QCS

Quarzglas Komponenten und Service GmbH

Products Catalogue

01/2009

QCS

Contents

Quarzglas Komponenten und Service QCS GmbH
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Destamat

Bi-Distillation Apparatus Bi 18E
made of Quartz Glass

Quarzglas Komponenten und Service QCS GmbH
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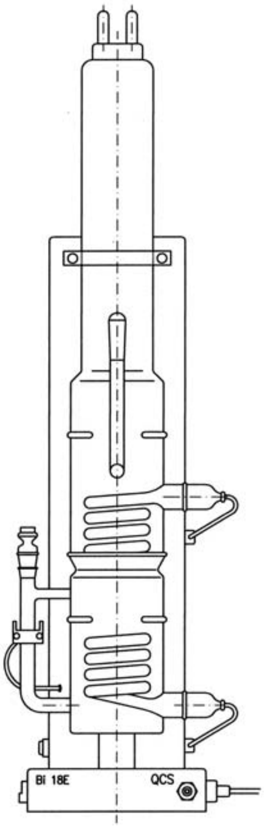
DESTAMAT

Bi-Distallation Apparatus
Bi 18 E made of Quartz Glass



In the Bi 18 E components coming into contact with water are quartz glass parts which, contrary to ordinary laboratory glass is non-hygroscopic and thus resistant to H2O. These properties warrant the high purity requirements a distillate must fulfill.
Due to a solenoid valve, it is assured that only so much feed water (as a rule expensive VE water) is metered in, as is subsequently distilled off what finally results in a considerable cost reduction.
The optimization of the cooling water volume is controlled by a cooling water flowmeter. The Bi18E offers the possibility of connecting an additional filling level sensor control which enables the control of the distillation volume in the collection vessel. When the vessel is full, the sensor will signal the unit to shut off or, alternatively, when the filling level falls below a preset level in the collection vessel, the apparatus switches on again automatically.
In the event of a cooling or feed water shortage, the power supplying part is automatically shut off, thus ensuring an optimum operating safety.

Plug and screw connections facilitate an easy cleaning and maintenance, and thus assembly and dismantling of the quartz glass components can be easily and quickly done.
The modular structure makes it possible to increase the distillation capacity easily. The water supply is provided by simply connecting the devices via special couplings.

Electrical safety
The apparatus Bi 18 E meets the EG standard 89/336/EWG and EG standard 73/23/EWG.

Advantages:
free of pyrogenes
free of heavy metals
distillate meets requirements according to DAB 10
optimal operating safety
compact structure
easy handling
easy assembly – only the quartz glass components and the water and electrical connection (plug/socket) are to be assembled
modular structure for adaptation of distilling capacity
connection of filling level sensor and distillate collection vessel possible
easy assembly and dismantling facilitate cleaning and maintenance.

Physical and Technical Data

Output	l/h	1.8
Electrical conductivity	µS/cm	0.4
Distillate outlet temperature approx.	°C	85
Evaporation residues	mg/1 (ppm)	< 0.4
Connection load (230 V/50 Hz)	kW	3.1
Cooling water consumption approx.	l/min	3.5
Dimensions/space requirement approx. Width Height Depth	 mm mm mm	 200 1000 270
Weight of basic modal approx.	kg	15

Subject to technical alterations reserved · 01/2009

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Acidest

Acid-Distillation Unit
made of Quartz Glass for
discontinuous using

Quarzglas Komponenten und Service QCS GmbH
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ACIDEST

Acid-Distillation Unit made of Quartz Glass for discontinuous using

The principle of surface evaporation is especially suitable for the purification of liquids by distillation. Unlike boiling evaporation no fog or aerosol is produced. The distillate is therefore of very high purity. For an analytic decomposition substances are needed which have no numerical result in a blank test. In this case it is of advantage to distill the required acid fresh. Only thereby can any contamination by storage be avoided. During the construction phase of the ACIDEST the experience of well-known trace analytical specialists was taken into consideration. All contact of liquid and sockets is avoided. The sockets of filling tube and collecting bottle are arranged in a way that drains impurities to the outer wall. The apparatus is filled by a specially formed funnel. After having started the operation this funnel is rotated by 90°. So the U-shaped outlet is filled with liquid and acts like a syphon between apparatus and outer atmosphere. Pressure balance takes place through this syphon during the heating and cooling period.

Electric heating is done by two infrared elements of each 400 Watt at a voltage of 220 V. The full power is necessary for the distillation of sulfuric acid, whereas water, hydrochloric acid and nitric acid can be distilled with only 200-500 Watt. In this case the ACIDEST is used best in connection with an usual in the trade electronic power regulator.

During the construction phase of the ACIDEST a high value was set on easy handling. On the stainless steel frame a high-adjustable console for the collecting flask can be installed either on the right or left side. For thorough cleaning the infrared elements can be removed easily. The coolant joints have GL 14 screw connection. The bottom is emptied through the filling tube which is installed at a hight which ensures that the liquid cannot wet either the condenser or the infrared element.

After filling the apparatus with 700 ml of liquid the following distillation yields are obtained approximately in the state of equilibrium (heating period is not considered):

Distillation yields (g/min)

Watt	H_2O	HNO_3	HCl	H_2SO_4
200	1.1	1.2	0.8	
400	2.8	3.3	2.9	
600	4.4	5.3	4.9	0.3
800	5.8	7.5	7.1	0.8

The exceptional high purity of the liquids distilled only once in the ACIDEST was tested in well-known trace analytical laboratories. As a starting material demineralized water and common p.a.-acids with metal contents of up to 100 ng/ml and more were used.

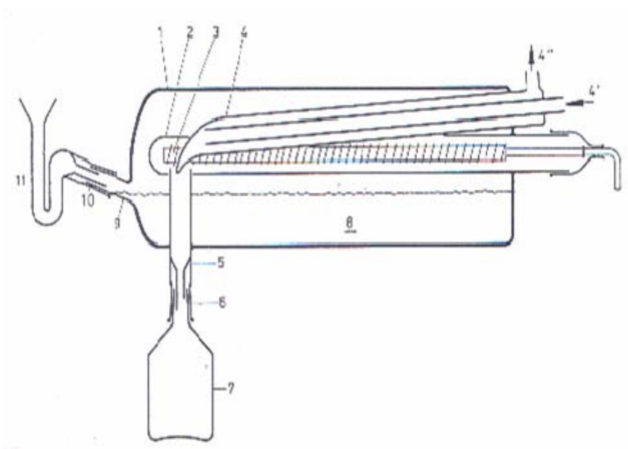
Trace content (ng/ml)

	H_2O	HNO_3	HCl
Al	< 0.05	< 0.05	0.07
Cd	0.01	0.001	0.01
Cu	0.04	0.25	0.07
Fe	0.32	0.20	0.6
Mg			0.06
Pb	0.02	< 0.05	< 0.05
Zn			0.04
Yield (g/min)	3.8	0.9	1.8

These values can only be obtained when the ACIDEST and all other used glassware was cleaned thoroughly by steaming out with concentrated nitric acid for several hours and when all analytical work is done with the required care for work with purest materials.

Dimensions

Width:		400 mm
Height:		320 mm
Depth:		200 mm
Destillation Flask:	Length	300 mm
	Dia.	105 mm



1 = Distillation Flask
2 = Covering Tube for Infrared Heaters
3 = Infrared Heaters
4 = Cooling Finger with 4 ` = Cooling water in, 4`` = Cooling water out
5 = Outlet Connecting Piece
6 = Covering Body with Joint Socket
7 = Collecting Bottle with Joint Cone
8 = Acid to be distilled (sump)
9 = Filling Tube
10 = Joint of Filling Tube
11 = Filling Funnel with U-Tube

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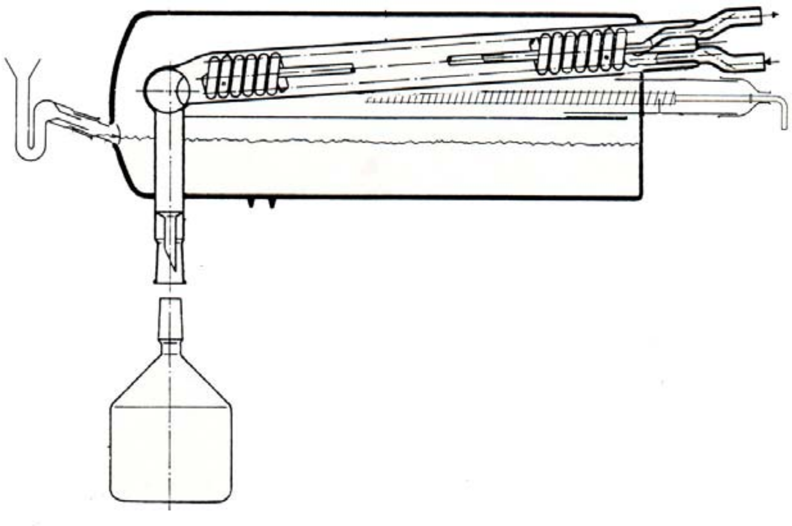
Pyrodest

High purity Water-Distillation
made of Quartz Glass
for discontinuous using



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PYRODEST

High purity Water-Distillation Unit made of Quartz Glass for discontinuous using

The principle of surface evaporation is especially suitable for the purification of liquids by distillation. Unlike boiling evaporation no fog or aerosol is produced. The distillate is therefore of very high purity.

