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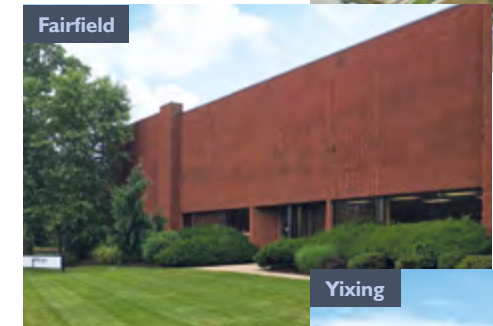
Our company

Since its foundation, Morgan Advanced Materials Haldenwanger developed into a leading global producer of high-tech ceramics. We offer you a comprehensive product range of oxide and non-oxide materials, primarily for use in demanding thermal, chemical and mechanical applications. By virtue of our extensive ceramic expertise, we are able to act not only as your supplier but also as a reliable partner in finding solutions to any technical challenges you may face.

The Haldenwanger Group employs more than 400 people at three locations: Waldkraiburg, Fairfield and Yixing. The British parent company Morgan Advanced Materials employs approx. 7,400 people at over 75 locations worldwide.



Waldkraiburg



Fairfield

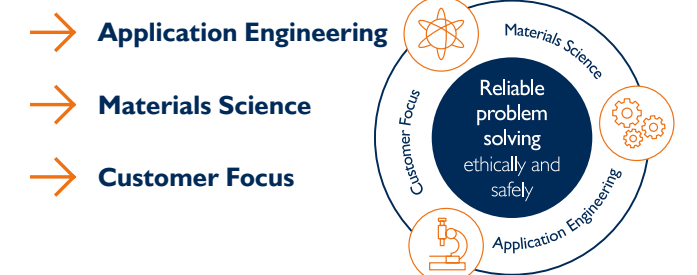


Yixing

Our extensive range of tubes

Stable processes require customised components. Our comprehensive range of tubes provides optimal solutions for applications up to 2000°C, whether in aggressive media or under high thermal shock. We offer a total of 15 oxide and carbide materials in numerous designs, including Alsint 99.7 (C 799), Pythagoras (C 610) and Sillimant 60 (C 530), in accordance with DIN EN 60672. Use our wide Haldenwanger range to optimise your processes.

Core competencies of Morgan Advanced Materials:



Oxide ceramics – standard tubes

Alsint 99.7	Pythagoras	Sillimantin 60	Sillimantin KS
High-purity, gas-tight aluminium oxide	Gas-tight aluminium silicate	Porous aluminium silicate	Supporting tubes for heating elements
Material type C 799 acc. to DIN EN 60672-3	Material type C 610 acc. to DIN EN 60672-3	Material type C 530 acc. to DIN EN 60672-3	
Aluminium oxide content > 99.7%	Aluminium oxide content 56–58%	Aluminium oxide content 72–74%	Aluminium oxide content 70–72%
Working temperature up to 1800°C	Working temperature up to 1400°C	Working temperature up to 1350°C	Working temperature up to 1350°C
Outer Ø x Inner Ø	Outer Ø x Inner Ø	Outer Ø x Inner Ø	Outer Ø x Inner Ø
0.8 x 0.3	–	–	15 x 7
1.3 x 0.7	1.3 x 0.7	–	20 x 12
1.6 x 1	1.6 x 1	–	20 x 15
1.8 x 1.2	1.8 x 1.2	–	25 x 18
2 x 1	2 x 1	–	30 x 20
2.7 x 1.7	2.7 x 1.7	–	35 x 25
3 x 2	3 x 2	–	40 x 30
4 x 2	4 x 2	–	45 x 35
5 x 2	5 x 2	–	50 x 40
6 x 4	6 x 4	–	55 x 45
8 x 5	8 x 5	–	
9 x 6	9 x 6	–	
9.6 x 6.4	9.6 x 6.4	–	
10 x 6	10 x 7	10 x 7	
12 x 8	12 x 8	12 x 8	
12.7 x 8.9	12.7 x 8.9	12.7 x 8.9	
14 x 10	14 x 10	14 x 10	
15 x 10	15 x 10	15 x 10	
17 x 12	17 x 12	17 x 12	
20 x 15	20 x 15	20 x 15	
24 x 18	24 x 19	24 x 19	
25 x 20	26 x 18	26 x 18	
30 x 23	30 x 23	30 x 23	
35 x 27	35 x 27	35 x 27	
40 x 32	40 x 32	40 x 32	
50 x 40	50 x 40	50 x 40	
60 x 50	60 x 50	60 x 50	
65 x 56	65 x 56	65 x 56	
70 x 60	70 x 60	70 x 60	
75 x 65	75 x 65	75 x 65	
80 x 70	80 x 70	80 x 70	
85 x 75	85 x 75	85 x 75	
90 x 80	90 x 80	90 x 80	
100 x 85	100 x 85	100 x 85	
110 x 95	110 x 95	110 x 95	
120 x 100	120 x 100	120 x 100	
Further dimensions upon request			Further lengths upon request
Max. manufacturable outer Ø ca. 410	Max. manufacturable outer Ø ca. 300	Max. manufacturable outer Ø ca. 330	Production only in defined diameters
Max. length 4,000, depending on the outer Ø	Max. length 3,500, depending on the outer Ø	Max. length 4,000, depending on the outer Ø	Standardlängen bis 1,600

All dimensions in mm.

