

t-ceramics

Advanced Technical Ceramics

ZIRCONIA TOUGHENED ALUMINA (ZTA) CRUCIBLES

Max. Usable Temperature 1600 °C

Description.

Zirconia Toughened Alumina (ZTA) is a composite ceramic with excellent mechanical properties and a very attractive performance to price ratio. It is produced by the addition of Zirconia to the main Alumina matrix before sintering.

The main advantages of Zirconia Toughened Alumina (ZTA) over Alumina are that provides additional strength, fracture toughness, elasticity, hardness, and wear resistance for temperatures below 1500 C, and has fairly improved thermal shock resistance. Also ZTA crucibles exhibit better surface finish than Alumina making them an excellent choice for bio-compatible and analytical grade application. The mechanical robustness compared to Alumina is attributed to the phase transformation of the metastable tetragonal Zirconia grains when the material is stressed. The stress concentration at a crack tip can cause a transformation from a tetragonal crystal structure to a monoclinic one, which has an associated volume expansion of Zirconia. This volume expansion effectively pushes back the propagation of the crack and results in higher toughness and strength.

Thermansys **t-ceramics ZTA** crucibles are offered without significant additional cost compared to pure Alumina crucibles, retaining its prices much lower than Fully Yttria Stabilized Zirconia (8YSZ), while have improved some of the properties where Yttria Stabilized Zirconia outbalance Alumina. Thus ZTA crucibles are presenting a cost effective alternative to YSZ for temperatures up to 1500C. Thermansys is producing a broad range of analytical grade, crystallized, dense Zirconia Toughened Alumina crucibles in various sizes and forms. Custom solutions available upon request.

Applications.

Analytical applications, metals melting, ceramic powders heat treatment, material acid treatment even at elevated temperature, crucibles for annealing, crucibles for fusion processes, crucibles for crystal growing, crucibles for extremely corrosive environments. Other common application is dental Zirconia restorations sintering.

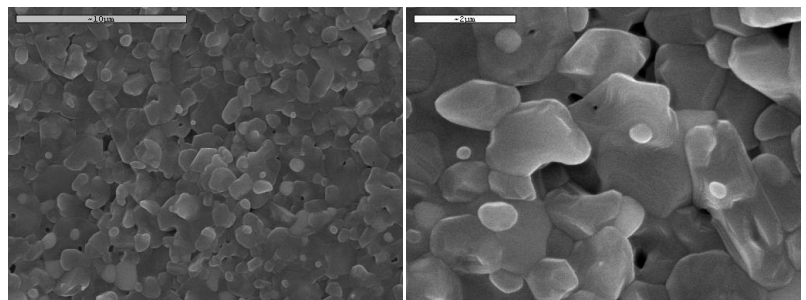


Available shapes

- Dishes (Round Shallow)
- Conical (Tapered Wall)
 - Classic Form
 - Cylindrical
 - Rectangular
 - Lids
- Custom Shapes

Chemical Composition.

• Al ₂ O ₃ % wt	84.6
• ZrO ₂ + HfO ₂ % wt.	9.7
• SiO ₂ % wt	5.6
• Fe ₂ O ₃ % wt	0.03
• TiO ₂ % wt	0.02
• Na ₂ O % wt	0.10



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Properties.

• Max. Operating Temperature, °C.....	1600	• Dielectric Strength, AC-KV/mm.....	9.0
• Porosity, % vol.	<0.5	• Dielectric Constant, 1 MHz.....	11.0
• Density, gr/cm ³	3.6	• Compressive Strength, MPa.....	2900
• Color.....	White	• Flexural Strength, MPa.....	450
• Thermal Conductivity at 20°C, W/mK....	27	• Elastic Modulus, GPa.....	-
• Thermal Conductivity at 800°C, W/mK...	-	• Shear Modulus, GPa.....	-
• Coefficient of Thermal Expansion, 10 ⁻⁶ /°C	8.3	• Hardness, kg/mm ²	-

NOTE: The values listed on properties table above are intended to illustrate typical material properties. Property values vary with size, and shape of part. The material properties values contained herein should not be construed as absolute or engineering data and does not constitute a representation or warranty for which Thermansys assumes legal responsibility.

Heating and Cooling Suggestions.

Recrystallized Alumina crucibles have moderate sensitivity to thermal shock.

