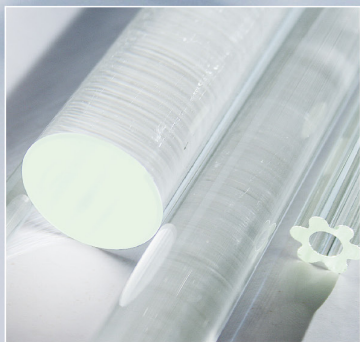


SOLUTIONS IN GLASS

Boroclear Simax®



Röhren & Stäbe aus Borosilikatglas *Tubes & Rods made of Borosilicate Glass*

GVB 
SOLUTIONS IN GLASS

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Amtsgericht Aachen HRB 16683
Geschäftsführer Norbert Braun

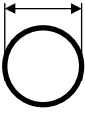
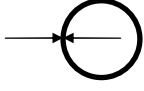
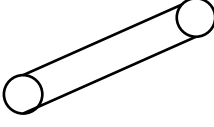
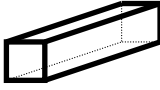
Boroclear Simax[®]

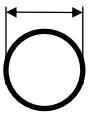
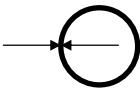
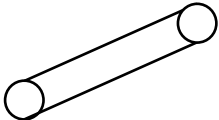
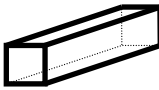
Tubs, Rods and Capillary

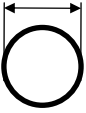
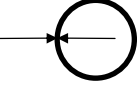
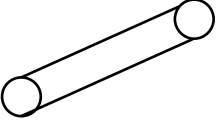
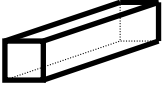
Borosilicate Glass 3.3

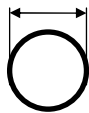
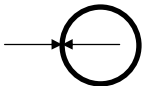
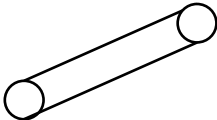
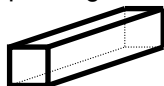
Page	Content
3 - 8	Order information tubes
9	Order information Rods
9 - 10	Order information profile rods
10	Order information flat capillary
11	Order information triangle capillary
11 - 12	Order information profile tubing
13	Order information profile tubing
13	Order information profile rods oval
14 - 15	Order information capillary
16	General description
17	Thermal, physical, mechanical and electrical properties
17	Optical properties
18	Chemical properties
18	Chemical composition
18	How to cool glass after annealing temperature
18	Pressure resistance of tubes and capillary tubes
19	Heat stability
19 -20	Technical terms of delivery

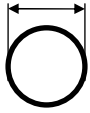
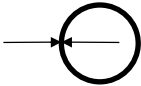
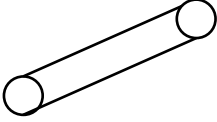
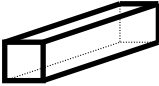
Order information tubes

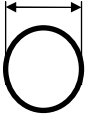
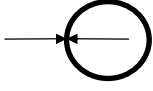
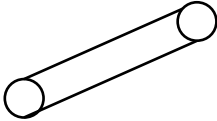
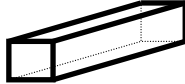
outer diameter  mm	wall thickness  mm	weight per tube  g	packing unit 		order no. <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 5px;">No.</div>
			amount of tubes	weight app. kg	
4 ± 0,15	0,8 ± 0,04	27	400	10,8	2080004
5 ± 0,15	0,8 ± 0,10	35	256	9,0	2080005
6 ± 0,15	1,0 ± 0,04	53	170	9,0	2080006
	1,5 ± 0,10	71	170	12,1	3080006
7 ± 0,15	1,0 ± 0,04	63	121	7,6	2080007
	1,5 ± 0,10	87	121	10,5	3080007
8 ± 0,15	1,0 ± 0,04	74	100	7,4	2080008
	1,5 ± 0,10	102	100	10,2	3080008
9 ± 0,15	1,0 ± 0,04	84	81	6,8	2080009
	1,5 ± 0,10	118	81	9,6	3080009
10 ± 0,15	1,0 ± 0,04	95	64	6,1	1080010
	1,5 ± 0,10	134	64	8,6	2080010
	2,2 ± 0,15	180	64	11,5	3080010
	3,5 ± 0,25	239	64	15,3	4080010
11 ± 0,20	1,0 ± 0,04	105	121	12,7	1080011
	1,5 ± 0,10	150	121	18,2	2080011
	2,2 ± 0,15	203	50	10,2	3080011
12 ± 0,20	1,0 ± 0,04	116	100	11,6	1080012
	1,5 ± 0,10	166	100	16,6	2080012
	2,2 ± 0,15	227	49	11,1	3080012
	3,5 ± 0,20	313	49	15,3	4080012
13 ± 0,20	1,0 ± 0,04	126	81	10,2	1080013
	1,5 ± 0,10	181	81	14,7	2080013
	2,2 ± 0,15	250	81	20,3	3080013
14 ± 0,20	1,0 ± 0,04	137	64	8,8	1080014
	1,5 ± 0,10	197	64	12,6	2080014
	2,2 ± 0,15	273	64	17,5	3080014
15 ± 0,20	1,2 ± 0,05	174	49	8,5	1080015
	1,8 ± 0,10	250	49	12,3	2080015
	2,5 ± 0,15	328	49	16,1	3080015
16 ± 0,20	1,2 ± 0,05	187	49	9,2	1080016
	1,8 ± 0,10	269	49	13,2	2080016
	2,5 ± 0,15	355	49	17,4	3080016
	3,5 ± 0,30	460	49	22,5	4080016