The purest water is needed for seeding the cell, tissue and organic cultures. There is no contact of water with the sockets. The sockets at the filling tube and the collecting bottle are arranged in a way that drains impurities to the outer wall. The apparatus is filled by a specially formed funnel. After having started the operation this funnel is rotated on the filling tube by 90°, so the U-shaped outlet is filled with liquid and acts like a siphon between apparatus and outer atmosphere. Pressure balance takes place through this siphon during the heating and cooling period.

Operation

The water surface gets heated and evaporated by infra red elements. The water steam enters the unit made of quartz glass
and gets overheated (450-500°C) on its way to the cooling system. The overheated water steam condenses in the cooler and cumulated via outlet connecting piece in a collecting bottle. This happens without connection of water and the joints, otherwise, we have a danger of impurity. For this operation a distillated or salt free liquid is necessary.

Advantages of surface evaporation by overheat-level:

- totally sterile distillate
- pyrogene free
- very low electric capability
- lack of high molecular organic connection i. e. bacteria, pesticides, insecticides or detergencies
- heavy metal free
- distillate exceeds clearly the DAB7 regulations
- the heating system has a double function- as a surface evaporator and an overheating device
- small size of an apparatus
- saving energy

Such high level of purity is needed mainly in the medicine, biology, chemistry and physics.

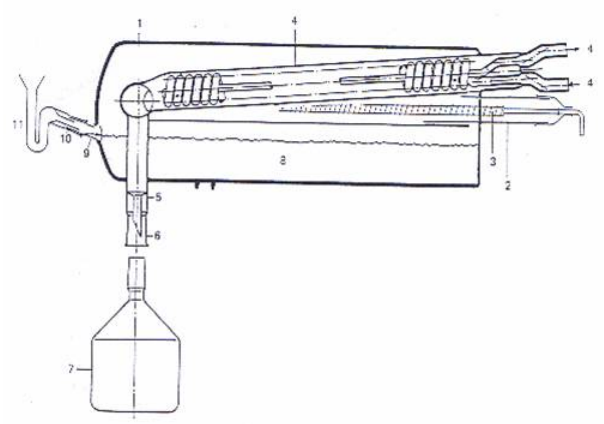
During the construction phase of the PYRODEST a high value was set on easy handling. On the stainless steel frame a high-adjustable console for the collecting flask can be installed either on the right or left side. For thorough cleaning the infra red elements can be easily removed. The coolant joints have GL 14 screw connection. The bottom is emptied through the filling tube which is installed at a height which ensures that the liquid cannot wet either the condenser or the infra red element.

After filling the apparatus with liquid, it gets distillated till maximum 550 ml/h.

The purity values can only be obtained when the PYRODEST and all other used glassware was cleaned thoroughly by steaming out with concentrated nitric acid for several hours and when all analytical work is done with the required care for work with purest materials.

Dimensions

Wide:	approx. 500 mm
Height:	approx. 200 mm
Depth:	approx: 350 mm
<u>Distillation flask:</u>	
Length:	approx: 320 mm
Diameter:	approx: 105 mm



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7 = Collecting Bottle with Joint Cone
8 = Liquid to be distilled
9 = Filling Tube
10 = Joint of Filling Tube
11 = Filling Funnel with U-Tube

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Surface Evaporator

Made of opaque fused silica

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Surface Evaporator made of opaque fused silica

for rapid, economical evaporation and concentration of liquids and solutions

A helically electrical filament winding, covered by opaque fused/ transparent silica, with a big surface which is assembled in an opaque fused silica paraboloid dish with a grip, permits an indirect temperature rise heating of liquids by infra-red radiation.

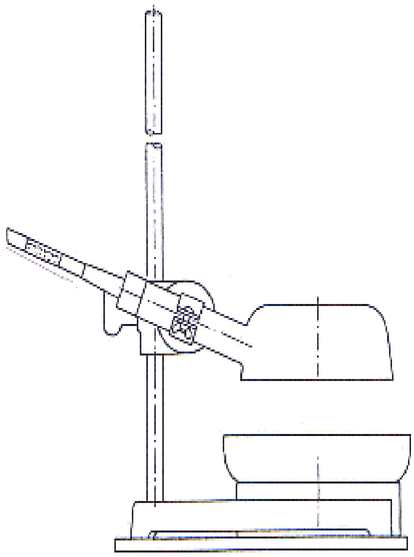
In this way, rapid, economical evaporation or concentration of liquids is possible.

According to this principle, only the upper surface of the liquid to evaporate is heated very quickly as most of the radiation heat is absorbed already in low depth of penetration and, thus, it enables an economical, regular evaporation. Contrary to simmering evaporation, there is no substance loss because of splashing or super-boiling.

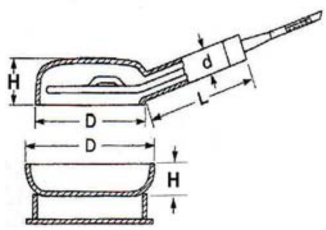
As surface evaporators are exclusively made of opaque fused/ transparent silicia, it is possible to make sensibly use of this material and its many advantages, as there are good IR-permeability, heat resistance, resistance to changes of temperature, extremely low electrical conductivity, exceptionally high chemical purity and resistance. These advantages of the material permit an economical evaporation of acids and other liquid chemical, except for hydrofluoric acid, phosphorus acid, and liquids with high alkali contents.

Electrical Safety
The opaque fused silicia encasing tube is a very good electrical insulator – protection against electric-shock hazard, optimal electrical safety by means of earthing of the inner tube.

Surface evaporators meet the EG standard 89/336/EWG and EG standard 73/23/EWG.



Surface Evaporator Type	Order No.	Power Wattage	Dimensions D mm	L mm	H mm	d mm	Net Weight approx. kg
OV 140	9705011	700	140	120	55	27	0,88
OV 200	9705021	1000	200	190	70	40	1,2
OV 300	9705031	1500	300	190	100	40	2,4
Evaporation basin ROTOSIL flat version	**Order No.**	**Volume ccm**	**Dimensions D mm**		**H mm**		**Net Weight approx. kg**
to OV 140	9705012	400	160		50		0,34
to OV 200	9705022	1000	230		70		0,63
to OV 300	9705032	4000	350		100		2,2
Tripod	**Order No.**	**Base Area mm**	**Dimensions H mm**				**Net Weight approx. kg**
to OV 140	9705017	330 x 250	520				4,0
to OV 200	9705017	330 x 250	520				4,0
to OV 300	9705017	330 x 250	520				4,0



All surface evaporators are delivered with a silicone connection piece and a 1.5 m long cable with earthing contact-type plug of PVC.

They are designed for 230 V ~.

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Immersion heater

Made of Quartz Glass
for laboratory and galvanoplastic

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Immersion Heater rod-shaped, earthed version of quartz glass for laboratory and galvanoplastics

Advantages of rod-shaped immersion heaters, earthed version

Maximum energy transfer
through infra-red radiation – the encasing tube allows infra-red transmission, through heat conduction – the quartz glass encasing tube facilitates an extremely good heat transfer.

Temperature resistance
As quartz glass has practically no heat expansion, these immersion heaters will with-stand termal shock in particular.

Acid resistance
Quartz glass immersion heaters are almost completely resistant to acid attacks, with the exception of phosphorus acid above 300 °C and hydrofluoric acid. Immersion heaters are, therefore, particularly well-suited to heat chemicals directly in laboratories and galvanoplastics.

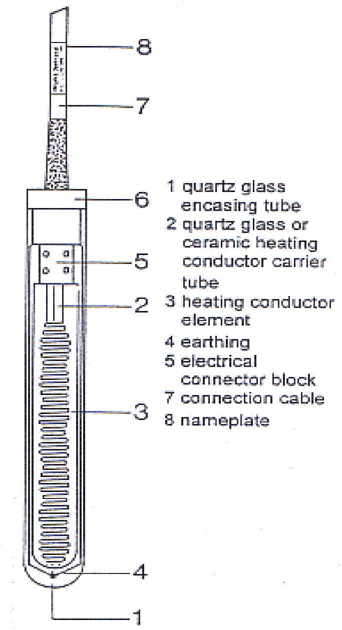
Electrical Safety
The quartz glass encasing tube is an excellent electrical insulator – protection against electric-shock hazard, optimal electrical safety by means of earthing of the inner tube.

Immersion heaters meet the EG standard 89/336/EWG and EG standard 73/23/EWG.

Aller immersion heaters are delivered with a silicone connection piece and a 1.5 m long cable with earthing contact-type plug of PVC and are designed for 230 V ~.

Special models with regard to design and elctrical output on request.