Heat up: Warm up the furnace chamber gradually. Heating rate of 4-6 °C per minute is recommended for the first 1-2 hours to reduce the impact of thermal shock. Maximum recommended heating rate 10 °C per minute.

Cool down: Lower the temperature as gradually as possible. Recommended cooling down rate should be retained below 10 °C per minute. It is better to remove the crucibles from the hot zone only if the temperature drops below 100 °C. When taking the crucibles out of furnace and bring them into room temperature to pour the melted material try to make the process as gradual as possible. A better practice is after pouring the melted metal to restore the crucible back into the furnace and leave it cool down inside the furnace.

Atmosphere - Chemical Compatibility - Corrosion.

Zirconia Toughened Alumina (ZTA) crucibles can be used at high temperature under oxidizing (air), reduced, or inert (Nitrogen, Argon) conditions with no restriction. Can also be used under vacuum conditions.

Zirconia Toughened Alumina crucibles have very good chemical resistance against diluted or concentrated Acids (with the exception of hydrofluoric acid and phosphoric acid), Alkalis, Melted Metals and Halogens. Like Alumina, ZTA is insoluble in water and has negligible solubility in strong acid and alkaline solutions. The low chemical solubility of ZTA ceramics components makes them highly resistant to chemical corrosion. The almost zero porosity and excellent smoothness of Thermansys crucibles surface prevents chemical attack. Generally, Zirconia Toughened Alumina crucibles have similar behavior with Alumina concerning chemical compatibility. It should be noted however that ZTA can, like the Yttria Stabilized Zirconia, be vulnerable to chemisorption in the presence of water molecules but this effect is much reduced compared with YSZ. However use in moist environments at temperatures above 250C also must be carefully considered.

Chemical erosion of ceramic materials is not easy to be measured and determined in a way that will lead to accurate and represented scientific data for all shapes and sizes.

Health and Safety.

Our ceramic materials, as it is delivered, do not contain substances dangerous to health, or create them during use. They are produced using natural inert raw materials. Any organic binder or other substances used during manufacturing are burned through production firing. Thermansys however cannot guarantee that ceramic crucibles exposed to conditions that could produce residual material or create material transformations retain its health and safety properties upon reuse.

The product at its final delivery form is fully dense and do not produce dust during normal handling and operation. However, if the customer desire to proceed with further product processes like cutting or drilling inert dust might be created. Workers therefor should be provided with suitable dust protection equipment.

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Standard Crucible Delivery Forms and Dimensions Tables.

Tables below are listing dimensions and capacity data for all standard shapes and sizes that are available from Thermansys. All data quoted are nominal values. Dimensional tolerances in the order of $\pm 3\%$ are apply to all our products.

Special shape or size Alumina engineering ceramics are available upon request. Thermansys can provide a detailed quote even for low volume order. Please send as a detailed drawing of the desired product and we will provide you with a quote.

Conical Form

t-ceramics ZTA Conical crucibles are available in three forms:

- Tall Form with *Top I.D.* $\cong 0.6 \times$ Internal Height
- Balanced Form with *Top I.D.* \cong Internal Height
- Short Form with *Top I.D.* $\cong 2 \times$ Internal Height

Custom sizes available upon request



Conical Tall Form

Capacity (ml)	Top O.D. (mm)	Top I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
0.4	10	8	1	13	CZTA-CO-T 0.4	3.5
1.0	12	10	1	16	CZTA-CO-T 1.0	4.8
1.8	14	12	1	20	CZTA-CO-T 1.8	5.9
4.2	19	16	1.5	26	CZTA-CO-T 4.2	8.3
8.2	23	20	1.5	33	CZTA-CO-T 8.2	11.2
16	28	25	1.5	42	CZTA-CO-T 16	15.2
28	33	30	1.5	50	CZTA-CO-T 28	19.8
48	40	36	2	60	CZTA-CO-T 48	25.8
76	48	42	3	70	CZTA-CO-T 76	32.3
130	56	50	3	84	CZTA-CO-T 130	42.2
196	64	58	3	94	CZTA-CO-T 196	51.9
268	70	64	3	106	CZTA-CO-T 268	60.8
350	76	70	3	116	CZTA-CO-T 350	69.7
488	84	78	3	130	CZTA-CO-T 488	82.5
564	89	82	3.5	136	CZTA-CO-T 564	88.9
750	98	90	4	150	CZTA-CO-T 750	102.8
1024	110	100	5	166	CZTA-CO-T 1024	120.6