outer diameter	wall thickness	weight per tube	packing unit		order no
 mm	 mm	 g			<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>
			amount of tubes	weight app. kg	
17 ± 0,20	1,2 ± 0,05	199	36	7,2	1080017
	1,8 ± 0,10	288	36	10,4	2080017
	2,5 ± 0,15	381	36	13,7	3080017
18 ± 0,20	1,2 ± 0,05	212	36	7,6	1080018
	1,8 ± 0,10	306	36	11,0	2080018
	2,5 ± 0,15	407	36	14,7	3080018
19 ± 0,20	1,2 ± 0,05	224	64	14,3	1080019
	1,8 ± 0,10	325	64	20,8	2080019
	2,5 ± 0,15	433	36	15,6	3080019
20 ± 0,25 ± 0,30	1,2 ± 0,05	237	49	11,6	1080020
	1,8 ± 0,10	344	49	16,9	2080020
	2,5 ± 0,15	460	49	22,5	3080020
	4,0 ± 0,20	673	36	24,2	4080020
22 ± 0,25	1,2 ± 0,05	262	36	9,4	1080022
	1,8 ± 0,10	382	36	13,8	2080022
	2,5 ± 0,15	512	36	18,4	3080022
24 ± 0,25 ± 0,30	1,2 ± 0,05	288	36	10,4	1080024
	1,8 ± 0,10	420	36	15,1	2080024
	2,5 ± 0,15	565	36	20,3	3080024
	4,0 ± 0,40	841	25	21,0	4080024
26 ± 0,25	1,4 ± 0,05	362	36	13,0	1080026
	2,0 ± 0,10	504	36	18,1	2080026
	2,8 ± 0,15	683	36	24,6	3080026
28 ± 0,25 ± 0,30	1,4 ± 0,05	391	25	9,8	1080028
	2,0 ± 0,10	546	25	13,7	2080028
	2,8 ± 0,15	741	25	18,5	3080028
	4,0 ± 0,40	1009	16	16,1	4080028
30 ± 0,40	1,4 ± 0,10	421	36	15,2	1080030
	2,0 ± 0,15	588	36	21,2	2080030
	2,8 ± 0,20	800	25	20,0	3080030
	4,0 ± 0,40	1093	16	17,5	4080030
32 ± 0,40 ± 0,60	1,4 ± 0,10	450	25	11,3	1080032
	2,0 ± 0,15	631	25	15,8	2080032
	2,8 ± 0,20	859	25	21,5	3080032
	4,0 ± 0,40	1177	16	18,8	4080032
33 ± 0,40	2,0 ± 0,15	652	27	17,6	2080033
34 ± 0,40	1,4 ± 0,10	480	16	7,7	1080034
	2,0 ± 0,15	673	16	10,8	2080034
	2,8 ± 0,20	918	16	14,7	3080034

outer diameter  mm	wall thickness  mm	weight per tube  g	packing unit  amount of tubes weight app. kg	order no <div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>	
36	$\pm 0,45$	$1,4 \pm 0,10$	509	16 8,1	1080036
	$\pm 0,60$	$2,0 \pm 0,15$	715	16 11,4	2080036
		$2,8 \pm 0,20$	977	16 15,6	3080036
		$4,0 \pm 0,40$	1345	16 21,5	4080036
38	$\pm 0,45$	$1,4 \pm 0,10$	538	16 8,6	1080038
	$\pm 0,60$	$2,0 \pm 0,15$	757	16 12,1	2080038
		$2,8 \pm 0,20$	1036	16 16,6	3080038
40	$\pm 0,60$	$1,6 \pm 0,10$	646	16 10,3	1080040
		$2,3 \pm 0,20$	911	16 14,6	2080040
		$3,2 \pm 0,30$	1237	16 19,8	3080040
		$4,0 \pm 0,20$	1512	16 24,2	4080040
		$5,0 \pm 0,40$	1845	9 16,6	5080040
42	$\pm 0,60$	$1,6 \pm 0,10$	679	16 10,9	1080042
		$2,3 \pm 0,20$	960	16 15,4	2080042
		$3,2 \pm 0,30$	1305	16 20,9	3080042
44	$\pm 0,60$	$1,6 \pm 0,10$	713	16 11,4	1080044
		$2,3 \pm 0,20$	1008	16 16,1	2080044
		$3,2 \pm 0,30$	1372	16 22,0	3080044
	$\pm 0,80$	$4,5 \pm 0,40$	1868	9 16,8	4080044
45	$\pm 0,70$	$5,0 \pm 0,40$	2109	9 19,0	2080045
46	$\pm 0,70$	$1,6 \pm 0,10$	747	16 12,0	1080046
		$2,3 \pm 0,20$	1056	16 16,9	2080046
		$3,2 \pm 0,30$	1439	16 23,0	3080046
48	$\pm 0,70$	$1,6 \pm 0,10$	780	9 7,0	1080048
		$2,3 \pm 0,20$	1105	9 9,9	2080048
		$3,2 \pm 0,30$	1507	9 13,6	3080048
50	$\pm 0,70$	$1,8 \pm 0,15$	912	12 10,9	1080050
		$2,5 \pm 0,20$	1248	9 11,2	2080050
		$3,5 \pm 0,30$	1710	9 15,4	3080050
		$5,0 \pm 0,40$	2363	9 21,3	4080050
		$7,0 \pm 0,60$	3174	9 28,6	5080050
52	$\pm 0,80$	$1,8 \pm 0,15$	950	12 11,4	1080052
		$2,5 \pm 0,20$	1300	12 15,6	2080052
		$3,5 \pm 0,30$	1784	9 16,1	3080052
		$5,0 \pm 0,40$	2478	9 22,3	4080052
54	$\pm 0,80$	$1,8 \pm 0,15$	987	9 8,9	1080054
		$2,5 \pm 0,20$	1353	9 12,2	2080054
		$3,5 \pm 0,30$	1857	9 16,7	3080054
		$5,0 \pm 0,40$	2575	9 23,2	4080054