Immersion heater without standard ground joint



Type		Order no.	Voltage	Power Wattage	Dimensions			Net Weight Approx kg
					LG mm	LB mm	LS mm	
LT	250	X 970 6505	230 V, 50 Hz	250	270	100	-	0,35
LTS	250	X 970 6555	230 V, 50 Hz	250	270	100	180	0,35
LT	500	X 970 6515	230 V, 50 Hz	500	320	150	-	0,44
LTS	500	X 970 6565	230 V, 50 Hz	500	320	150	230	0,44
LT	750	X 970 6525	230 V, 50 Hz	750	420	250	-	0,53
LTS	750	X 970 6575	230 V, 50 Hz	750	420	250	330	0,53
LT	1000	X 970 6535	230 V, 50 Hz	1000	470	300	-	0,55
LTS	1000	X 970 6585	230 V, 50 Hz	1000	470	300	380	0,50
LT	1500	X 970 6545	230 V, 50 Hz	1500	520	350	-	0,59
LTS	1500	X 970 6595	230 V, 50 Hz	1500	520	350	430	0,60

Diameter quartz glass encasing tube = 28 mm

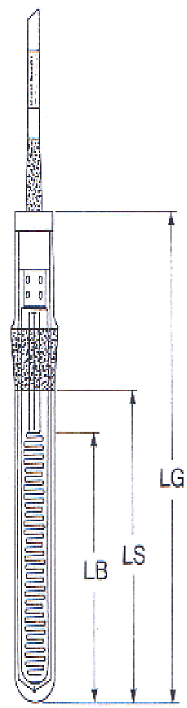
Model / Construction

LT = without standard ground joint

LTS = with standard ground joint NS 34/35

Immersion heater with standard ground joint NS 34/35

LB = heated length



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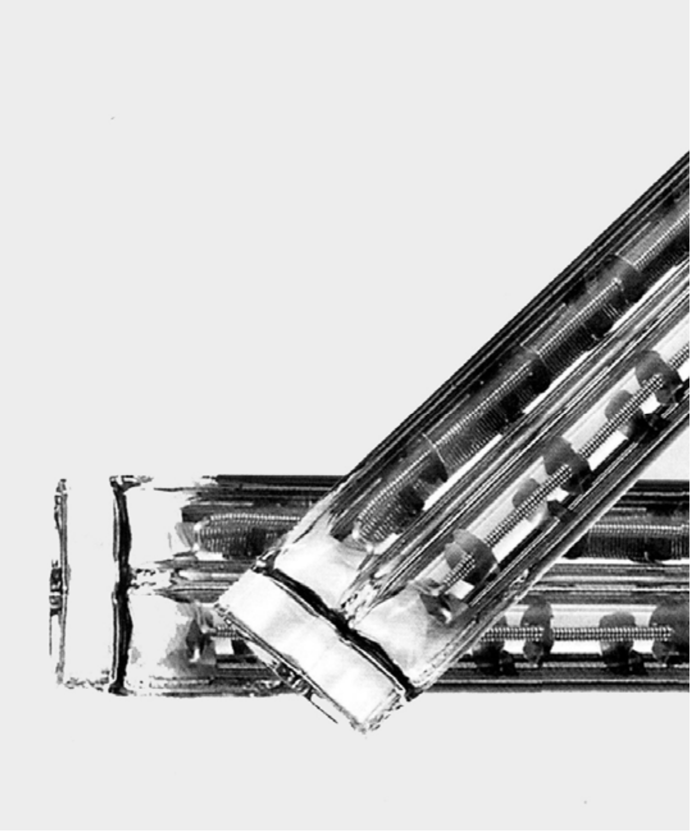
Quartz Glass

IR-Medium wave
infra red emitters



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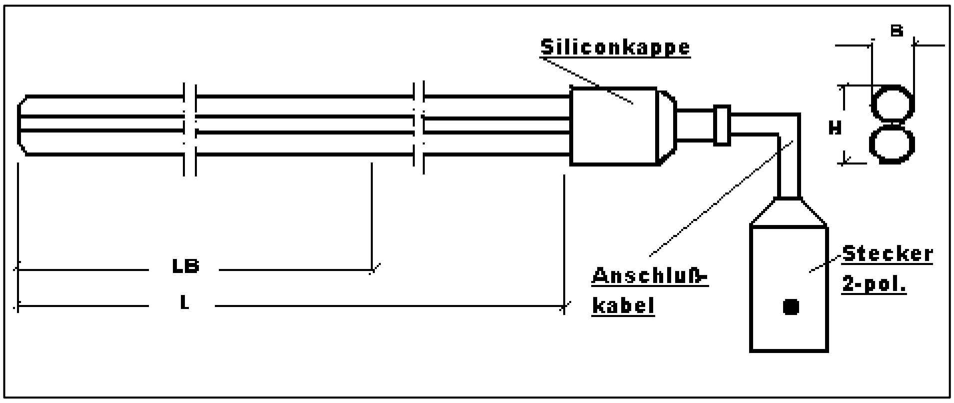
Quartz glass IR-Double Tube-Radiator

Typ Type	Leistg Power KW	Spannung Pressure V / Hz	L mm	Beh. L heat. L mm	B mm	H mm	Bestell-Nr. Order no.
A	4,3	380 / 60	800	350	15	35	**9714031**
B	3,7	380 / 60	800	350	15	35	**9714032**
C	1,8	230 / 60	440	200	11	23	**X45108895**
D	1,5	230 / 60	440	190	11	23	**X45132277**
E	1	230 / 60	490	130	11	23	**X45132278**
F	3	500 / 60	1200	430	11	23	**X45132279**
G	2,5	380 / 60	1200	600	11	23	**X45132280**
H	3	400 / 60	1200	500	11	23	**9266555**
I	1	230 / 60	700	600	8	18	**JR1000230700600**
J	0,85	230 / 60	630	530	8	18	**JR850230630530**



L = Gesamtlänge / total length
LB = Beheizte Länge / heated length
B = Breite / breadth
H = Höhe / height

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Hydrogen-Oxygen Combustion Apparatus

V5

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Hydrogen-Oxygen Combustion Apparatus V 5
According to the Wickbold-method

- Offers high working safety at cotinuous operation due to
- electrical control
- electronic surveillance
- and clear design for disintegration of organic samples for Cl, Br, F, B, S, Hg, J, P, Pb, Se, As, V, Cd, Zn analysis.
- Order no.: 9788508

The Proven Wickbold Method

The Wickbold method has been a proven success for about 30 years. It was formerly developed for the disintegration or organic samples in petrochemistry, to determine halogens and sulphur.

This method is very suitable for sulphur contents of 1 to 50,000 ppm and chlorine contents of 0.5 to 10 ppm. Certainly, substances with higher contents can also be disintegrated.

In the course of time, however, this method has also proved suitable for the disintegration of organic samples, whose content of mercury, arsenic and selenium is to be determined. Lately, the Wickbold method has also been used for the determination of EOX and the detection of sulphur in spruce/ and pine needles.

In comparsion with other disintegration methods, oxidizing combustion in a hydrogen-oxygen flame (above 2000°C) has the advantage that after disintegration, the elements to be determined are on hand as ions in a hydrous solution. Very often, the analytical determination can directly be performed in this solution, because it is free from excess disintegration auxiliaries.

Therefore, this method is used increasingly in the analyses of trace metallic elements in organic matrices. In the case of very low trace element concentrations, the continuous flame combustion permits consumption of a larger quantity of substance, thereby ensuring a concentration above the level of detection. Through simple concentration of the aqueous solution, it is possible to achieve the necessary concentration levels for the use of, for example, AAS. Furthermore, by the addition of complex formers the metallic trace elements can be enriched. In particular, the method is suitable for the precipitate exchange reaction on a thin sulphide layer to enrich heavy metals for the trace determination by the AAS and X-ray fluorescent methods. Using pre-enriching techniques, limits of detection in aqueous solutions in the ng/l range are achievable.

Operating convenience – high reliability

For still better operating convience and additionally higher reliability the combustion apparatus type 5 is available. It was designed according to ergonomic principles. High reliability and operational convience characterise the new development of this apparatus. All display and control elements are – easily visible – coordinated on a console.

The control of the inert and combustion gas is carried out by convenient handoperated valves on the front side of the console.

On the front panel of the console there are two valves on the left side, these are for controlling the working pressure, as well as a mixing valve which allows the convenient distribution of the gases when used with the solid burners. By using a throttle and by-pass valve, it is possible to maintain constant pressure under varying operation conditions. The manometer is easily readable on the lateral front of the console. Situated underneath it are all the switches and buttons for the electrical control of the apparatus.

The blocking of all gas flows is achieved with magnetic valves so that the handoperated needle valves are used exclusively to control the gas flow. Electronic safety circuits control the apparatus in operation. Extinguishing of the main flame or failure of the cooling water system automatically switches off the gass supplies.

Electrical control, eletronic monitoring

Multi switches control the gas supply to the individual quartz glass burners. LED (light emitting diodes) above the appertaining control valves and flowmeters, indicate the working position of the magnetic valves. A further light-emitting-diode indicates the operation of the cooling water. A fixture for supporting the quartz glass burner during intervals between combustion processes is equipped with an electrical ignition system. Burner ignition is simply achieved by push button. Change-over to main flame takes place automatically on removal of the burner. If it is not indroduced immediately in the combustion chamber, the flame will extinguish after a short time.

Combustion chamber/ Absorption vessel/ Rinsing device

The combustion apparatus type 5 contains an absorption vessel with a rising device according to Dr. Brüning and Roth, which permits the continuous operation with series analyses. The rinsing device on the top end of the absorption vessel allows the addition of absorption solutions as well as quantitative rinsing of the inner wall. The burner remains operational throughout.

The long combustion chamber of the apparatus allows a rapid combustion of large quantities of substances. After intensive cooling, the gas flow reaches the absorption vessel distributed into fine bubbles by a frit. This allows the combustion products to be washed out quanti-tatively by the absorption vessel. Due to the bubbling effect, a large gas/ liquid interface is produced in the absorption vessel, resulting in a maximum of product exchange. The geo-metrical surface of the absorption vessel is very small and the absorption of trace elements on the glass is minimal.