Silicon carbides – standard tubes

Halsic-R/-RX	Halsic-N	Halsic-I	SiC mullite-bonded
Recrystallised silicon carbide (RSiC)	Nitride-bonded silicon carbide (NSiC)	Silicon-filtrated, reaction-bonded silicon carbide (SiSiC)	Mullite-bonded silicon carbide
porous	porous	vacuum-tight	porous
Working temperature up to 1600°C oxidising, up to 2000°C under inert gas	Working temperature up to 1400°C	Working temperature up to 1350°C	Working temperature up to 1350°C
Outer Ø x Inner Ø	Outer Ø x Inner Ø	Outer Ø x Inner Ø	Outer Ø x Inner Ø
15 x 5	15 x 5	15 x 5	16 x 10
20 x 10	20 x 10	20 x 10	20 x 12
22 x 12	22 x 12	22 x 12	23 x 17
25 x 15	25 x 15	25 x 15	26 x 18
30 x 20	30 x 20	30 x 20	30 x 22
32 x 22	32 x 22	32 x 22	35 x 28
34 x 24	34 x 24	34 x 24	40 x 32
35 x 25	35 x 25	35 x 25	45 x 35
40 x 30	40 x 30	40 x 30	50 x 40
45 x 35	45 x 35	45 x 35	60 x 50
50 x 38	50 x 38	50 x 38	65 x 55
60 x 46	60 x 46	60 x 46	70 x 60
70 x 56	70 x 56	70 x 56	80 x 70
75 x 61	75 x 61	75 x 61	95 x 80
80 x 66	80 x 66	80 x 66	115 x 95
			120 x 100
Further dimensions upon request			
Max. manufacturable outer Ø up to approx. 250	Max. manufacturable outer Ø up to approx. 250	Max. manufacturable outer Ø up to approx. 80	
Max. length 3,500, depending on the outer Ø		Max. length 3,200, depending on the outer Ø	

All dimensions in mm.

The Haldenwanger-variety

Our extensive range of tubes enables us to offer a ceramic solution for every application. The tables list a small selection of typical dimensions of standard materials oxide ceramics and silicon carbides. All tubes are available with dimensions: both ends open, one end closed, both ends open with flange, one end closed with flange. **Further dimensions upon request.**

Standard tubes for temperature monitoring

We are your specialist for technical ceramics – especially for use at high temperatures. Through our extensive product portfolio of oxide and non-oxide materials, we offer you the best ceramic solution. The listed dimensions show a small selection of our standard protection tubes, further dimensions or maximum lengths upon request.



Alsint 99.7	Pythagoras	Sillimantin 60
High-purity, gas-tight aluminium oxide	Gas-tight aluminium silicate	Porous aluminium silicate
Material type C 799 acc. to DIN EN 60672-3	Material type C 610 acc. to DIN EN 60672-3	Material type C 530 acc. to DIN EN 60672-3
Aluminium oxide content > 99.7%	Aluminium oxide content 56–58 %	Aluminium oxide content 72–74 %
Working temperature up to 1800°C	Working temperature up to 1400°C	Working temperature up to 1350°C
Outer Ø x Inner Ø	Outer Ø x Inner Ø	Outer Ø x Inner Ø
4 x 2	4 x 2	12 x 8
5 x 3	5 x 3	15 x 10
6 x 4	6 x 4	16 x 12
8 x 5	8 x 5	17 x 13
9 x 6	9 x 6	20 x 15
9.6 x 6.4	9.6 x 6.4	22 x 17
10 x 6	10 x 7	26 x 18
12 x 8	12 x 8	
15 x 10	15 x 11	
16 x 12	16 x 12	
17 x 12	17 x 13	
20 x 15	20 x 15	
22 x 17	22 x 17	
24 x 18	24 x 19	
Non-binding guide value ID tolerance for standard lengths acc. to DIN 40680		

Halsic-R/-RX	Halsic-N	Halsic-I
Recrystallised silicon carbide (RSiC)	Nitride-bonded silicon carbide (NSiC)	Silicon-filtrated, reaction-bonded silicon carbide (SiSiC)
porous	porous	vacuum-tight
Working temperature up to 1600°C oxidising, up to 2000°C under inert gas	Working temperature up to 1400°C	Working temperature up to 1350°C
Outer Ø x Inner Ø	Outer Ø x Inner Ø	Outer Ø x Inner Ø
20 x 10	16 x 8	20 x 10
22 x 12	22 x 12	22 x 12
25 x 15	28 x 16	25 x 15
30 x 20 (15)	with groove if desired	26 x 18
35 x 25		28 x 18
40 x 30		30 x 20
45 x 35		35 x 25
50 x 38		40 x 30
Non-binding guide value ID tolerance for standard lengths +3/-0		Non-binding guide value ID tolerance for standard lengths +2/-1

All dimensions in mm.