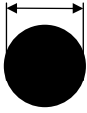

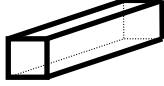
outer diameter  mm	wall thickness  mm	weight per tube  g	packing unit  amount of tubes weight app. kg	order no <div style="border: 1px solid black; padding: 2px; display: inline-block;">No.</div>
55 ± 0,80	5,0 ± 0,40	2627	9 23,6	2080055
56 ± 1,0	1,8 ± 0,15	1025	12 12,3	1080056
	2,5 ± 0,20	1406	12 16,9	2080056
	3,5 ± 0,30	1931	9 17,4	3080056
	5,0 ± 0,40	2680	9 24,1	4080056
58 ± 0,80	1,8 ± 0,15	1063	12 12,8	1080058
	2,5 ± 0,20	1458	12 17,5	2080058
	3,5 ± 0,30	2005	4 8,0	3080058
	5,0 ± 0,40	2794	4 11,2	4080058
60 ± 0,90	2,2 ± 0,20	1336	12 16,0	1080060
	3,2 ± 0,25	1910	12 22,9	2080060
	4,2 ± 0,40	2463	4 9,9	3080060
	5,0 ± 0,40	2890	4 11,6	4080060
	7,0 ± 0,60	3912	4 15,6	5080060
	9,0 ± 0,70	4840	4 19,4	6080060
65 ± 0,90	2,2 ± 0,20	1452	8 11,6	1080065
	3,2 ± 0,25	2078	8 16,6	2080065
	4,2 ± 0,40	2683	8 21,5	3080065
	5,0 ± 0,40	3153	4 12,6	4080065
70 ± 1,0	2,2 ± 0,20	1567	8 12,5	1080070
	3,2 ± 0,25	2246	8 18,0	2080070
	4,2 ± 0,40	2904	8 23,2	3080070
	5,0 ± 0,40	3415	4 13,7	4080070
	7,0 ± 0,60	4650	4 18,6	5080070
	9,0 ± 0,70	5788	4 23,2	6080070
75 ± 1,0	2,2 ± 0,20	1683	4 6,7	1080075
	3,2 ± 0,25	2414	4 9,7	2080075
	4,2 ± 0,40	3125	4 12,5	3080075
	5,0 ± 0,40	3678	4 14,7	4080075
80 ± 1,3	2,5 ± 0,20	2036	4 8,1	1080080
	3,5 ± 0,30	2814	4 11,3	2080080
	5,0 ± 0,50	3841	4 15,8	3080080
	9,0 ± 0,80	6737	4 26,9	4080080
85 ± 1,3	2,5 ± 0,20	2167	4 8,7	1080085
	3,5 ± 0,30	2998	4 12,0	2080085
	5,0 ± 0,50	4203	4 16,8	3080085
90 ± 1,5	2,5 ± 0,20	2299	4 9,2	1080090
	3,5 ± 0,30	3181	4 12,7	2080090
	5,0 ± 0,50	4466	4 17,9	3080090
	7,0 ± 0,70	6126	4 24,5	4080090
	9,0 ± 0,80	7686	4 39,7	5080090

outer diameter  mm	wall thickness  mm	weight per tube  g	packing unit  amount of tubes weight app. kg		order no <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;">No.</div>
95 ± 1,5	2,5 ± 0,20	2430	4	9,7	1080095
	3,5 ± 0,30	3365	4	13,5	2080095
	5,0 ± 0,50	4729	4	18,9	3080095
100 ± 1,5	2,5 ± 0,20	2561	3	7,7	1080100
	3,0 ± 0,20	3058	3	9,2	2080100
	3,5 ± 0,30	3549	3	10,6	3080100
	5,0 ± 0,50	4992	3	15,0	4080100
	7,0 ± 0,70	6864	3	20,6	5080100
	9,0 ± 0,80	8635	3	25,9	6080100
105 ± 1,7	3,0 ± 0,3	3216	3	9,6	1080105
	5,0 ± 0,5	5254	3	15,8	2080105
110 ± 1,7	3,0 ± 0,3	3373	3	10,1	1080110
	5,0 ± 0,5	5517	3	16,6	2080110
	7,0 ± 0,8	7602	3	22,8	3080110
115 ± 1,7	3,0 ± 0,3	3531	3	10,6	1080115
	5,0 ± 0,5	5780	3	17,3	2080115
	7,0 ± 0,8	7971	3	23,9	3080115
120 ± 1,7	3,0 ± 0,4	3689	3	11,1	1080120
	5,0 ± 0,6	6042	3	18,1	2080120
	7,0 ± 0,8	8340	3	25,0	3080120
	9,0 ± 0,9	10533	1	10,5	4080120
125 ± 1,7	3,0 ± 0,4	3846	3	11,5	1080125
	5,0 ± 0,5	6305	3	18,9	2080125
	9,0 ± 0,9	11008	1	11,0	3080125
130 ± 1,8	3,0 ± 0,5	4004	2	8,0	1080130
	5,0 ± 0,6	6568	2	13,1	2080130
	7,0 ± 0,9	9078	2	18,2	3080130
	9,0 ± 0,9	11482	1	11,5	4080130
135 ± 1,8	3,0 ± 0,5	4161	2	8,3	1080135
	5,0 ± 0,6	6831	2	13,7	2080135
	7,0 ± 0,9	9447	2	18,9	3080135
140 ± 1,9	3,0 ± 0,5	4319	2	8,6	1080140
	5,0 ± 0,6	7093	2	14,2	2080140
	7,0 ± 0,9	9816	2	19,6	3080140
145 ± 1,9	3,0 ± 0,5	4477	2	9,0	1080145
	5,0 ± 0,6	7356	2	14,7	2080145