The outlet for the analysis solution is placed immediately above the frit plate of the absorption vessel. Draining of the liquid into a measuring flask is achieved by means of a multi-way tap. This controls, by means of mutual locking, the gas extraction, the ventilation of the measuring flask and the outflow of the liquid, thus excluding the possibility of operational faults. In order to achieve shorter flow paths for the liquids, the taps on the rinsing device and ab-sorption vessel are not built into the console as individual control elements.

Precombustion Unit VE for solids, pasty samples and contaminated liquids.

The electrically heated precombustion unit VE optimizes the precombustion by providing a targetable and controllable preincineration temperature in a semimonocoque tubular oven.

The burner allows a careful pyrolysis process that is individually selectable for each type of sample.

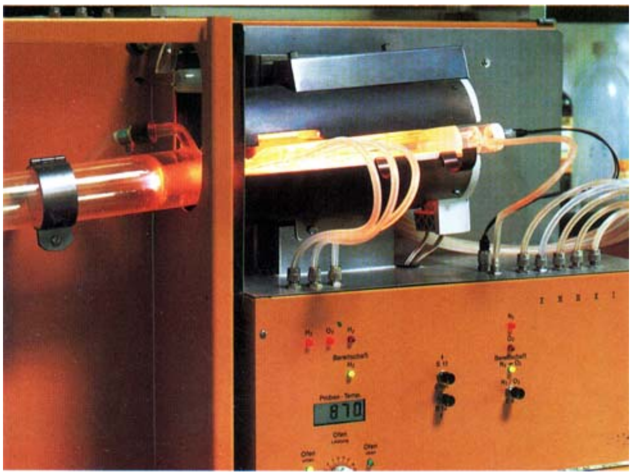
The avoidance of buildup of condensates in the burner and its capillaries quarantees trans-mission of all organic sample components into the H_2/ O_2 flame.

Possible residues in the burner capillaries can be removed with a H_2/ O_2 flame.

As the result of modifications in the gas supply feeds, the hydrogen/ oxygen flame has been improved in performance.

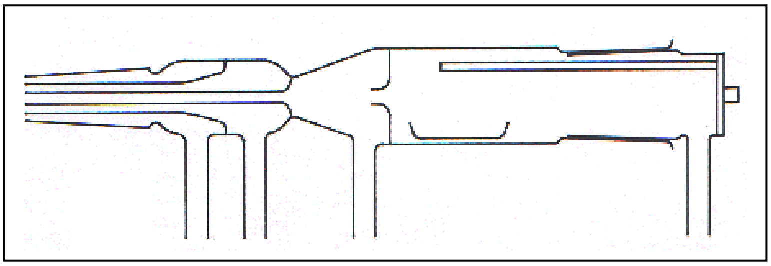
Quick and simple mounting and dismounting allows easy exchange of burners.

Please compare our special information PHL-B 41.



		Order no
Precombustion Unit	VE	9788522
Burner	BITC-VE	9788516
Ground piece	VE	9788512
Boat	VE	9788422

Wickbold V 5 with VE-unit in use



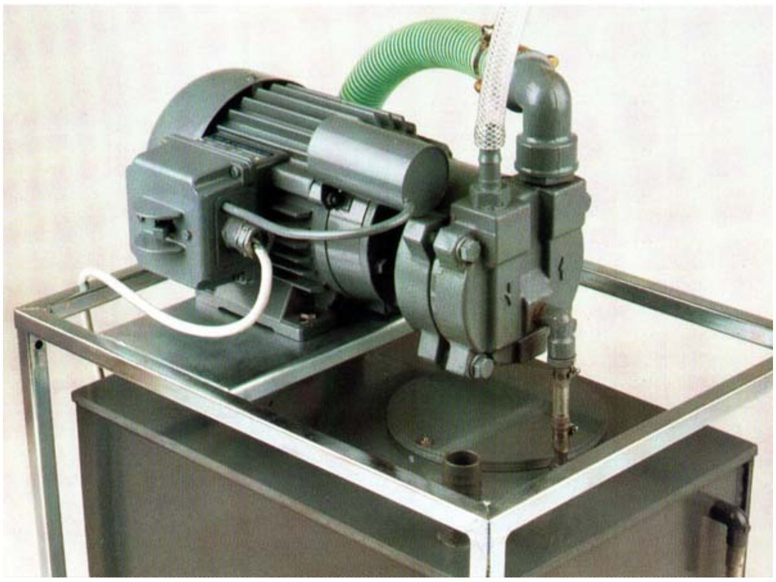
Burner BITC-VE

Vacuum Pump

A vacuum pump, specially designed for use with combustion apparatus, is available. As a water ring pump, it can be used without any restrictions for the extraction of oxygen.

The rotor and the housing are made from corrosion resistant alloys.

The electrical connection of the pump is carried out with a special plug on the combustion apparatus type 5. In this case, the pump is controlled by a main switch on the console.

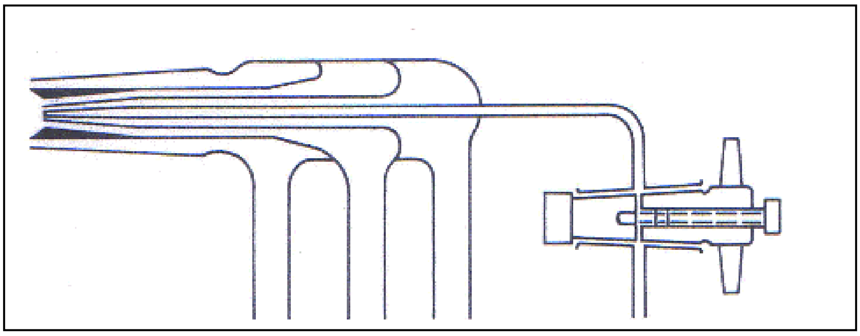


Order no.: 9268580

QCS

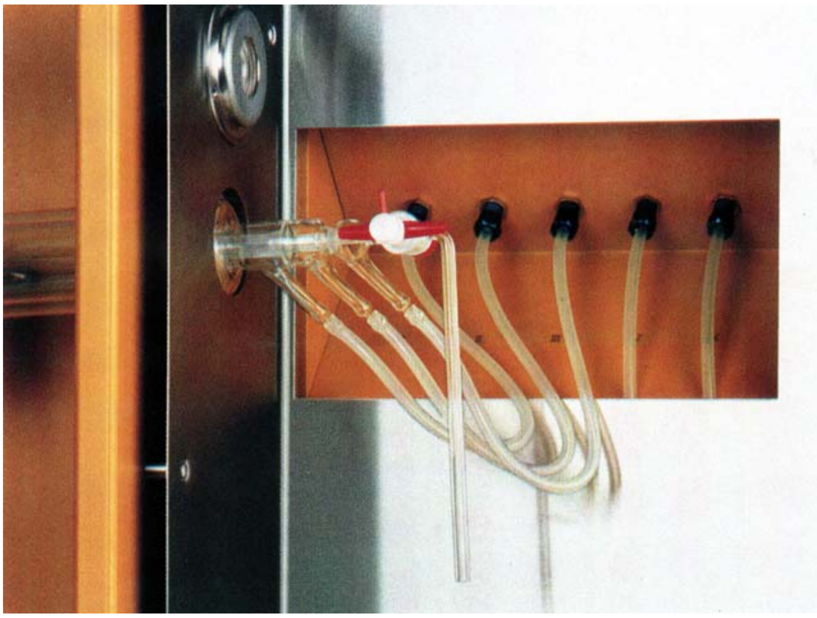
Combustion burner SB 5 for all liquids

This proven burner is the successor of SB 2. Its particular advantages are high-quality and high capacity combustion.



Order no.: 9788024

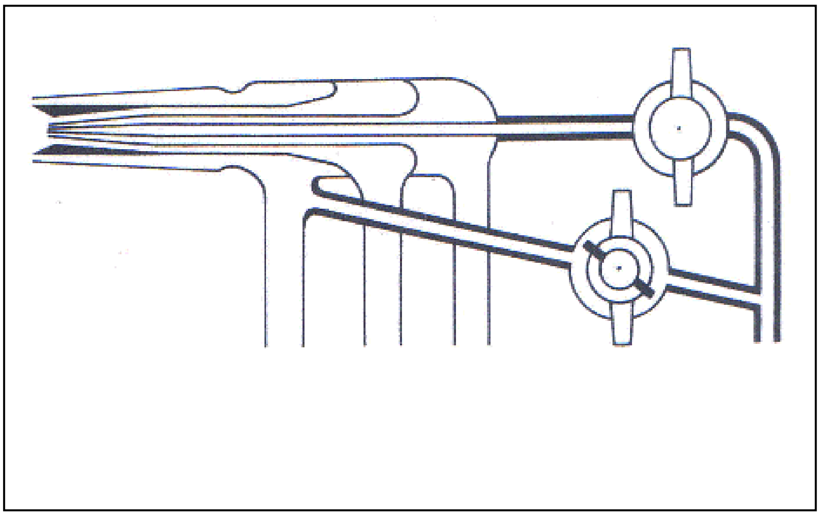
V 5 model with SB 5



Burner F 1 for gaseous Samples

The combustion rate of liquid gases
(e. g. propane, butane, propylene) can be considerably increased by enlarging the inlet cross section for the gasified substance.