Special materials

Alsint PG

Alsint PG only recently developed is a high-purity, fine-grained aluminium oxide for special applications in the high temperature range. The use of especially selected high-purity raw materials and the smart microstructure design result in an increased service life of the protection tubes.

Alsint PG is characterised by the following properties:

- High corrosion resistance to chemical attacks
- High imperviousness in gaseous atmospheres
- Low creep tendency at high temperatures
- High purity
- High strength

Availability and feasibility upon request. We align production campaigns exclusively on the basis of orders for defined diameters and lengths.

Zirconium oxide CaO-FSZ

Our fully calcia stabilised zirconium oxide is temperature resistant up to 2000°C and has improved corrosion resistance compared to aluminium oxide, especially against alkalis, acids and bases.

Fully calcia stabilised zirconium oxide protection tubes are used for the temperature measurement in carbonaceous atmospheres, such as in DSS-furnaces in the photovoltaics and silicon industry. For this purpose, a corrosion-resistant CaO-FSZ outer protection tube is used in combination with an internal protective tube and insulating rod made from Alsint 99.7.

Availability and feasibility upon request. We align production campaigns exclusively on the basis of orders for defined diameters and lengths.



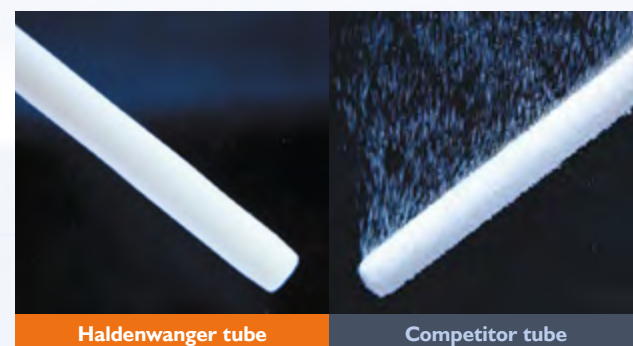
Physical properties	Unit	Value
Material group acc. to type DIN EN 60672	–	C 799
Al ₂ O ₃ content	%	> 99.8
Bulk density	$\frac{g}{cm^3}$	> 3.90
Flexural strength at 20°C	MPa	350
Young's modulus	GPa	300–380
Thermal expansion at 20–1000°C	$\frac{l}{10^6 K}$	8–9
Thermal conductivity at 200°C	$\frac{W}{m K}$	25
Maximal approximate temperature for load bearing elements	°C	1800

Physical properties	Unit	Value
ZrO ₂ + HfO ₂ content	%	94
CaO content (stabiliser)	%	5
Bulk density	$\frac{g}{cm^3}$	> 5.4
Flexural strength at 20°C	MPa	200
Thermal expansion at 20–1000°C	$\frac{l}{10^6 K}$	10
Thermal conductivity at 200°C	$\frac{W}{m K}$	1.5–3.0
T _{max} application limit without load	°C	2000

Please note that all the values quoted are based on test specimens and may vary according to component design. These values are not guaranteed in any way and should only be treated as indicative values. They should be used for guidance only and for no other purpose.

→ **Long service life**

The images below show a gas-tight Haldenwanger tube compared with a gas-permeable tube following long-term use in a leaktightness test.