outer diameter	wall thickness	weight per tube	packing unit		order no
 mm	 mm	 g			No.
			amount of tubes	weight app. kg	
150 ± 2,0	3,0 ± 0,5	4634	1	4,6	1080150
	5,0 ± 0,6	7619	1	7,6	2080150
	7,0 ± 0,9	10554	1	10,6	3080150
	9,0 ± 1,0	13380	1	13,4	4080150
155 ± 2,0	5,0 ± 0,7	7881	1	7,9	2080155
160 ± 2,0	5,0 ± 0,6	8144	1	8,1	2080160
	7,0 ± 1,0	11292	1	11,3	3080160
165 ± 2,0	5,0 ± 0,7	8407	1	8,4	2080165
	7,0 ± 1,0	11661	1	11,7	3080165
170 ± 2,0	5,0 ± 0,7	8699	1	8,7	2080170
	7,0 ± 1,0	12030	1	12,0	3080170
	9,0 ± 1,1	15278	1	15,3	4080170
180 ± 2,0	5,0 ± 0,7	9226	1	9,2	2080180
	7,0 ± 1,0	12768	1	12,8	3080180
	9,0 ± 1,2	16227	1	16,2	4080180

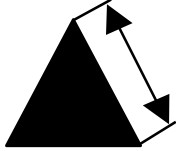

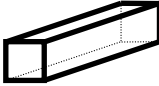
♦ Further dimensions upon request
♦ All listed amounts of pieces and weights are average values

Order information Rods

Outer diameter  mm	weight per rod  g	packing unit 		order no. <div style="border: 1px solid black; padding: 2px; display: inline-block;">No.</div>
		amount of rods	weight app. kg	
3 ± 0,15	24	700	16,8	9000003
4 ± 0,15	42	400	16,8	9000004
5 ± 0,15	66	256	16,9	9000005
6 ± 0,15	95	170	16,2	9000006
7 ± 0,15	129	121	15,6	9000007
8 ± 0,25	168	100	16,8	9000008
9 ± 0,25	213	81	17,3	9000009
10 ± 0,25	263	64	16,8	9000010
11 ± 0,25	318	50	15,9	9000011
12 ± 0,25	378	49	18,5	9000012
13 ± 0,35	444	36	16,0	9000013
14 ± 0,35	515	25	12,9	9000014
15 ± 0,35	591	25	14,8	9000015
16 ± 0,35	673	16	10,8	9000016
18 ± 0,45	851	16	13,6	9000018
20 ± 0,45	1051	16	16,8	9000020
22 ± 0,50	1272	9	11,4	9000022
24 ± 0,50	1513	9	13,6	9000024
26 ± 0,60	1776	9	16,0	9000026
28 ± 0,90	2060	4	8,2	9000028
30 ± 0,90	2364	4	9,5	9000030
40 ± 0,90	4200	4	16,8	9000040

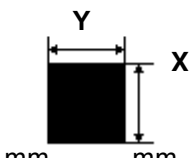

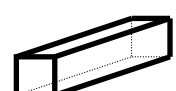
◆ Further dimensions upon request
◆ All listed amounts of pieces and weights are average values

Order information profile rods

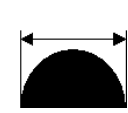

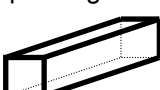
dimensions  mm	weight per rod  g	packing unit 		order no. <div style="border: 1px solid black; padding: 2px; display: inline-block;">No.</div>
		amount of tubes	weight app. kg	
6 x 6 x 6 ± 0,4	63	180	11,3	9100006
7 x 7 x 7 ± 0,4	86	130	11,2	9100007
8 x 8 x 8 ± 0,4	111	100	11,1	9100008
9 x 9 x 9 ± 0,4	141	80	11,3	9100009
10 x 10 x 10 ± 0,4	178	64	11,4	9100010
11 x 11 x 11 ± 0,5	214	55	11,8	9100011

◆ Further dimensions upon request
◆ All listed amounts of pieces and weights are average values

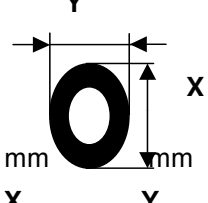

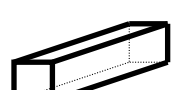
Order information profile rods

dimensions	weight per rod	packing unit		order no.
 mm mm Y X	 g	 weight per rod amount app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>	
4 ± 0,5 x 5,4 ± 0,5	71	280	19,9	9120405
5 ± 0,5 x 6,7 ± 0,5	109	180	19,6	9120506
6 ± 0,5 x 8,0 ± 0,5	153	130	19,9	9120608
7 ± 0,5 x 9,4 ± 0,5	211	90	19,0	9120709
8 ± 0,5 x 10,8 ± 0,5	278	70	19,5	9120810
9 ± 0,5 x 12,0 ± 0,5	332	54	17,9	9120912
10 ± 0,5 x 13,2 ± 0,5	413	48	19,8	9121013
11 ± 0,5 x 14,6 ± 0,5	506	35	17,7	9121114
12 ± 0,5 x 16,0 ± 0,5	607	30	18,2	9121216

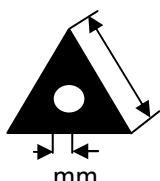


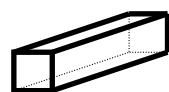
Order information profile rods

dimensions	weight per rod	packing unit		order unit
 mm	 g	 amount of rods weight app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>	
8 ± 0,3	80	150	12,0	9130008
9 ± 0,3	99	130	12,9	9130009
10 ± 0,4	127	100	12,7	9130010
11 ± 0,4	153	90	13,8	9130011
12 ± 0,4	178	70	12,5	9130012
13 ± 0,4	209	60	12,5	9130013
14 ± 0,4	249	50	12,5	9130014
15 ± 0,4	289	45	13,0	9130015
16 ± 0,4	313	42	13,1	9130016