This is achieved with a connection between the substance channel and the hydrogen channel.



Order no.: 9788412

V 5 model with burner F 1

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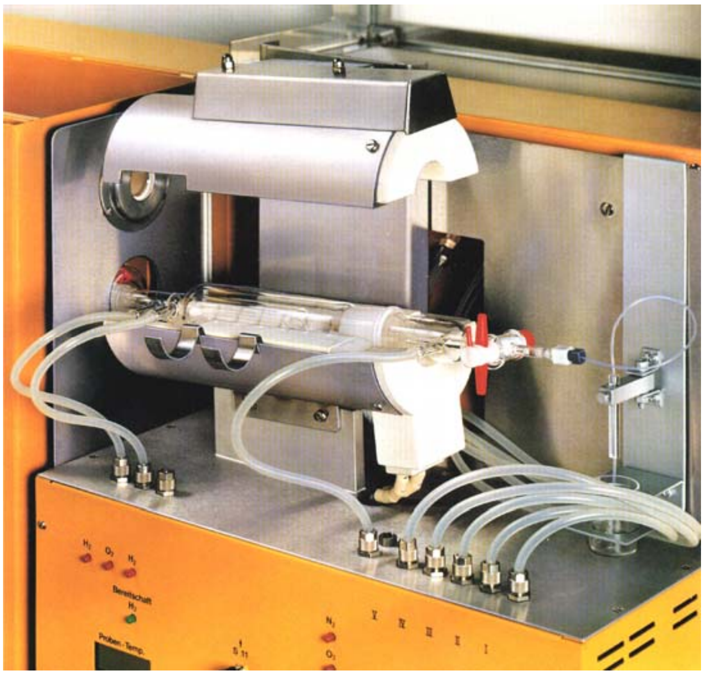
Precombustion Unit VE

For the use with the Disintegration System V5
according to the Wickbold Method and the
Multi Usage Combustion Burner UVE



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Disintegration according to Wickbold

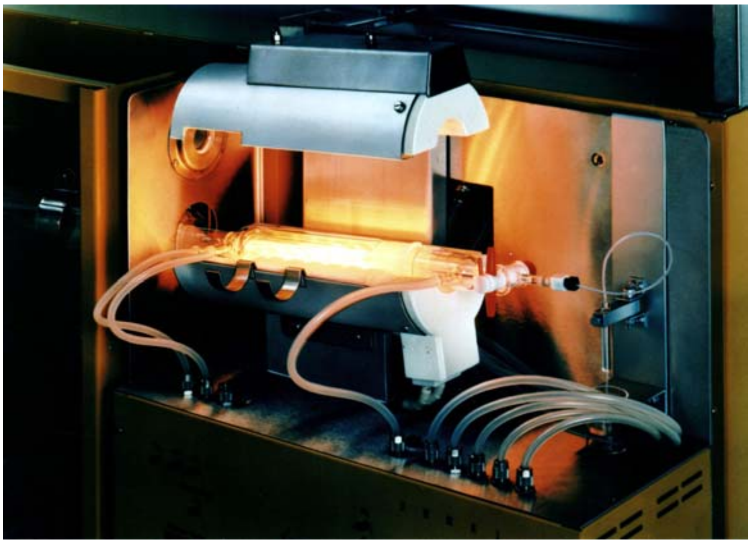
The function of the hydrogen-oxygen combustion apparatus V5 is to disintegrate solid, gaseous and liquid organic samples for the subsequent determination of principally halogens and sulphur, but also of mercury, arsenic, and selenium. Over the years it has proven itself in the field with regard to operational safety and reliability.

The electrically heated precombustion unit VE optimizes the precombustion by providing a targetable and controllable preincineration in a semimonocoque tubular oven.

The operating comfort and the disintegration quality of the combustion of solid or pasty samples as well as liquids contaminated with solids is further improved with the use of the new UVE Mulit Usage Burner.

Optimized Disintegration according to the Wickbold method for liquid, solid and pasty samples by electrical heated Pyrolysis with VE Apparatus and Multi Usage Combustion Burner.

The advantage of the Multi Usage Combustion Burner UVE is the possibility of determining liquid, solid and pasty samples with one burner only without mounting or dismounting of the VE precombustion unit. This is realised with a new Multi Usage Burner which guaranties that the sample is always flowing vaporously into the H_2/ O_2 flame. This result is obtained by using the precombustion oven VE as a way of thermal vaporization which warrants that the substance stays in the hot zone long enough to supply the H_2/ O_2 flame with its vaporous state.



Through the special construction of the system the quartz glass burner is protected to a large extent from attacks by alkalis which often leads to destruction by recrystallization. With the help of a crucible, carrying the sample boat in it, the resting time in the hot zone is increased in such a way that the H_2/ O_2 flame is always supplied with the sample in its vaporous state what minimizes direct damage of the combustion burner by substances damaging quartz glass.

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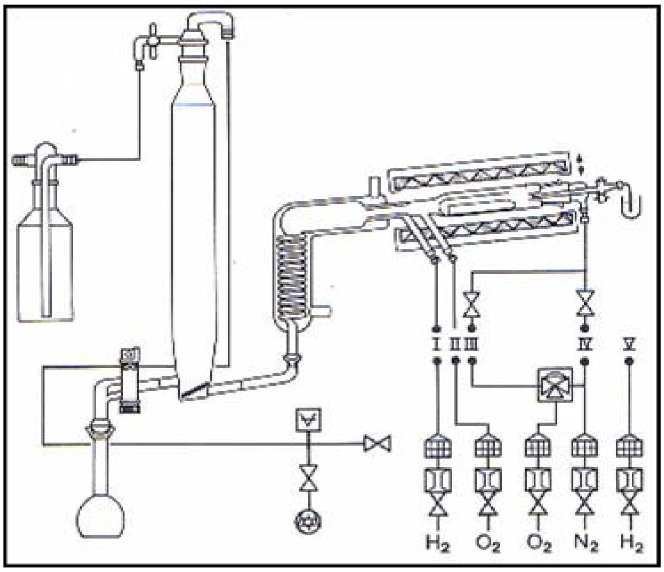
Organic deposits in the combustion capillary are prevented by a precombustion of the vaporous substance by mixing with O_2 which is supplied at the side of the burner and thereby produce a precombustion flame in the burner.

The completeness of the determination is improved because this substance, having been burned in advance, reaches the H_2/ O_2 flame as a turbulent O_2 mixture. This mixture burns to an extremly high degree what guarantees an optimal combustion and, thereby, a complete determination.



Disintegration acc. to Wickbold with the precombustion unit VE and the UVE Multi Usage Combustion Burner.

The advantages of this multi usage determination system are:

- No mounting or dismounting of the VE unit when changing from solid/ pasty to liquid samples and vice versa.
- Samples are transfered always in the vaporized state into the H_2/ O_2 flame.
- Protection of burner from recrystallization.
- Effective precombustion under O_2.
- Avoidance of condensate formation in burner and capillary.
- Big and turbulent hydrogen/ oxygen flame and, therefore, better conditions for determination.

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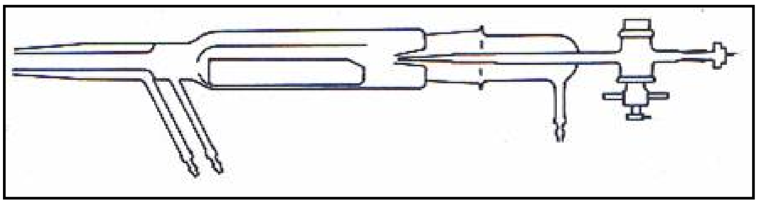
Multi Usage Combustion Burner UVE
for solid/ pasty samples



Technical Specifications

Design:	Semimonocoque tubular oven, lightweight con-struction. All circuit and control elements are in an integrated control unit. Connection to the V5 apparatus by a multi polar connection cable.
Power:	approx. 1 kW
Temperature Range:	to approx. 1100°C
Heating Time to Max. Temperature:	approx. 7-8 minutes

Product Indication and Order no.:

		Order no.
Precombustion Unit	VE	9788522
Multi Usage Combustion Burner	UVE	9788573
Joint Piece (Burner Cap)	UVE	9788574
Sample Boat	UVE	9788576
Burner Insert – Solid Samples	UVE-S	9788575
Burner Insert – Liquid Samples	UVE-L	9788577

Retrofitting Existing Equipment

Connection of the VE unit is already provided for all V5 apparatus equipped with the VE modification unit MVE.

This is true for all V5 instruments including and after the instrument no. 375, built in 1988.

Older models can be retrofitted without problem: The modification unit MVE can be subsequently built into the V5 combustion apparatus.