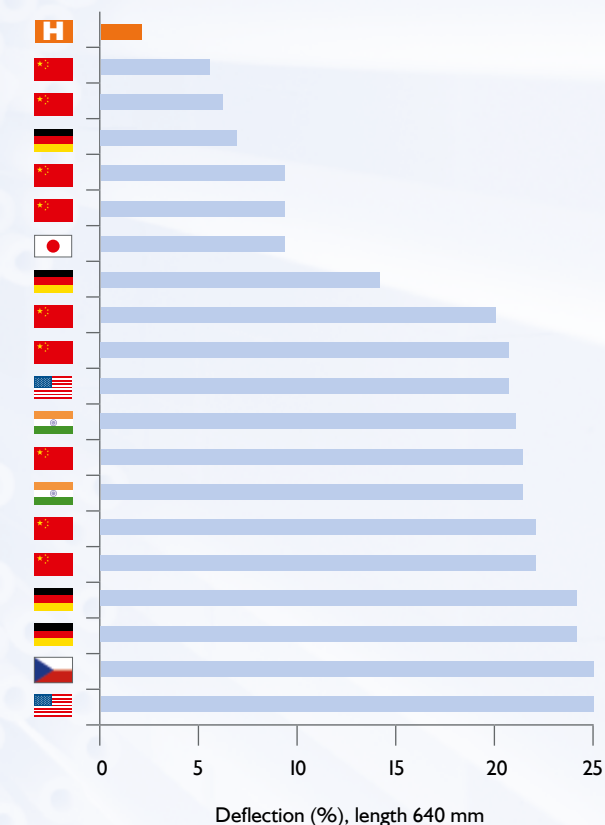
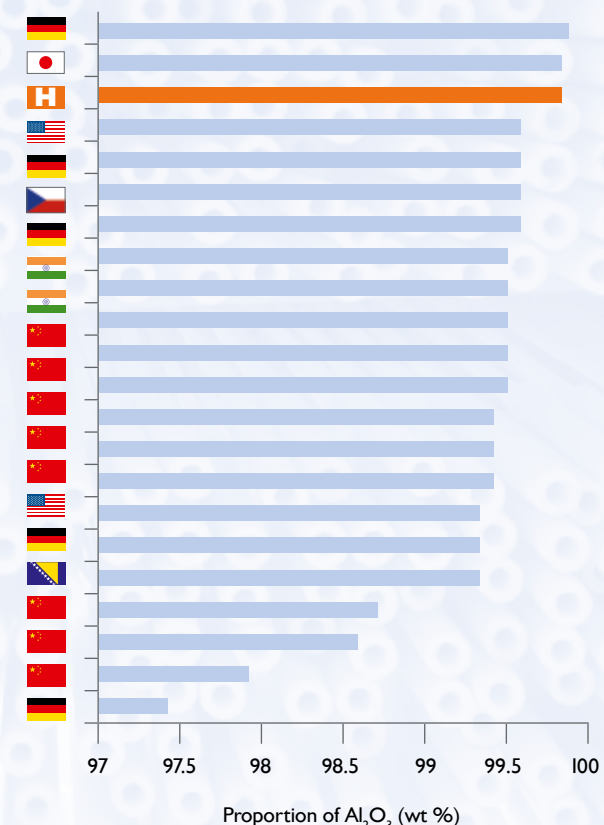
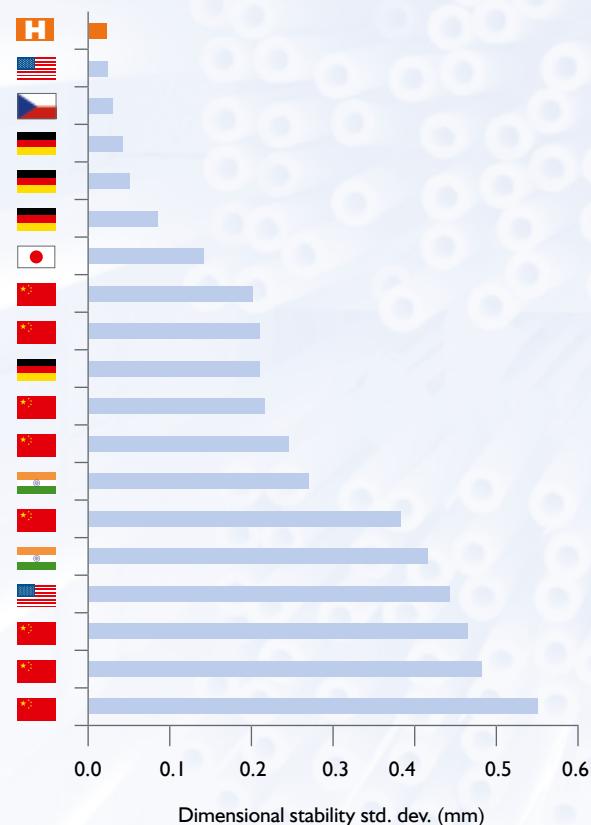
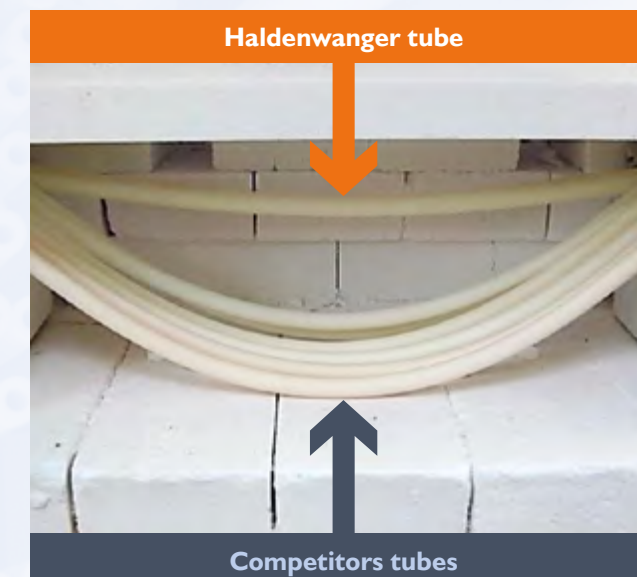