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Conical Balanced Form

Capacity (ml)	Top O.D. (mm)	Top I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
0.3	10	8	1	8	CZTA-CO-B 0.3	3.2
0.7	12	10	1	10	CZTA-CO-B 0.7	4.2
1.2	14	12	1	12	CZTA-CO-B 1.2	5.1
2.8	19	16	1.5	16	CZTA-CO-B 2.8	7.0
5.5	23	20	1.5	20	CZTA-CO-B 5.5	9.4
11	28	25	1.5	25	CZTA-CO-B 11	12.6
18	33	30	1.5	30	CZTA-CO-B 18	16.2
32	40	36	2	36	CZTA-CO-B 32	21.1
50	48	42	3	42	CZTA-CO-B 50	26.3
85	56	50	3	50	CZTA-CO-B 85	34.2
133	64	58	3	58	CZTA-CO-B 133	42.7
178	70	64	3	64	CZTA-CO-B 178	49.5
234	76	70	3	70	CZTA-CO-B 234	56.8
299	84	78	3	78	CZTA-CO-B 299	64.3
375	89	82	3.5	82	CZTA-CO-B 375	72.2
496	97	90	3.5	90	CZTA-CO-B 496	83.2
680	108	100	4	100	CZTA-CO-B 680	97.8
906	120	110	5	110	CZTA-CO-B 906	113.3

Conical Short Form

Capacity (ml)	Top O.D. (mm)	Top I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
0.8	19	16	1.5	8	CZTA-CO-S 0.8	4.4
3.0	23	20	1.5	10	CZTA-CO-S 3.0	7.2
5.0	27	24	1.5	12	CZTA-CO-S 5.0	9.0
12	36	32	2	16	CZTA-CO-S 12	13.3
24	46	40	3	20	CZTA-CO-S 24	18.4
46	56	50	3	25	CZTA-CO-S 46	25.2
79	66	60	3	30	CZTA-CO-S 79	32.9
136	78	72	3	36	CZTA-CO-S 136	43.2
216	90	84	3	42	CZTA-CO-S 216	54.5
366	107	100	3.5	50	CZTA-CO-S 366	71.3
571	124	116	4	58	CZTA-CO-S 571	89.4
767	138	128	5	64	CZTA-CO-S 767	104.0
1004	150	140	5	70	CZTA-CO-S 1004	119.4

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Cylindrical Form

t-ceramics ZTA Cylindrical crucibles are available in three forms:

- Tall Form with $I.D. \cong 0.6 \times \text{Internal Height}$
- Balanced Form with $I.D. \cong \text{Internal Height}$
- Short Form with $I.D. \cong 2 \times \text{Internal Height}$

Custom sizes available upon request



Cylindrical Tall Form

Capacity (ml)	O.D. (mm)	I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
0.7	10	8	1	13	CZTA-CY-T 0.7	4.1
1.3	12	10	1	17	CZTA-CY-T 1.3	5.3
2.3	14	12	1	20	CZTA-CY-T 2.3	6.6
5.4	19	16	1.5	27	CZTA-CY-T 5.4	9.7
10.5	23	20	1.5	33	CZTA-CY-T 10.5	13.3
20	28	25	1.5	42	CZTA-CY-T 20	18.5
35	33	30	1.5	50	CZTA-CY-T 35	24.5
61	40	36	2	60	CZTA-CY-T 61	32.6
97	48	42	3	70	CZTA-CY-T 97	41.6
164	56	50	3	83	CZTA-CY-T 164	55.0
255	64	58	3	97	CZTA-CY-T 255	69.8
343	70	64	3	107	CZTA-CY-T 343	81.9
449	76	70	3	117	CZTA-CY-T 449	94.7
621	84	78	3	130	CZTA-CY-T 621	112.9
721	89	82	3.5	137	CZTA-CY-T 721	122.4
954	98	90	4	150	CZTA-CY-T 954	142.5
1308	110	100	5	167	CZTA-CY-T 1308	169.3