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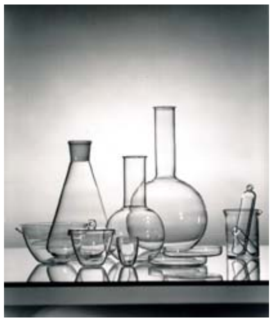
Laboratory Quartz glass



Verrerie Quartz pour le Laboratoire

DIN 12242
Kegelschliffe
Standard Ground Joints
Cone and Socket
Rodages normalisés

DIN 12244
Kugelschliffe
Ball and Socket Joints
Rodages sphériques

DIN 12216
Normgewinde
Standardized Screw Threads
Les Embouts filetés

DIN 28403
Vakuum-Kleinflansche
Vacuum Flanges

DIN 12542
Hähne
Stopcocks
Robinets

DIN 12330
Bechergläser
Beakers
Béchers

DIN 12395
Reagenzgläser
Test Tubes
Tubes à essais

DIN 51720
DIN 51740
DIN 12904
Tiegel
Crucibles
Creusets

DIN 12353
Rundkolben
Round Bottom Flasks
Ballons fond rond

DIN 12353
Stehkolben
Flat Bottom Flasks
Ballons fond plat

DIN 12353
Erlenmeyerkolben
Erlenmeyer Flasks
Fioles Erlenmeyer

DIN 12360
Kjeldahlkolben
Kjeldahl flasks
Kjeldahl Ballons

DIN 12341
Uhrglas-Schalen
Watch Glass Capsules
Verres de montre

DIN 12336
Abdampfschalen
Evaporating Basins
Capsules d'évaporation

DIN 12337
DIN 12338
Kristallisierungsschalen
Crystallizing Dishes

DIN 12339
Petrischalen
Petri dishes
Petri Basins

Verbrennungsschiffchen
Combustion Boats

Verbrennungsrohre
Combustion Tubes

Kühler
Condenser

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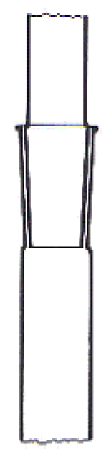
Standard Joints

Standard Ground Joints (DIN 12242)



Cone				Socket		
NS	Tube O Ø	Overall length	Item-no.	Tube O Ø	Overall length	Item-no.
5/13	4	120	9786970	8	120	9786971
7/16	6	120	9786972	10	120	9786973
10/19	8	120	9786974	13	120	9786975
12/21	11	120	9786976	15	120	9786977
14/23	13	120	9786978	17	120	9786979
19/26	17	120	9786980	22	125	9786981
24/29	22	150	9786982	28	135	9786983
29/32	26	150	9786984	34	135	9786985
34/35	30	150	9786986	40	150	9786987
45/40	40	150	9786988	50	150	9786989
60/46	55	180	9786990	65	180	9786991
71/51	65	200	9786992	75	200	9786993
85/55	80	200	9786994	90	200	9786995
100/60	95	200	9786996	105	200	9786997
110/60	105	200	9786998	105	200	9786999
115/60	110	200	9786700	120	200	9786701
120/60	115	200	9787002	125	200	9787003
125/60	120	200	9787004	130	200	9787005
130/60	125	200	9787006	135	200	9787007
135/60	130	200	9787008	140	250	9787009
145/60	140	200	9787010	150	250	9787011
150/60	145	200	9787012	155	200	9787013

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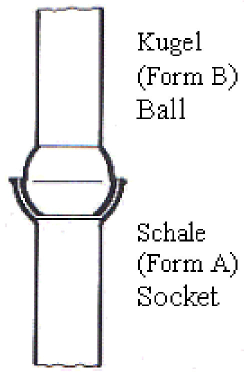
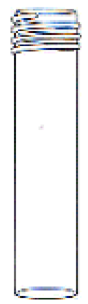
Ball and Socket Joints (DIN 12244)



Socket (Form A)				Ball (Form B)
	Overall length	**Tube**	**Item-no.**	**Item-no.**
S13	100	8 x 1,9	9786653	9786652
S19	100	13 x 2	9786655	9786654
S29	120	19 x 2	9786657	9786656
S35	120	25 x 2,5	9786659	9786658
S40	150	30 x 2,2	9786661	9786660
S41	150	30 x 2,5	9786663	9786662
S51	150	36 x 2,2	9786665	9786664
S64	150	48 x 2,4	9786667	9786666
S76	150	58 x 3,4	9786669	9786668
S102	150	82 x 3,4	9786671	9786670

Screw Threads

Standardized Screw Threads on clear fused Quartz Tubes (DIN 12216, Form E)



Size	Tube-Ø (mm)	Thickness (mm)	Item-no.	Packing Size
GL 14	12	1,4	9787301	10
GL 18	16	2	9787302	10
GL 25	22	2	9787303	5
GL 32	28	2,2	9787304	5
GL 45	42	2,4	9787305	3

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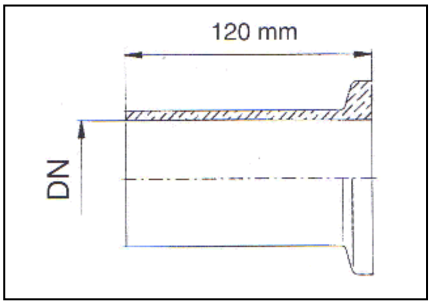
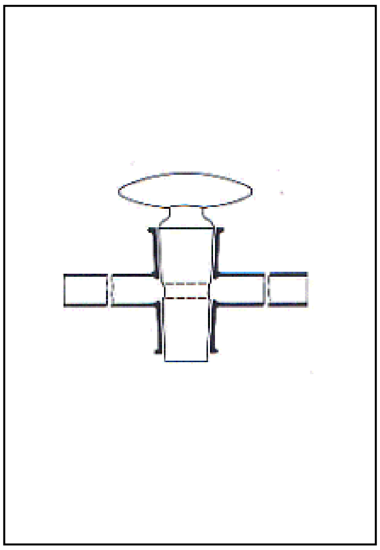
Vacuum Flanges (DIN 28403)



Nennweite DN	Item-no.
DN 10	9780010
DN 16	9780016
DN 25	9780025
DN 40	9780040
DN 50	9780050

Special Flanges on request.

One-Way Stopcocks (DIN 12542)



Reference No.	Bore (mm)	Item-no.
2	1,5	9786560
3	2,5	9786561
4	4	9786562
6	6	9786563
10	10	9786565

Three-way Stopcocks and special Stopcocks on request.

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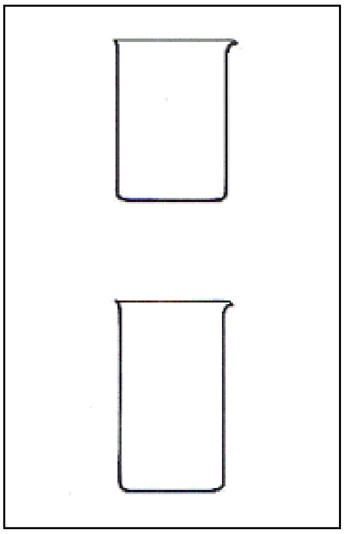
Beakers / Test Tubes

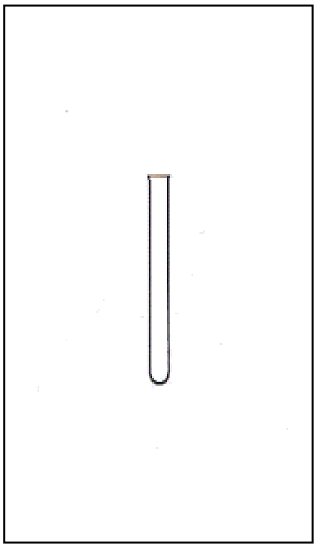
Beakers with Spout (DIN 12330)



low form				tall form			
ml	Ø mm	H mm	Ident-no.	ml	Ø mm	H mm	Item-no.
5	21	29	9785250	25	30	55	9785204
10	25	35	9785251	50	38	65	9785205
25	32	47	9785254	100	45	80	9785206
50	39	55	9785255	150	52	97	9785207
100	49	70	9785256	250	60	115	9785209
150	55	80	9785257	400	70	130	9785211
250	69	90	9785259	600	78	145	9785213
400	80	100	9785261	800	86	170	9785214
600	90	115	9785263	1000	95	185	9785215
800	98	135	9785264	2000	115	235	9785217
1000	105	145	9785265	3000	135	280	9785219
2000	130	185	9785267	-	-	-	-
3000	155	210	9785269	-	-	-	-
5000	170	270	9785271	-	-	-	-

Special dimensions on request.