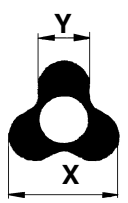
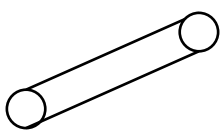
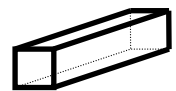
Order information oval capillary

Outer diameter	weight per tube	packing tube		order no.
 mm mm X Y	 g	 amount of tubes weight app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>	
14,0 ± 0,5 x 6,3 ± 0,5	247	60	14,8	3014063
14,5 ± 0,5 x 5,5 ± 0,5	220	68	15,0	3014535
15,0 ± 0,6 x 4,0 ± 0,4	163	100	16,3	3015040
16,0 ± 0,6 x 4,2 ± 0,4	186	95	17,7	3016042
17,0 ± 0,6 x 4,5 ± 0,4	208	70	14,6	3017045
18,0 ± 0,6 x 4,8 ± 0,4	237	64	15,2	3018048
18,0 ± 0,5 x 8,0 ± 0,5	405	40	16,2	3018080
19,0 ± 0,6 x 5,0 ± 0,4	269	64	17,2	3019050
20,0 ± 0,6 x 5,3 ± 0,4	300	60	18,0	3020053
21,0 ± 0,6 x 5,5 ± 0,4	328	50	16,4	3021055

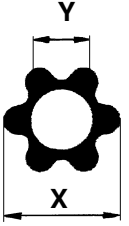
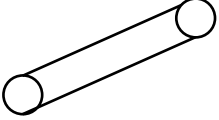
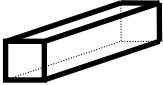
Order information triangular capillary

dimensions	inside diameter	weight per tube	packing unit		order no.
 mm	 mm	 g	 amount of tubes	weight app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>
7 x 7 x 7 ± 0,4 8 x 8 x 8 ± 0,4 9 x 9 x 9 ± 0,4 10 x 10 x 10 ± 0,4 11 x 11 x 11 ± 0,4	1 – 1,5 1 – 1,5 1 – 1,5 1 – 1,5 1 – 1,5	80 102 130 166 199	175 100 80 64 75	14,0 10,2 10,4 10,6 14,9	9140007 9140008 9140009 9140010 9140011
<ul style="list-style-type: none"> ◆ Further dimensions upon request ◆ All listed amounts of pieces and weights are average values 					

Order information profile tubes

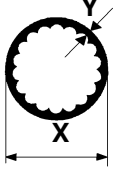
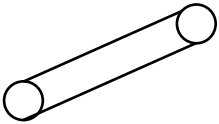
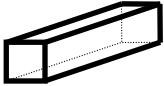
dimensions	weight per tube	packing unit		order no.
 X mm Y mm	 g	 amount of tubes	weight app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>
15,0 ± 1,0 x 7,0 ± 0,5 19,0 ± 1,0 x 9,5 ± 1,0 24,0 ± 1,0 x 10,5 ± 1,0	310 560 877	74 36 25	22,9 20,2 21,9	2001570 2001995 2024105
<ul style="list-style-type: none"> ◆ Further dimensions upon request ◆ All listed amounts of pieces and weights are average values 				

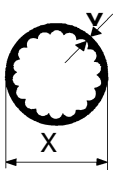
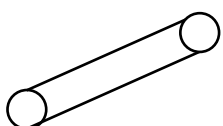
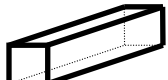
Order information profile tubes

dimensions		weight per tube g	packing unit		order no. No.
X mm	Y mm		amount of tubes	weight app. kg	
					
9,0 ± 0,5 x 4,0 ± 0,5		123	168	20,7	2009040
10,0 ± 0,5 x 4,5 ± 0,5		153	126	19,3	2010045
11,0 ± 0,5 x 5,0 ± 0,5		185	121	22,4	2011050
12,0 ± 0,5 x 5,3 ± 0,5		219	100	21,9	2012053
13,0 ± 0,5 x 5,5 ± 0,5		250	81	20,3	2013055
14,0 ± 0,5 x 6,2 ± 0,5		300	64	19,2	2014062
15,0 ± 0,5 x 6,5 ± 0,5		340	49	16,7	2015065
16,0 ± 0,5 x 7,1 ± 0,5		394	49	19,3	2016071
17,0 ± 0,5 x 7,0 ± 0,5		462	36	16,6	2017070
18,0 ± 0,5 x 7,8 ± 0,5		478	36	17,2	2018078
19,0 ± 0,5 x 8,5 ± 0,5		544	36	19,6	2019085
20,0 ± 0,5 x 8,2 ± 0,5		628	36	22,6	2020082
22,0 ± 0,5 x 11,5 ± 0,5		635	36	22,9	2220115
24,0 ± 0,5 x 12,0 ± 0,5		793	25	19,8	2240120
26,0 ± 0,8 x 16,0 ± 0,8		660	25	16,5	2260160
28,0 ± 0,5 x 17,5 ± 0,5		920	16	14,7	2280175
30,0 ± 0,5 x 18,0 ± 0,5		1045	16	16,7	2300180
32,0 ± 0,5 x 19,0 ± 0,5		1160	16	18,6	2320190
35,0 ± 1,5 x 21,0 ± 0,5		1480	16	23,7	2350210
40,0 ± 1,5 x 24,0 ± 1,5		1840	9	16,6	2400240

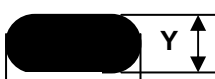


- ◆ Further dimensions upon request
- ◆ All listed amounts of pieces and weights are average values