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Cylindrical Balanced Form

Capacity (ml)	O.D. (mm)	I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
0.4	10	8	1	8	CZTA-CY-B 0.4	3.5
0.8	12	10	1	10	CZTA-CY-B 0.8	4.3
1.4	14	12	1	12	CZTA-CY-B 1.4	5.3
3.2	19	16	1.5	16	CZTA-CY-B 3.2	7.7
6.3	23	20	1.5	20	CZTA-CY-B 6.3	10.4
12	28	25	1.5	25	CZTA-CY-B 12	14.4
21	33	30	1.5	30	CZTA-CY-B 21	18.9
37	40	36	2	36	CZTA-CY-B 37	25.0
58	48	42	3	42	CZTA-CY-B 58	31.8
98	56	50	3	50	CZTA-CY-B 98	41.9
153	64	58	3	58	CZTA-CY-B 153	53.1
206	70	64	3	64	CZTA-CY-B 206	62.2
269	76	70	3	70	CZTA-CY-B 269	71.8
373	84	78	3	78	CZTA-CY-B 373	85.6
433	89	82	3.5	82	CZTA-CY-B 433	92.8
572	97	90	3.5	90	CZTA-CY-B 572	108.0
785	108	100	4	100	CZTA-CY-B 785	128.2
1045	120	110	5	110	CZTA-CY-B 1045	149.8

Cylindrical Short Form

Capacity (ml)	O.D. (mm)	I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
1.6	19	16	1.5	8	CZTA-CY-S 1.6	5.7
3.1	23	20	1.5	10	CZTA-CY-S 3.1	7.6
5.4	27	24	1.5	12	CZTA-CY-S 5.4	9.7
13	36	32	2	16	CZTA-CY-S 13	14.7
25	46	40	3	20	CZTA-CY-S 25	20.6
49	56	50	3	25	CZTA-CY-S 49	29.1
85	66	60	3	30	CZTA-CY-S 85	38.8
146	78	72	3	36	CZTA-CY-S 146	51.8
233	90	84	3	42	CZTA-CY-S 233	66.4
393	107	100	3.5	50	CZTA-CY-S 393	88.0
613	124	116	4	58	CZTA-CY-S 613	112.1
823	138	128	5	64	CZTA-CY-S 823	131.5
1077	150	140	5	70	CZTA-CY-S 1077	152.3

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Classic Form

t-ceramics ZTA Classic Form crucibles are available in two forms:

- Balanced Form with $I.D. \cong 1.04 \times \text{Internal Height}$
- Short Form with $I.D. \cong 0.55 \times \text{Internal Height}$

Custom sizes available upon request



Classic Balanced Form

Capacity (ml)	Top O.D. (mm)	Top I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
5.5	23	20	1.5	21	CZTA-HF-B 5.5	9.6
12	29	25	2	26	CZTA-HF-B 12	13.9
17	34	30	2	31	CZTA-HF-B 17	16.5
27	40	35	2.5	36	CZTA-HF-B 27	20.7
45	45	40	2.5	42	CZTA-HF-B 45	26.8
80	56	50	3	52	CZTA-HF-B 80	36.0
132	66	60	3	63	CZTA-HF-B 132	46.8
210	76	70	3	73	CZTA-HF-B 210	59.7
310	86	80	3	83	CZTA-HF-B 310	73.3
440	97	90	3.5	94	CZTA-HF-B 440	88.2
600	107	100	3.5	104	CZTA-HF-B 600	104.0
700	112	105	3.5	109	CZTA-HF-B 700	112.9
815	118	110	4	115	CZTA-HF-B 815	122.5
1000	128	118	5	123	CZTA-HF-B 1000	136.6

Classic Short Form

Capacity (ml)	Top O.D. (mm)	Top I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
22	45	40	2.5	22	CZTA-HF-S 22	18.7
46	56	50	3	28	CZTA-HF-S 46	27.1
78	66	60	3	33	CZTA-HF-S 78	35.6
125	76	70	3	39	CZTA-HF-S 125	45.5
184	86	80	3	44	CZTA-HF-S 184	55.7
262	97	90	3.5	50	CZTA-HF-S 262	67.0
356	107	100	3.5	55	CZTA-HF-S 356	78.8
476	118	110	4	61	CZTA-HF-S 476	92.0
625	128	120	4	66	CZTA-HF-S 625	106.3
800	138	130	4	72	CZTA-HF-S 800	121.2
1000	150	140	5	77	CZTA-HF-S 1000	136.6