Test Tubes (DIN 12395)



Ø (mm)	Length (mm)	Item-Code
8	70	9785300
10	100	9785301
12	100	9785302
14	130	9785303
16	160	9785304
18	180	9785305
20	180	9785306
30	200	9785307
40	200	9785308

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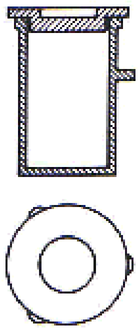
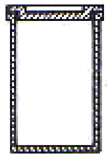
Crucibles (DIN 51720 / DIN 51740 / DIN 12904)

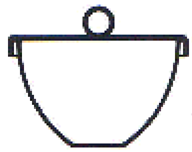
Form R



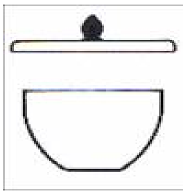
Form I



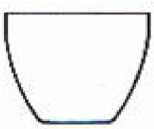
Form S



	Item-no.			Item-no.			Item-no.	
	Crucible	**Lid**		**Crucible**	**Lid**		**Crucible**	**Lid**
Dr. Rademacher	9783250	9783251	ISO DIN 51 720	9783260	9783261	Swelling Test DIN 51 741	9783270	9783271
Ø = 27 mm	Height 45 mm	Weight 27-29	Ø = 25 mm	Height 38 mm	Weight 10-14	Ø = 41 mm	Height 26 mm	Weight 10-12,75



Form 1



Form 2

Form 3

	Crucible (DIN 12904)				CrucibleLid (DIN 12904)	
	ml	**Ø (mm)**	**H (mm)**	**Item-no.**	**Ø (mm)**	**Item-no.**
Form 1	6	30	19	9783300	34	9783330
	11	35	22	9783301	39	9783331
	15	40	25	9783302	44	9783332
	25	45	28	9783303	49	9783333
	29	50	32	9783304	54	9783334
	50	60	38	9783305	64	9783335
	85	70	44	9783306	74	9783336
Form 2	15	35	28	9783307	39	9783331
	20	40	32	9783308	44	9783332
	38	45	36	9783309	49	9783333
	49	50	40	9783310	54	9783334
	90	60	48	9783311	64	9783335
	150	70	56	9783312	74	9783336
Form 3	15	30	38	9783313	34	9783330
	24	35	44	9783314	39	9783331
	40	40	50	9783315	44	9783332
	50	45	56	9783316	49	9783333
	75	50	62	9783317	54	9783334
	120	60	75	9783318	64	9783335

Subject to technical alterations reserved · 01/2009

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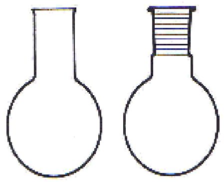
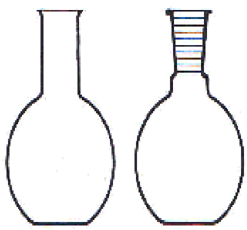
Flasks

Round Bottom Flasks (DIN 12353)



ml	Ø (mm)	d (mm)	H (mm)	Without socket Item-no.	With socket	Item-no.
narrow neck						
50	51	22	105	9782000	14	9782006
100	64	22	115	9782001	19	9782007
250	85	34	145	9782002	29	9782008
500	105	34	175	9782003	29	9782009
1000	131	42	210	9782004	29	9782010
2000	165	50	260	9782005	29	9782011
4000	207	76	315	9782085	60	9782088
5000	223	65	305	9782086	60	9782089
6000	236	89	355	9782087	60	9782090
wide neck						
50	51	34	105	9782012	29	9782018
100	64	34	115	9782013	29	9782019
250	85	50	145	9782014	45	9782020
500	105	50	175	9782015	45	9782021
1000	131	65	210	9782016	45	9782022
2000	165	76	260	9782017	45	9782023
4000	207	76	315	9782091	-	-
5000	223	65	305	9782092	-	-
6000	236	89	355	9782093	-	-

Flat Bottom Flasks (DIN 12353)



ml	Ø (mm)	D (mm)	H (mm)	without socket Item-no.	With socket	Item-no.
narrow neck						
50	51	22	100	9782024	19	9782030
100	64	22	110	9782025	19	9782031
250	85	34	140	9782026	29	9782032
500	105	34	170	9782027	29	9782033
1000	131	42	200	9782028	29	9782034
2000	165	50	250	9782029	29	9782035
wide neck						
50	51	34	100	9782036	29	9782042
100	64	34	100	9782037	29	9782043
250	85	50	140	9782038	45	9782044
500	105	50	170	9782039	45	9782045
1000	131	65	200	9782040	45	9782046
2000	165	76	250	9782041	45	9782047

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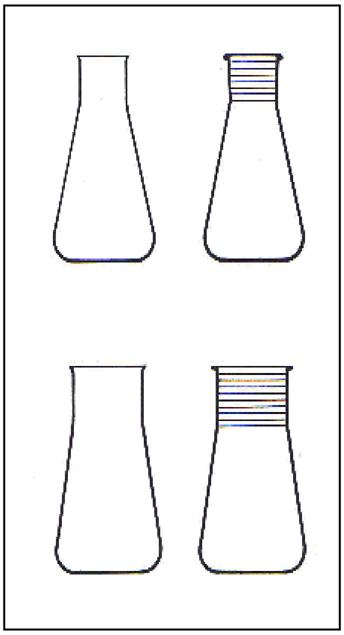
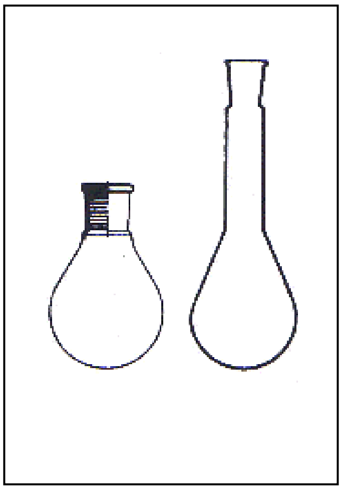
Erlenmeyer Flasks (DIN 12353)



ml	Ø (mm)	H (mm)	without socket Item-Code	with socket	Item-Code
narrow neck					
25	42	70	9782050	19	9782057
50	54	80	9782051	19	9782058
100	65	105	9782052	19	9782059
250	85	140	9782053	29	9782060
500	105	175	9782054	29	9782061
1000	134	210	9782055	29	9782062
2000	166	280	9701034	-	-
3000	185	315	9782056	45	9782063
wide neck					
50	51	80	9782064	29	9782069
100	64	105	9782065	29	9782070
250	85	140	9782066	45	9782071
500	105	175	9782067	45	9782072
1000	130	210	9782068	45	9782073
2000	153	275	9782074	45	-

Kjeldahl with cut (DIN 12360)



ml	d 1 (mm)	d 2 (mm)	H (mm)	with socket	Item-no.	Item-no.
50	51	22	200	19/26	9782110	-
50	51	22	200	-	-	9782101
100	60	22	200	19/26	9782111	-
100	60	22	200	-	-	9782102
250	81	34	270	29/32	9782112	-
250	81	34	270	-	-	9782103
500	101	34	300	29/32	9782113	-
500	101	34	300	-	-	9782104
750	115	34	340	29/32	9782114	-
750	115	34	340	-	-	9782105
1000	126	34	350	29/32	9782115	-
1000	126	34	350	-	-	9782106

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Capsules Basins
Watch Glass Capsules (DIN 12341)

Ø (mm)	r (mm)	Item-no.
20	58	9784408
40	58	9784400
50	58	9784401
60	58	9784402
70	65	9784403
80	74	9784404
100	102	9784405
125	130	9784406
150	160	9784407

Evaporating Basins with Spout (DIN 12336)

ml	Ø (mm)	H (mm)	Item-no.
10	40	18	9784100
15	50	25	9784101
45	60	30	9784102
60	70	35	9784103
90	80	45	9784104
170	95	55	9784105
320	115	65	9784106
600	140	80	9784107
1500	190	100	9784108

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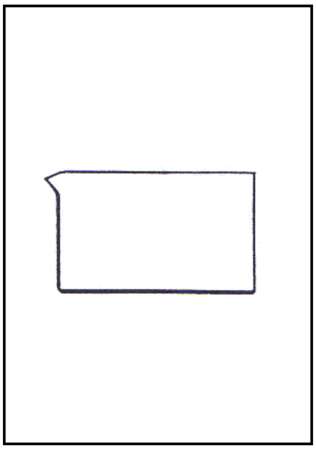
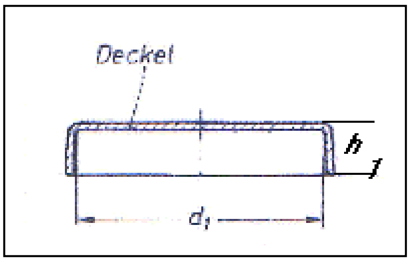
Crystallizing Dishes (DIN 12 337/ DIN 12 338)

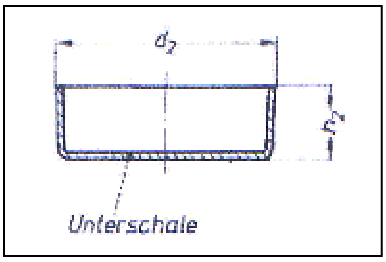


Capacity (ml)	Ø (mm)	H (mm)	Order no. without spout	Order no. with spout
20	40	25	9789024	9789033
40	50	30	9789025	9789034
60	60	35	9789026	9789035
100	70	40	9789027	9789036
150	80	45	9789028	9789037
300	95	55	9789029	9789038
400	100	60	9789030	9789039
500	115	65	9789031	9789040
900	140	75	9789032	9789041

Culture (Petri) Dishes (DIN 12339)



Petri dishes cover



Petri dishes base

Cover	d 1 mm	h 1 mm	Item-no.	Base	d 2 mm	h 2 mm	Item-no.
20	20	6	9781151	**15**	15	8	9781164
25	25	6	9781152	**20**	20	8	9781165
30	30	6	9781153	**25**	25	8	9781166
35	35	6	9781154	**30**	30	8	9781167
40	40	12	9781155	**35**	35	15	9781168
45	45	12	9781156	**40**	40	15	9781169
50	50	12	9781157	**45**	45	20	9781170
60	60	12	9781158	**55**	55	20	9781171
70	70	12	9781159	**65**	65	20	9781172
80	80	12	9781160	**75**	75	20	9781173
90	90	12	9781161	**85**	85	20	9781174
100	100	12	9781162	**95**	95	20	9781175
120	120	12	9781163	**115**	115	20	9781176
150	150	20	9781177	**140**	140	30	9781178

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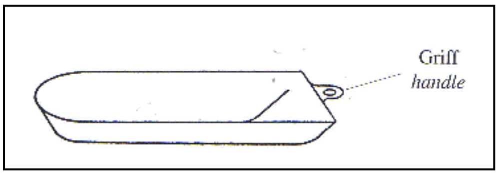
Combustion Boats
Nacelles



length (mm)	breadth (mm)	high (mm)	Ident-no.
25	5	4	9261540
48	15	10	9261541
77	16	9	9261542
78	19	11	9261543
103	21	14	9261544
154	34	17	9261545
200	26	20	9261546
250	26	20	9261547
300	26	20	9261548
350	26	20	9261549
400	26	20	9261550
450	26	20	9261551
480	26	20	9261552
500	26	20	9261553

Other lengths and widths can be manufactured upon request.