Order information profile tubes

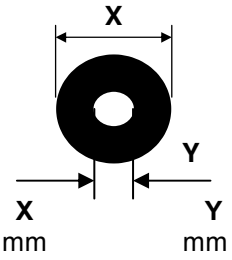
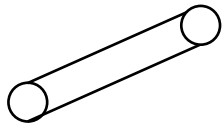
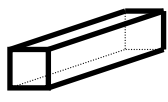
dimensions		weight per tube g	packing unit		order no. No.
X mm	Y mm		amount of tubes	weight app. kg	
					
11,0 ± 0,4 x 1,0 ± 0,15		127	121	15,4	2011010
14,0 ± 0,4 x 1,0 ± 0,15		150	64	9,6	2014010
15,0 ± 0,4 x 1,0 ± 0,15		179	49	8,8	2015010
22,0 ± 0,5 x 1,0 ± 0,15		283	36	10,2	2022010
26,0 ± 0,5 x 1,5 ± 0,15		466	36	16,8	2026015
28,0 ± 0,5 x 2,0 ± 0,20		546	25	13,7	2028020
30,0 ± 0,8 x 2,0 ± 0,20		703	36	25,3	2030020
34,0 ± 0,8 x 2,0 ± 0,30		780	16	12,5	2034020
36,0 ± 0,8 x 2,0 ± 0,25		835	16	13,4	2036020
38,0 ± 0,8 x 2,0 ± 0,25		900	16	14,4	2038020

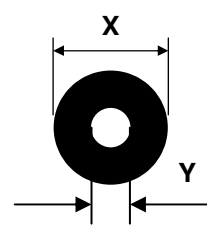
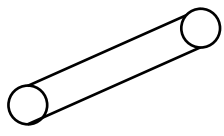
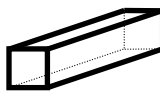
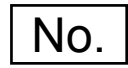
dimensions	weight per tube	packing unit	order no.
 X mm Y mm	 g	 amount of tubes weight app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>
40,0 ± 1,5 x 2,0 ± 0,3 50,0 ± 1,5 x 2,5 ± 0,3 60,0 ± 1,5 x 2,3 ± 0,3 70,0 ± 1,8 x 2,8 ± 0,3 80,0 ± 1,8 x 3,2 ± 0,3 100,0 ± 1,8 x 3,0 ± 0,4	985 1516 1771 2500 3432 4200	16 15,8 12 18,2 12 21,3 8 20,0 4 13,7 3 12,6	2040020 2050025 2060023 2070028 2079032 2100030
<ul style="list-style-type: none"> ◆ Further dimensions upon request ◆ All listed amounts of pieces and weights are average values 			

Order information oval profile rods

dimensions	weight per rod	packing unit	order no.
 X mm Y mm	 g	 Amount of rods weight app. kg	<div style="border: 1px solid black; padding: 5px; display: inline-block;">No.</div>
5,0 ± 0,5 x 2,6 ± 0,5 6,0 ± 0,5 x 3,2 ± 0,5 7,0 ± 0,5 x 3,7 ± 0,5 8,0 ± 0,5 x 4,2 ± 0,5 9,0 ± 0,5 x 4,8 ± 0,5 10,0 ± 0,5 x 4,5 ± 0,5 11,0 ± 0,5 x 5,0 ± 0,5 11,0 ± 0,5 x 5,8 ± 0,5 12,0 ± 0,5 x 5,4 ± 0,5 12,0 ± 0,5 x 6,4 ± 0,5 13,0 ± 0,5 x 5,8 ± 0,5 14,0 ± 0,5 x 5,2 ± 0,5 14,0 ± 0,5 x 6,3 ± 0,5 15,0 ± 0,5 x 6,7 ± 0,5 16,0 ± 0,5 x 7,1 ± 0,5 17,0 ± 0,5 x 7,5 ± 0,5 18,0 ± 0,5 x 8,0 ± 0,5 20,0 ± 0,6 x 8,0 ± 0,5	36 52 72 95 122 130 155 176 182 211 213 205 250 288 323 365 408 461	390 14,0 280 14,6 220 15,8 160 15,2 120 14,6 112 14,6 105 16,3 91 16,0 84 15,3 72 15,2 78 16,5 80 16,4 60 15,0 55 15,8 50 16,2 40 14,6 40 16,3 40 18,4	9005026 9006032 9007037 9008042 9009048 9010053 9011050 9011058 9012054 9012064 9013058 9014052 9014063 9015067 9016071 9017075 9018080 9020080
<ul style="list-style-type: none"> ◆ Further dimensions upon request ◆ All listed amounts of pieces and weights are average values 			

Order information capillary

dimensions	weight per capillary	packing unit		order no.	
 <p style="font-size: small; margin: 0;">X mm Y mm</p>	 <p style="font-size: small; margin: 0;">g</p>	 <p style="font-size: small; margin: 0;">amount of capillary weight app. kg</p>		No.	
4 ± 0,2	0,8 ± 0,08	40	400	16,0	3004008
	0,4 ± 0,08	65	256	16,6	3005004
	0,5 ± 0,08	65	256	16,6	3005005
5 ± 0,2	0,6 ± 0,08	65	256	16,6	3005006
	0,8 ± 0,08	64	256	16,4	3005008
	1,0 ± 0,08	63	256	16,1	3005010
	1,2 ± 0,08	62	256	15,9	3005012
	1,5 ± 0,10	60	256	15,4	3005015
6 ± 0,20	0,4 ± 0,08	94	170	16,0	3006004
	0,8 ± 0,08	93	170	15,8	3006008
	1,0 ± 0,08	92	170	15,6	3006010
	1,2 ± 0,08	91	170	15,5	3006012
	1,5 ± 0,10	89	170	15,1	3006015
	1,7 ± 0,10	87	170	14,8	3006017
	2,0 ± 0,10	84	170	14,3	3006020
	2,2 ± 0,10	82	170	13,9	3006022
	2,5 ± 0,10	78	170	13,3	3006025
	2,7 ± 0,10	75	170	12,8	3006027
7 ± 0,25	0,8 ± 0,08	127	121	15,4	3007008
	1,2 ± 0,08	125	121	15,1	3007012
	1,5 ± 0,10	123	122	15,0	3007015
	1,7 ± 0,10	121	121	14,6	3007017
	2,0 ± 0,10	118	122	14,4	3007020
	2,2 ± 0,10	116	121	14,0	3007022
	2,5 ± 0,10	112	122	13,7	3007025
	2,7 ± 0,10	110	121	13,3	3007027
3,0 ± 0,10	105	122	12,8	3007030	