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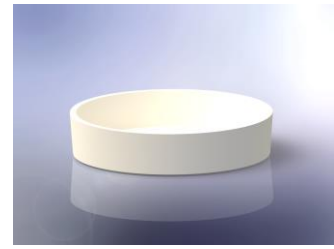
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Dishes (Round Shallow Form)

t-ceramics ZTA Dishes are available in one form:

- Round shallow crucibles with $I.D. \cong (3 \text{ to } 5) \times \text{Internal Height}$

Custom sizes available upon request



Dishes

Capacity (ml)	O.D. (mm)	I.D. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
1.9	23	20	1.5	6	CZTA-DH- 1.9	6.1
5.7	33	30	1.5	8	CZTA-DH- 5.7	10.1
13	44	40	2	10	CZTA-DH- 13	14.9
24	56	50	3	12	CZTA-DH- 24	20.5
40	66	60	3	14	CZTA-DH- 40	26.9
62	76	70	3	16	CZTA-DH- 62	34.1
90	86	80	3	18	CZTA-DH- 90	41.9
127	96	90	3	20	CZTA-DH- 127	50.4
173	107	100	3.5	22	CZTA-DH- 173	59.5
228	117	110	3.5	24	CZTA-DH- 228	69.3
294	128	120	4	26	CZTA-DH- 294	79.6
371	138	130	4	28	CZTA-DH- 371	90.6
462	148	140	4	30	CZTA-DH- 462	102.1
565	160	150	5	32	CZTA-DH- 565	114.2
683	170	160	5	34	CZTA-DH- 683	126.8
817	182	170	6	36	CZTA-DH- 817	140.0
966	192	180	6	38	CZTA-DH- 966	153.7

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Rectangular Form

t-ceramics ZTA rectangular crucibles are available in two forms:

- Square Form with *Length. \cong Width*
- Oblong Form with *Length. \cong 1.5 x Width*

Custom sizes available upon request



Rectangular Square Form

Capacity (ml)	Length Int. (mm)	Width Int. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
4.0	20	20	2	10	CZTA-RC-S 4.0	8.7
18	40	40	2	14	CZTA-RC-S 17.6	19.4
51	60	60	2	18	CZTA-RC-S 51	35.5
111	80	80	3	22	CZTA-RC-S 111	55.8
204	100	100	3	26	CZTA-RC-S 204	80.1
339	120	120	3	30	CZTA-RC-S 339	108.1
523	140	140	4	34	CZTA-RC-S 523	139.9
764	160	160	4	38	CZTA-RC-S 764	175.2
1068	180	180	4	42	CZTA-RC-S 1068	214.0

Rectangular Oblong Form

Capacity (ml)	Length Int. (mm)	Width Int. (mm)	Wall Th. (mm)	Height Int. (mm)	Part No.	Price (Euro)
2.7	20	13	1.5	10	CZTA-RC-O 2.7	7.1
13	40	24	1.5	14	CZTA-RC-O 13.4	16.7
39	60	36	2	18	CZTA-RC-O 39	30.4
84	80	48	3	22	CZTA-RC-O 84	47.7
156	100	60	3	26	CZTA-RC-O 156	68.3
259	120	72	3	30	CZTA-RC-O 259	92.2
400	140	84	3	34	CZTA-RC-O 400	119.2
584	160	96	3	38	CZTA-RC-O 584	149.3
816	180	108	4	42	CZTA-RC-O 816	182.3
1104	200	120	4	46	CZTA-RC-O 1104	218.2

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Boats

t-ceramics ZTA boats are available in two forms:

- With tail and hole (*Length. \cong Width*)
- Without tail and hole (*Length. \cong Width*)

Custom sizes available upon request



Boats with Tail and Hole

Capacity (ml)	Length Int. (mm)	Width Int. (mm)	Height Int. (mm)	Wall Th. (mm)	Part No.	Price (Euro)
4.5	40	14	8	2	CZTA-BT-T 4.5	13.3
6.7	60	14	8	2	CZTA-BT-T 6.7	16.2
9.0	80	14	8	2	CZTA-BT-T 9	18.7
11	100	14	8	2	CZTA-BT-T 11	21.1
12	110	14	8	2	CZTA-BT-T 12	22.2
10	60	14	12	2	CZTA-BT-T 10	19.9
13	80	14	12	2	CZTA-BT-T 13	23.3
17	100	14	12	2	CZTA-BT-T 17	26.4
18	110	14	12	2	CZTA-BT-T 18	27.9
20	120	14	12	2	CZTA-BT-T 20	29.3
32	100	20	16	2	CZTA-BT-T 32	38.5
38	120	20	16	2	CZTA-BT-T 38	43.0
45	140	20	16	2	CZTA-BT-T 45	47.3
62	120	26	20	3	CZTA-BT-T 62	58.2
73	140	26	20	3	CZTA-BT-T 73	64.1