→ **High dimensional accuracy**

Using benchmarking analysis, the dimensional stability of Haldenwanger protecting tubes is compared with that of other tube manufacturers below. Pores resulting from the casting method do not arise in extrusion moulding. The properties of a Haldenwanger extruded tube include dimensional accuracy, gas tightness, electrical insulation and dielectric strength.

→ **Excellent high temperature properties**

The practical test at a temperature of 1750°C and with an exposure time of five hours emphasises the quality on offer from Haldenwanger (see photo on the right).



Alsint 99.7 insulation rods

2 bore rods	O Ø x B Ø
	1.2 x 0.3
	2.0 x 0.5
	2.5 x 0.7
	3.0 x 0.8
	3.5 x 1.2
	4.0 x 1.2
	4.5 x 1.2
	5.0 x 1.0
	5.5 x 1.2
	6.0 x 1.8
	8.0 x 2.0
	8.5 x 2.5

4 bore rods	O Ø x B Ø
	1.6 x 0.4
	2.0 x 0.5
	2.7 x 0.8
	3.0 x 0.8
	4.0 x 1.0
	4.0 x 1.2
	4.5 x 1.2
	5.0 x 1.0
	5.5 x 1.2
	6.0 x 1.8
	8.5 x 1.5
	10.2 x 2.7

2 bore rods	Width / Height x B Ø
	2.0 / 1.5 x 0.7
	2.3 / 1.4 x 0.7
	2.5 / 1.5 x 0.8
	3.0 / 2.0 x 0.7
	4.0 / 2.8 x 1.0
	4.5 / 2.8 x 1.2
	5.0 / 3.0 x 1.5
	7.5 / 5.0 x 2.2

5 bore rods	O Ø x IB Ø / B Ø
	3.0 x 0.9 / 0.3
	5.0 x 2.3 / 0.7
	6.0 x 3.0 / 0.8
	7.0 x 3.3 / 1.0
	8.5 x 4.0 / 0.8
	8.5 x 4.0 / 1.0
	8.5 x 4.4 / 1.2
	9.0 x 3.2 / 1.15

6 bore rods	O Ø x B Ø
	4.0 x 0.75
	4.4 x 1.0
	5.1 x 1.1
	6.0 x 1.2
	6.4 x 1.0
	8.0 x 1.2

10 bore rods	O Ø x B Ø
	5.5 x 0.8
	5.7 x 0.65
	6.0 x 0.75
	6.4 x 1.0
	7.0 x 1.1
	8.0 x 0.7

Pythagoras insulation rods

2 bore rods	O Ø x B Ø
	1.8 x 0.6
	2.0 x 0.6
	2.6 x 0.8
	3.0 x 0.8
	3.5 x 1.2
	4.0 x 1.2
	4.5 x 1.2
	5.0 x 1.5
	5.5 x 1.2
	6.0 x 1.8
	8.0 x 2.8
	8.5 x 2.5

4 bore rods	O Ø x B Ø
	1.7 x 0.4
	2.2 x 0.6
	2.7 x 0.8
	3.0 x 0.8
	3.5 x 1.0
	4.0 x 1.2
	4.5 x 1.2
	5.0 x 1.2
	5.5 x 1.2
	6.0 x 1.8
	8.5 x 1.5
	12.0 x 3.5

2 bore rods	Width / Height x B Ø
	2.3 / 1.4 x 0.7
	3.0 / 2.0 x 0.7
	4.0 / 2.7 x 1.0
	4.4 / 3.1 x 1.7
	4.6 / 3.3 x 1.5
	7.5 / 5.0 x 2.2

5 bore rods	O Ø x IB Ø / B Ø
	2.8 x 0.9 / 0.5
	4.5 x 1.2 / 0.75
	6.0 x 3.5 / 0.6
	8.5 x 4.0 / 1.0
	8.5 x 4.0 / 1.2
	9.0 x 4.0 / 1.1

6 bore rods	O Ø x B Ø
	4.0 x 0.75
	4.5 x 1.0
	5.1 x 1.1
	6.0 x 1.1
	6.0 x 1.5
	7.5 x 1.2

10 bore rods	O Ø x B Ø
	5.0 x 0.4
	5.2 x 0.8
	5.4 x 0.65
	5.6 x 0.75
	6.5 x 1.1
	7.5 x 0.7

O Ø = Outer diameter
B Ø = Bore diameter
CB Ø = Centre bore diameter
All dimensions in mm.