dimensions		weight per capillary	packing unit		order no.	
				amount of capillary	weight app. kg	
						mm
8	± 0,25	0,8 ± 0,08	166	100	16,6	3008008
		1,0 ± 0,08	166	100	16,6	3008010
		1,2 ± 0,08	164	100	16,4	3008012
		1,5 ± 0,10	162	100	16,2	3008015
		1,7 ± 0,10	161	100	16,1	3008017
		2,0 ± 0,10	158	100	15,8	3008020
		2,2 ± 0,10	155	100	15,5	3008022
		2,5 ± 0,10	152	100	15,2	3008025
		2,7 ± 0,10	149	100	14,9	3008027
		3,0 ± 0,10	144	100	14,4	3008030
3,5 ± 0,10	136	100	13,6	3008035		
9	± 0,25	0,8 ± 0,08	211	81	17,1	3009008
		1,2 ± 0,08	209	81	16,9	3009012
		1,5 ± 0,10	207	81	16,8	3009015
		1,7 ± 0,10	205	81	16,6	3009017
		2,0 ± 0,10	202	81	16,4	3009020
		2,2 ± 0,10	194	81	15,7	3009022
		2,5 ± 0,10	196	81	15,9	3009025
		2,7 ± 0,10	194	81	15,7	3009027
3,0 ± 0,10	189	81	15,3	3009030		
3,5 ± 0,10	181	81	14,7	3009035		
10	± 0,25	1,5 ± 0,10	257	64	16,4	3010015
		2,0 ± 0,10	252	64	16,1	3010020
		2,5 ± 0,10	246	64	15,7	3010025
		3,0 ± 0,10	239	64	15,3	3010030
		3,5 ± 0,10	231	64	14,8	3010035

♦ Further dimensions upon request
 ♦ All listed amounts of pieces and weights are average values

General Description

Boroclear is a colorless, machine produced borosilicate glass 3.3.

It belongs to the world-wide acknowledged and internationally defined group of borosilicate glasses class 3.3 according to standard DIN ISO 3585 and is completely compatible with other glasses which comply with this standard.

Boroclear can be supplied as tube and rod. Granulates can be supplied upon request within short term.

The favourable relation between price and features, the good machinery as well as the precision of the tubes and rods make Boroclear a material for many different applications.

It is known as very insensitive during quick changes of temperatures. Due to the low thermal expansion, Boroclear is an excellent material for the application in laboratories, for building chemical constructions, for the pharmaceutical field, as well as for artificial handicraft.

Boroclear is corrosion-resistant, and even in combination with aggressive chemicals it is absolutely neutral. It is very resistant against water, acids, as well as halogens. Furthermore, this material offers a good resistance against lyes. Boroclear reacts very positively to life environment and is absolutely unexceptionable from the ecological point of view.

For the production the latest technologies are applied and a permanent process control ensures the high quality of the products.

The glassworks Kavalier is certified according to EN ISO 9002..

CERTIFICATE

Management system as per EN ISO 9001 : 2000

In accordance with TÜV NORD CERT procedures, it is hereby certified that

KAVALIERGLASS, a.s.
Křížová 1018/6, 150 00 Praha 5
Production site: Sklářská 359, 285 06 Sázava
Czech Republic




with the sites acc. to the annex

applies a quality system in line with the above standard for the following
scope

**Design and production of glass products for household, laboratory,
technical and pharmaceutical use, glass tubes, incl. production of
metal glass making moulds.**

Certificate Registration No. 04 100 940602
Audit Report No. 623 174/600

Valid until 2010-11-15
(until 2012-11-04 in case of Upgrade to EN ISO 9001:2008)
Initial certification 1994-09-01


Certification Body
at TÜV NORD CERT GmbH

Praha, 2009-11-05

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is
subject to regular surveillance audits.

The annex (1 page) is the integral part of the certificate.

TÜV NORD CERT GmbH

Langemarckstrasse 20

45141 Essen

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Chemical properties

Boroclear is resistant against water and acids and their compound as well as against chlorine, iodine, and bromine. Even after a long period chemical resistance is better than those of most metals and many other materials.

The influence of water is very low. Boroclear forms on its surface a thin layer of quartz glass which further reduces the influence.

At higher temperatures and concentration, silicic acid, hot phosphate acids as well as alcalic solutions attack the surface.

water resistance (according ISO 719)	type 1
acid resistance (according ISO 1776)	acid class 1
lye resistance (according ISO 695)	lye class2

Chemical composition

SiO ₂	app. 80,4 weight percentage
B ₂ O ₃	app. 13,0 weight percentage
Al ₂ O ₃	app. 2,4 weight percentage
Na ₂ O + K ₂ O	app. 4,0 weight percentage

How to cool the glass after annealing temperature

To avoid permanent stresses during processing Boroclear is soaked well on transformation temperature. The time is dependent on the wall thickness of the parts. We recommend the following values for heating, holding the temperature, and cooling the glass:

wall thickness mm	heating Tg	holding time Tg	cooling		
			Tg - 490 °C	490 - 440 °C	440 - Rt °C
3	140 °C/min	5 min	14 °C/min	28 °C/min	140 °C/min
6	30 °C/min	10 min	3 °C/min	6 °C/min	30 °C/min
9	15 °C/min	18 min	1,5 °C/min	3 °C/min	15 °C/min
12	8 °C/min	30 min	0,6 °C/min	1,6 °C/min	8 °C/min

Taking into account the chemical resistance of the glass, the annealing time should be as short as possible. If for one article several annealings should become necessary during the production process, the total time of all annealings at Tg should not exceed two hours.