Boats without Tail and Hole

Capacity (ml)	Length Int. (mm)	Width Int. (mm)	Height Int. (mm)	Wall Th. (mm)	Part No.	Price (Euro)
4.5	40	14	8	2	CZTA-BT 4.5	12.3
6.7	60	14	8	2	CZTA-BT 6.7	14.5
9.0	80	14	8	2	CZTA-BT 9	16.4
11	100	14	8	2	CZTA-BT 11	18.1
12	110	14	8	2	CZTA-BT 12	18.9
10	60	14	12	2	CZTA-BT 10	17.3
13	80	14	12	2	CZTA-BT 13	19.7
17	100	14	12	2	CZTA-BT 17	21.9
18	110	14	12	2	CZTA-BT 18	23.0
20	120	14	12	2	CZTA-BT 20	24.0
32	100	20	16	2	CZTA-BT 32	30.2
38	120	20	16	2	CZTA-BT 38	33.2
45	140	20	16	2	CZTA-BT 45	36.0
62	120	26	20	3	CZTA-BT 62	43.0
73	140	26	20	3	CZTA-BT 73	46.8

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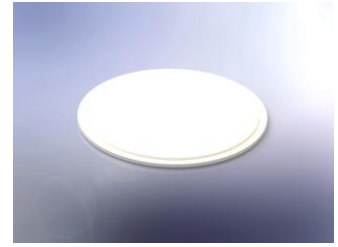
Lids

t-ceramics ZTA Lids are available for Conical, Cylindrical and Classic Form Crucibles.

Match the Crucible's Top I.D. value with Lid Fit Diameter.

For example: Lid with Part No. **CZTA-LD-C70** having Fit diameter 70mm is suitable for use with crucibles with I.D. 70mm, e.g. **CZTA-CY-T 449**

Custom sizes available upon request



Lids (For Conical, Cylindrical and Classic Form Crucibles)

Fit Diameter (mm)	Outside Diameter (mm)	Height Int. (mm)	Part No.	Price (Euro)
8	10	2.0	CZTA-LD-C 8	3.2
10	12	2.0	CZTA-LD-C 10	3.5
12	14	2.0	CZTA-LD-C 12	3.9
16	19	2.0	CZTA-LD-C 16	4.8
20	23	2.0	CZTA-LD-C 20	5.6
25	28	2.0	CZTA-LD-C 25	6.7
30	33	2.0	CZTA-LD-C 30	7.8
32	36	3.0	CZTA-LD-C 32	10.7
36	40	3.0	CZTA-LD-C 36	12.0
40	46	3.0	CZTA-LD-C 40	14.1
42	48	3.0	CZTA-LD-C 42	14.9
50	56	3.0	CZTA-LD-C 50	17.9
58	64	3.0	CZTA-LD-C 58	21.2
60	66	3.0	CZTA-LD-C 60	22.0
64	70	3.0	CZTA-LD-C 64	23.7
70	76	3.0	CZTA-LD-C 70	26.3
72	78	3.0	CZTA-LD-C 72	27.2
78	84	3.0	CZTA-LD-C 78	30.0
80	86	3.0	CZTA-LD-C 80	30.9
82	88	3.0	CZTA-LD-C 82	31.8
84	90	3.5	CZTA-LD-C 84	36.3
90	97	3.5	CZTA-LD-C 90	40.0
100	108	3.5	CZTA-LD-C 100	46.2
110	120	3.5	CZTA-LD-C 110	53.2
116	124	4.0	CZTA-LD-C 116	60.8
120	128	4.0	CZTA-LD-C 120	63.5
128	138	4.0	CZTA-LD-C 128	70.3
130	138	4.0	CZTA-LD-C 130	70.3
140	148	4.0	CZTA-LD-C 140	77.3

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Vacuum Hot Plates and Refractory Technical Ceramics.

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