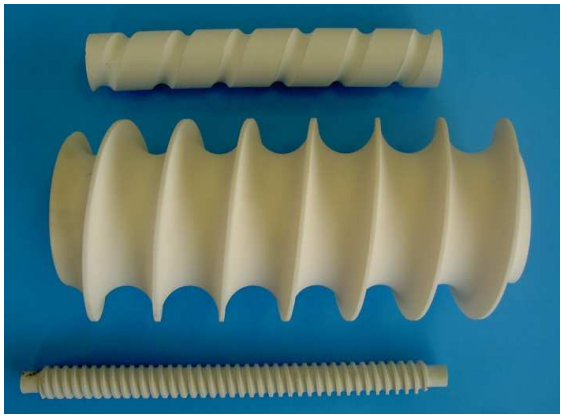
In this table there are mentioned some standard dimensions for tubes and isolators.

We can produce all other lengths, up to max 2100 mm, and other diameter from 2 mm to max 50 mm









Diameter tolerances - deflectional tolerances

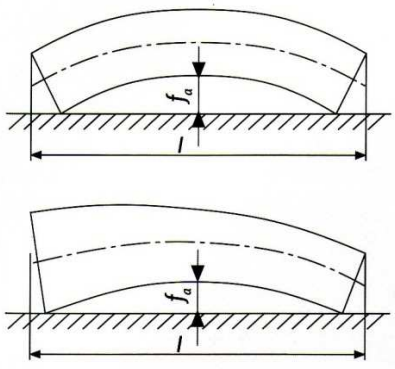
without grinding to DIN 40 680,

Nominal dimensional range for diameter or length in mm				Degree of accuracy coarse Permissible deviation in mm	Degree of accuracy medium Permissible deviation in mm
	up to	4		± 0.4	± 0.15
above	4	up to	6	± 0.6	± 0.20
above	6	up to	8	± 0.7	± 0.25
above	8	up to	10	± 0.8	± 0.30
above	10	up to	13	± 1.0	± 0.35
above	13	up to	16	± 1.2	± 0.40
above	16	up to	20	± 1.2	± 0.45
above	20	up to	25	± 1.5	± 0.50
above	25	up to	30	± 1.5	± 0.55
above	30	up to	35	± 2.0	± 0.60
above	35	up to	40	± 2.0	± 0.65
above	40	up to	45	± 2.0	± 0.70
above	45	up to	50	± 2.5	± 0.80
above	50	up to	55	± 2.5	± 0.90
above	55	up to	60	± 2.5	± 1.00
above	60	up to	70	± 3.0	± 1.20
above	70	up to	80	± 3.5	± 1.40
above	80	up to	90	± 4.0	± 1.60
above	90	up to	100	± 4.5	± 1.80
above	100	up to	110	± 5.0	± 2.00
above	110	up to	125	± 5.5	± 2.20
above	125	up to	140	± 6.0	± 2.50
above	140	up to	155	± 6.5	± 2.80
above	155	up to	170	± 7.0	± 3.00
above	170	up to	185	± 7.5	± 3.40
above	185	up to	200	± 8.0	± 3.80
above	200	up to	250	± 9.0	± 4.20
above	250	up to	300	± 10.0	± 4.60
above	300	up to	350	± 11.0	± 5.00
above	350	up to	400	± 12.0	± 5.50
above	400	up to	450	± 13.0	± 6.10
above	450	up to	500	± 14.0	± 6.80
above	500	up to	600	± 15.0	± 7.60
above	600	up to	700	± 16.0	± 8.30
above	700	up to	800	± 17.5	± 9.00
above	800	up to	900	± 19.0	± 9.50
above	900	up to	1000	± 20.0	± 10.00
above	1000			± 0.02 × D	± 0.01 × D

Nominal dimensional range for length in mm				Degree of accuracy coarse Permissible deflection f_a in mm	Degree of accuracy medium Permissible deflection f_a in mm
	up to	30		± 1.7	± 0.15
above	30	up to	40	± 1.8	± 0.20
above	40	up to	50	± 1.9	± 0.25
above	50	up to	60	± 2.0	± 0.30
above	60	up to	70	± 2.1	± 0.35
above	70	up to	80	± 2.1	± 0.40
above	80	up to	90	± 2.2	± 0.45
above	90	up to	100	± 2.3	± 0.50
above	100	up to	110	± 2.4	± 0.55
above	110	up to	125	± 2.5	± 0.65
above	125	up to	140	± 2.6	± 0.70
above	140	up to	155	± 2.7	± 0.80
above	155	up to	170	± 2.9	± 0.85
above	170	up to	185	± 3.0	± 0.90
above	185	up to	200	± 3.1	± 1.00
above	200	up to	250	± 3.5	± 1.25
above	250	up to	300	± 3.9	± 1.50
above	300	up to	350	± 4.3	± 1.75
above	350	up to	400	± 4.7	± 2.00
above	400	up to	450	± 5.1	± 2.25
above	450	up to	500	± 5.5	± 2.50
above	500	up to	600	± 6.3	± 3.00
above	600	up to	700	± 7.1	± 3.50
above	700	up to	800	± 7.9	± 4.00
above	800	up to	900	± 8.7	± 4.50
above	900	up to	1000	± 9.5	± 5.00
above	1000			± 1.5 + 0.8 % × L	± 0.5 % × L

Manufacturing method	Degree of accuracy coarse	medium
Cast and extruded for parts Ø 30 mm and above	application customary	
extruded for parts up to Ø 30 mm		application customary

Accuracy	coarse			medium		
DIN VDE 0335, Type	530	610	799	530	610	799
Manufacturing method						
cast, extruded Ø 30 mm and above	•	•	•			
extruded up to Ø 30 mm				•	•	•



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