Pressure resistance of tubes and capillary tubes

For simple applications the pressure resistance of tubes and capillary tubes can be calculated as follows:

Calculation of the pressure resistance (p in bar) for a given wall thickness (Wd in mm) and given outer diameter (Ad in mm):

$$p = \frac{Wd * 20 * K/S}{Ad - Wd}$$

Calculation of wall thickness (Wd in mm) at given pressure resistance (p in bar) and outer diameter (Ad in mm):

$$Wd = \frac{Ad * p}{20 * K/S + p}$$

The characteristic value of solidity (K/S) of borosilicate glass 3.3 is 7 N mm^{-2} (according to standard EN 1595 compressed air reservoir of borosilicate glass 3.3; general principles for the calculation, production, and examination).

Furthermore, the pressure resistance is affected by the following influences:

- ◆ processing of ends
- ◆ quality of surface
- ◆ temperature difference between inner and outer wall
- ◆ meeting the assembling requirements according to the regulations for compressed air reservoir
- ◆ length of tube

Furthermore, the following publications should be taken into account:

- ◆ AD-Merkblatt B1, issue 6.86 (cylinders and ball work pans with inner pressure burden)
- ◆ AD-Merkblatt N4, issue 6.86 (compressed air reservoir made of glass, encl. 1); issue 6.85 (evaluation of defects in walls of compressed air reservoirs made of glass)

Heat stability

The heat stability of tubes and rods depends on the wall thickness, the form, the size of parts, the areas which are warmed up, the status of the surface, the final treatment and the existing stresses. The following values are recommended:

wall thickness mm	heat stability app. K
1	303
3	175
5	136

Technical terms of delivery

length and kind of ends	diameter mm	length mm	kind of end
tubes:	4 - ≤ 7	1500 ± 20	un-melted
	> 7 - ≤ 10	1500 ± 10	un-melted
	> 10 - ≤ 48	1500 ± 10	melted
	> 48 - ≤ 165	1500 ± 5	melted
rods, capillary tubes:	3 - ≤ 7	1500 ± 20	un-melted
	> 7 - ≤ 17	1500 ± 10	un-melted
	> 17 - ≤ 30	1500 ± 30	un-melted

Special lengths can be produced up to 3500 mm depending on the diameter.
 Special diameters can be produced according to the customer's specifications.
 Minimum amount of sale: 300 kg

Ovality (unroundness) of the outer diameter

tubes: max. 2 % of the nominal diameter

rods and capillary tubes: max. 3 % of the nominal diameter

Maximal differences in wall thickness

thin walled tubes: max 25 % of the nominal wall thickness

medium and thick-walled tubes: max. 15 % of the nominal wall thickness

Maximal deflection

tubes: 0,6 % of the length for outer diameters ≤ 6 mm

0,4 % of the length for outer diameters > 6 - ≤ 10 mm

0,3 % of the length for outer diameters > 10 - ≤ 150 mm

rods and capillary tubes: 0,6 % of the length of rod for diameter ≤ 6 mm

0,5 % of the length of rod for diameter > 6 - ≤ 16 mm

0,15 % of the length of rod for diameter > 16 - ≤ 30 mm

Stones

tubes outer diameter 4 - ≤ 20 mm: diameter ≤ 0,3 mm allowed
 diameter > 0,3 - ≤ 1,0 mm max. 4 pieces/kg glass
 diameter > 1,0 - ≤ 2,0 mm max. 2 pieces/kg glass

tubes outer diameter > 20 mm: diameter ≤ 0,3 mm allowed
 diameter > 0,3 - ≤ 1,0 mm max. 2 pieces/kg glass
 diameter > 1,0 - ≤ 2,0 mm max. 1 piece/kg glass

per 1500 mm rods and capillary tubes: diameter ≤ 0,3 mm is allowed
 ≤ 24 mm diameter: diameter > 0,3 - ≤ 1,0 mm max. 3 pieces
 > 24 mm diameter: diameter > 0,3 - ≤ 1,0 mm max. 4 pieces

Knots, stringy knots

tubes:

diameter $\leq 0,3$ mm is alloweddiameter $> 0,3 - \leq 1,0$ mm max. 4 pieces/kg glassdiameter $> 1,0 - \leq 3,0$ mm max. 2 pieces/kg glass

per 1500 mm rods or capillary tubes:

 ≤ 24 mm diameter:diameter $\leq 0,3$ mm is alloweddiameter $> 0,3 - \leq 1,5$ mm max. 3 pieces > 24 mm diameterdiameter $> 0,3 - \leq 1,5$ mm max. 4 pieces**Bubbles**length: ≤ 20 mm is allowed > 20 mm max. 1,5 m (length of bubbles) for 10 m length of tube

The so called „length of bubbles“ is the total amount of the length of all bubbles larger than 20 mm.

width: tubes diameter $4 - \leq 40$ mm max. 0,2 mmtubes diameter > 40 mm max. 0,7 mm

rods and capillary tubes max. 0,3 mm

Stressestubes ≤ 43 mm diameter are not warmed uptubes > 43 mm diameter are warmed up

rods and capillary tubes are not warmed up

Miscellaneous

Tubes with an outer diameter of 8 – 40 mm are protected against scratching by an PE treatment.

We reserve the right to make changes without prior note!