Insulation rods made of Alsint 99.7 type C 799 or Pythagoras type C 610 are used to insulate inserted thermal wires. In accordance with DIN 43725, Pythagoras insulation rods can be heated to temperatures up to 1500°C. For higher temperatures, we recommend Alsint 99.7 insulation rods.

Our extensive range of tubes enables us to offer a ceramic solution for every application. Please refer to the tables for a small selection of typical dimensions of standard insulation rods. **Further dimensions upon request.**



DIN measurements

→ Designs

Unglased

Admissible tolerance of the wall thickness is in compliance with DIN 40680 Part 1, degree of accuracy: coarse. Admissible deflection is in compliance with DIN 40680 Part 2, degree of accuracy: fine, with the following specifications: A straight rod, diameter 0.8 x (dI-2s), must be able to be inserted to the bottom of the sheath tube. The rounded bottom of the sheath tube informly becomes the cylindrical section of the sheath tube.

→ Requirements

Thermal shock resistance

No visible damage after test implementation.

Dimensional stability

Original straightness after test implementation.

Gas-tightness

No air is released during testing: only valid for the sheath tubes labelled gas-tight in table.

→ Tests

Thermal shock resistance

The sheath tube is inserted with the closed end into a 40 mm internal diameter tube furnace at a constant rate (table). The furnace is heated to the maximum permissible continuous temperature of the sheath tube. The sheath tube must not come in contact with the tube furnace, therefore a vertical setup of the tube furnace is recommended. After a minimum of 20 minutes holding time, the sheath tube is removed at the same rate and is hung freely in order to cool in calm air.

Dimensional stability

The sheath tube is horizontally clamped into the tube furnace used for thermal shock resistance testing and is then heated to the maximum permissible continuous temperature. This procedure lasts for 30 minutes.

Gas-tightness

The sheath tube is exposed to an inner overpressure of 2 bar, and then submersed in water for one minute.

Note

The tests should be conducted in the abovementioned order. The thermal shock resistance tests and dimensional stability tests can be conducted simultaneously when the tube furnace is setup horizontally.



Guidelines for the selection of sheath tube materials according to DIN 43724, paragraph 7:

- **Type C 610**
Alkali- and hydrofluoric acid-free gases up to 1500°C
- **Type C 799**
Contact with alkali vapours up to 1500°C
- **Type C 530**
Gases of all kinds, if inner tubes are gas-tight, up to 1600°C
- **Type C 799**
Melting glasses up to 1500°C

Not general specifications; reference values only)

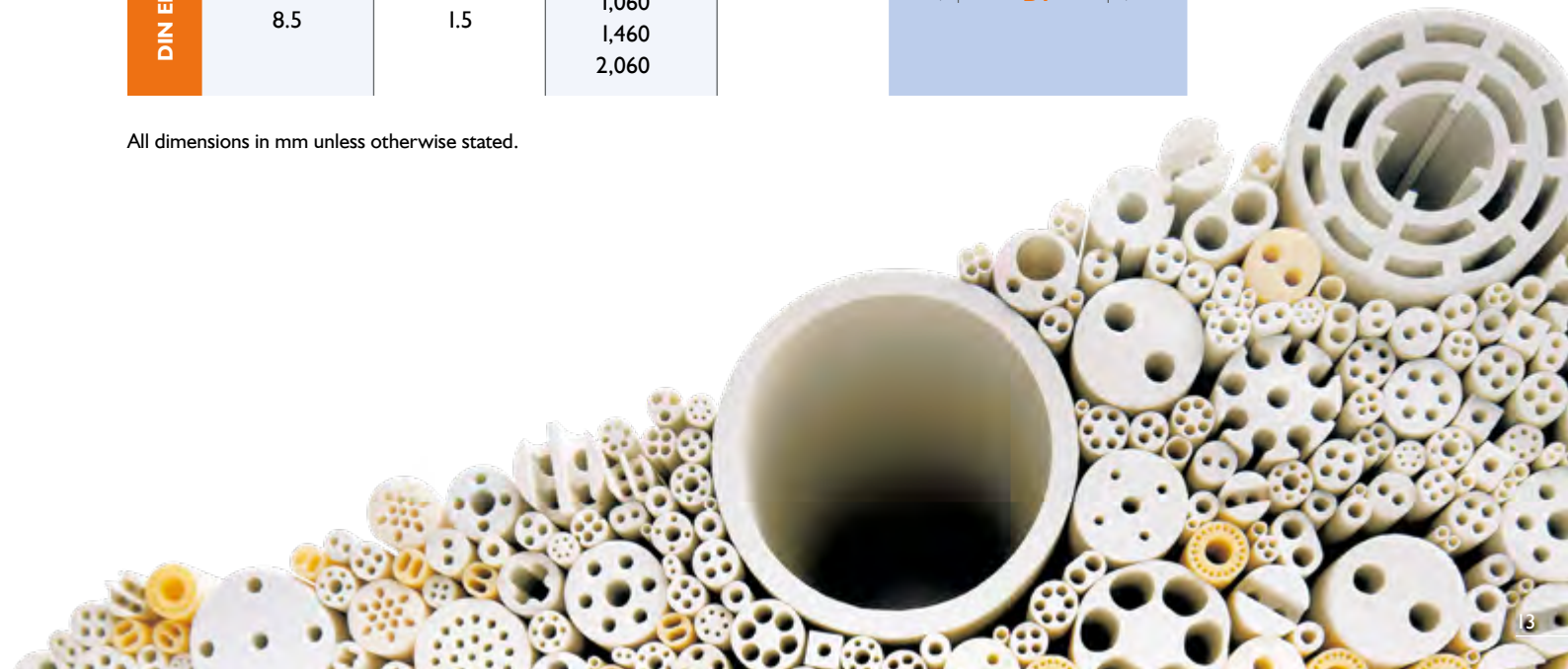
Ceramic sheath tubes according to DIN 43724 EN 50446

DIN EN 60672	D ₁ Outer Ø	D ₂ Inner Ø	L Length	Insertion rate cm/min	Thermal shock resistance	Perme- ability	Max. permissible continuous temp.	
C 610	10	7	200, 270, 375, 530, 740, 1,030	100	medium to good	gas-tight	1400°C	
	15	11	530, 740, 1,030, 1,430, 2,030	50				
	24	19	530, 740, 1,030, 1,430	1				
C 530	26	18	530, 740, 1,030, 1,430	1	very good	porous	1350°C	
C 799	10	6	200, 270, 375, 530	100	medium	gas-tight	1600°C	
	15	10	530, 740, 1,030	50				
	24	18	530, 740, 1,030, 1,430	1				

Insulation rods according to DIN 43725 EN 50446

DIN EN 60672 Type C 610 or C 799	D ₁ Outer Ø	D ₂ Bore Ø	Length	For wire Ø	
	5.5	1.2	205 275 380 560 770	≤ 0.8	
			1,060 1,460 2,060		
	8.5	1.5			

All dimensions in mm unless otherwise stated.

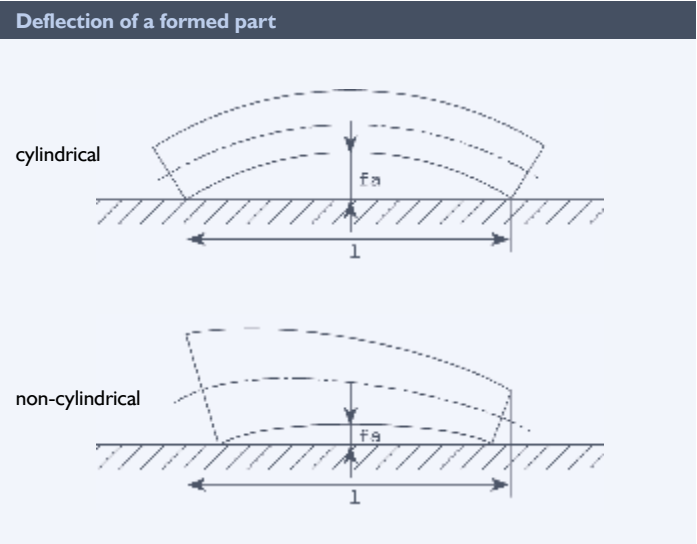


Tolerances according to DIN 40680

Diameter and deflection tolerances without grinding according to DIN 40680

Nominal Ø or length		Accuracy (admissible tolerances)	
		coarse	medium
above 4	above 4	± 0.4	± 0.15
	up to 6	± 0.6	± 0.20
6	8	± 0.7	± 0.25
8	10	± 0.8	± 0.30
10	13	± 1.0	± 0.35
13	16	± 1.2	± 0.40
16	20	± 1.2	± 0.45
20	25	± 1.5	± 0.50
25	30	± 1.5	± 0.55
30	35	± 2.0	± 0.60
35	40	± 2.0	± 0.65
40	45	± 2.0	± 0.70
45	50	± 2.5	± 0.80
50	55	± 2.5	± 0.90
55	60	± 2.5	± 1.00
60	70	± 3.0	± 1.20
70	80	± 3.5	± 1.40
80	90	± 4.0	± 1.60
90	100	± 4.5	± 1.80
100	110	± 5.0	± 2.00
110	125	± 5.5	± 2.20
125	140	± 6.0	± 2.50
140	155	± 6.5	± 2.80
155	170	± 7.0	± 3.00
170	185	± 7.5	± 3.40
185	200	± 8.0	± 3.80
200	250	± 9.0	± 4.20
250	300	± 10.0	± 4.60
300	350	± 11.0	± 5.00
350	400	± 12.0	± 5.50
400	450	± 13.0	± 6.10
450	500	± 14.0	± 6.80
500	600	± 15.0	± 7.60
600	700	± 16.0	± 8.30
700	800	± 17.5	± 9.00
800	900	± 19.0	± 9.50
900	1,000	± 20.0	± 10.00
1,000		± 0.02 · d	± 0.01 · d

All specifications in mm, please contact us for stricter tolerances.



Nominal length		Accuracy (admissible deflection fa)	
		coarse	medium
above 30	above 30	1.7	0.15
	40	1.8	0.20
40	50	1.9	0.25
50	60	2.0	0.30
60	70	2.1	0.35
70	80	2.1	0.40
80	90	2.2	0.45
90	100	2.3	0.50
100	110	2.4	0.55
110	125	2.5	0.65
125	140	2.6	0.70
140	155	2.7	0.80
155	170	2.9	0.85
170	185	3.0	0.90
185	200	3.1	1.00
200	250	3.5	1.25
250	300	3.9	1.50
300	350	4.3	1.75
350	400	4.7	2.00
400	450	5.1	2.25
450	500	5.5	2.50
500	600	6.3	3.00
600	700	7.1	3.50
700	800	7.9	4.00
800	900	8.7	4.50
900	1,000	9.5	5.00
1,000		1.5 + 0.8% · l	0.50% · l

Manufacturing process	Accuracy	
	coarse	medium
Cast, turned, extruded for parts with an envelope size of 30 mm and higher	●	
Extruded for parts with an envelope size up to 30 mm, non-metered pressed, metered semi-moist pressed, metered dry pressed, white machined		●

Manufacturing process	Accuracy			
	coarse		medium	
DIN EN 60672, type	C 610	C 799	C 610	C 799
Casted	●	●		
Turned	●			
Extruded envelope size 30 mm and higher	●	●		
Extruded envelope size up to 30 mm			●	●

The values for accuracy in the column under the heading 'coarse' are not applicable to the first manufacturing. Special agreements are required.
● Customary manufacturing process

WH-I500
refractory cement

Handling instructions

→ Getting prepared

Visual appearance of the two glue components

WH-I500 Part A component typically comes as a loose powder, whilst WH-I500 Part B component is a low viscosity liquid. If one or the other should show a different appearance (e.g., due to exceeding the "best-before" date or due to keeping under inappropriate storage conditions), this may be an indicator that the typical performance of the glue may be impaired.

Preparation of the surfaces

In order to achieve the optimum gluing result, all kinds of fatty, oily, dusty, and any other residues need to be completely removed from the surface areas of the two joining parts. This may be achieved by using highly volatile organic solvents, such as acetone, if necessary, in combination with a mechanic surface treatment, e.g. brushing. Depending on the kind of surface contamination, ceramics parts may additionally be subjected to a thermal treatment at a temperature of approx. 1000°C.

→ Joining

Mixing of the two components

Mixing of the two constituent components, WH-I500 Part A and WH-I500 Part B, shall be conducted according to the consistency required for the application ahead. The table shows typical mixing ratios for various applications. Common working (hardening) times are in the range of 10–40 minutes.

Joining and hardening

Apply a thin layer of WH-I500 on each of the surface areas of the two parts to be joined. In the case of porous materials, applying a primary layer of WH-I500 Part B component onto the surface may reduce the uptake behavior of the surfaces.

WH-I500 has a hydraulic binding behavior. Depending on the joining gap between the two parts, the cement should be dried for 24–48 hours at room temperature. Gaps between two parts typically ought to be in the range of between 0.3–1.5 mm. Complete drying of the parts is obtained by subjecting them to an additional heat treatment at 50–100°C.

In a mix of the two components with a higher content of WH-I500 Part A, heat treatment at 1200 to 1500°C in air will help enhance the mechanic strength of the joint.

Remark

When metals such as aluminium, tin, zink, and copper, are joined a passivation of the metal surface takes place.



Ratio of the two cement components A : B	Typical areas of application
1.2 : 1	Small joining gaps between the two parts Dense as well as porous materials Various materials (ceramics/metals) Long working time (retarded hardening)
2.4 : 1	Large joining gap between the two parts Porous materials Short working time (fast hardening)

Remark

When mixing or working with WH-I500 refractory cement, working safe is of paramount importance. The WH-I500 refractory cement is not classified as dangerous material, however we recommend the use of safety glasses and gloves. For further information please refer to our safety data sheets.