All Combustion Boats can be manufactured with and without a handle.

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Combustion Boats
Nacelles

Länge Length (mm)	Breite Breadth (mm)	Höhe High (mm)	Ident-no. Item-Code
90	20	15	9788576

Länge Length (mm)	Breite Breadth (mm)	Höhe High (mm)	Ident-no. Item-Code
100	20	15	9788422

Länge Length (mm)	Breite Breadth (mm)	Höhe High (mm)	Ident-no. Item-Code
130	20	15	9788403

Länge Length (mm)	Breite Breadth (mm)	Höhe High (mm)	Ident-no. Item-Code
154	32	17	9260002

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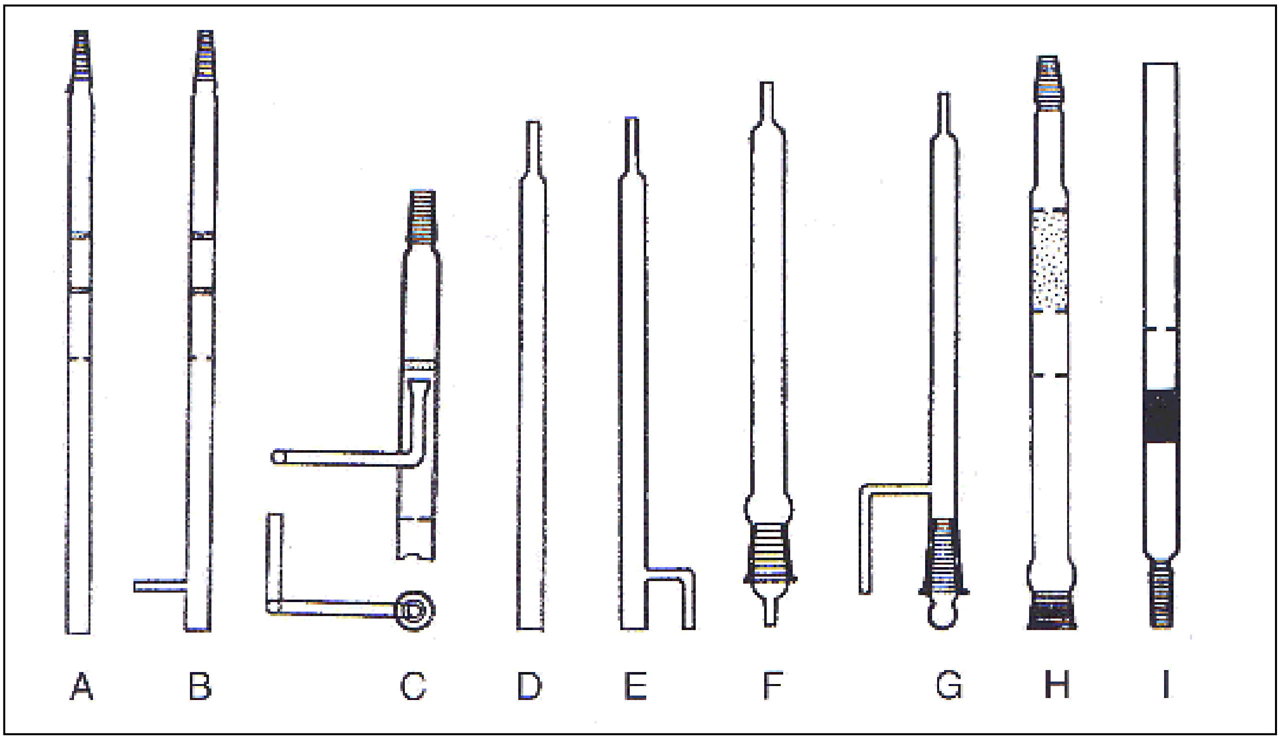
Combustion Tubes



shape	description	length (mm)	Ø (mm)	cut	sintered discs	Item-no.
A	macro tubes Grote-Krekeler	500	20	14,5	2	9782500
		550	20	14,5	2	9782501
		750	20	14,5	2	9782502
B	mit Ansatz	500	20	14,5	2	9782503
	with side connection	433	15	10	2	9782504
C	Zimmermann-Tube	500	20	14,5	1	9782505
		550	20	14,5	1	9782506

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shape	description	length (mm)	Ø (mm)	tube (mm)	connecion (mm)	Item-no.
D	peak tube	425	10	25x3x1	-	9782510
		450	10	25x3x1	-	9782511
		475	10	25x3x1	-	9782512
		525	10	25x3x1	-	9782513
		525	11	25x3x1	-	9782514
		700	12	25x3x1	-	9782515
E	peak tube with side connection *)	525	10	25x5x1	30x30x5x2	9782516
		670	10	25x5x3	35x35x5x2	9782517
		525	11	25x5x3	35x35x5x2	9782518
		670	11	25x5x3	40x40x5x2	9782519
		525	12	25x5x3	35x35x5x2	9782520
		670	12	25x5x3	40x40x5x2	9782521

shape	description	length (mm)	Ø (mm)	quartz (mm)	cone/socket (mm)	Item-no.
F	Makro nach Liebig	840	17	-	-	9782525
G	n. Pregel DIN 51721	840	12	-	-	9782526
H	ASTM-Conditions	500	18	1,5-2	14,5/19	9782527
		505	20	1,5-2	14,5/19	9782528
I	britische Vorschrift* SULFOR-Analysis*)	630	18	1,5-2	19/-	9782529
		500	20	1,5-2	14,5/-	9782530

*) Combustion tubes SULFOR-Analysis British I P-63/42(T).

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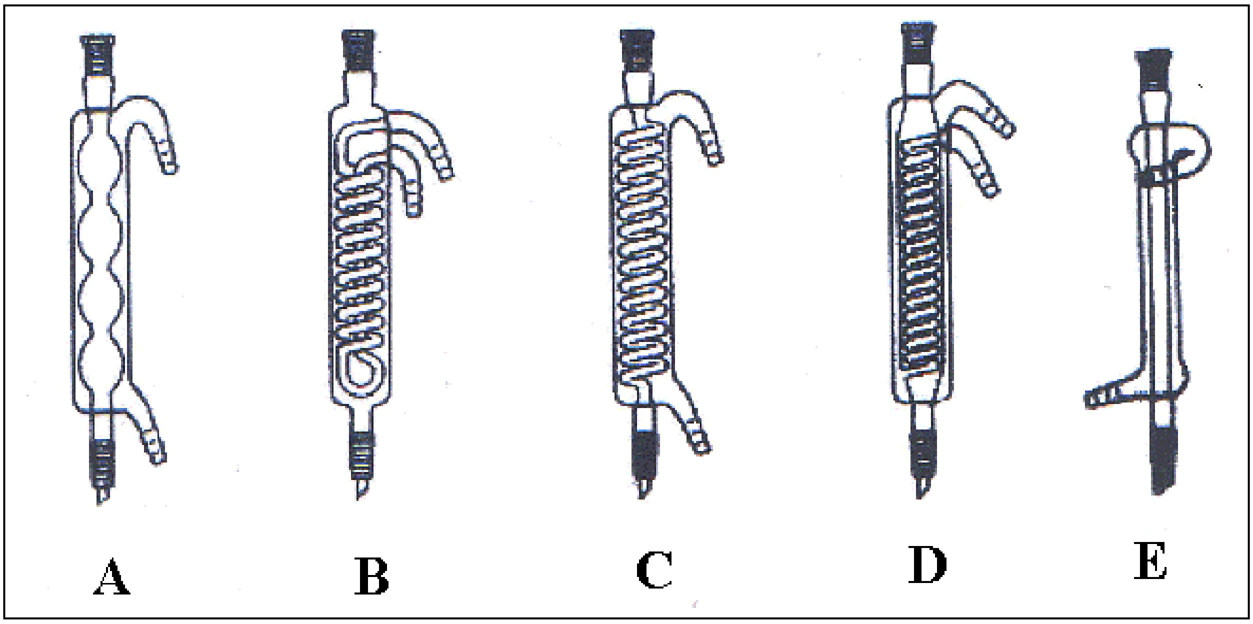
Condenser



shape	description	NS 14,5	jacket length (mm)	Item-no.
A	Bowl Condenser DIN 12581		200	9782550
			300	9782551
			400	9782552
B	Dimrothkühler		200	9782553
			300	9782554
			400	9782555
C	Twist Condenser		200	9782556
			300	9782557
			400	9782558
D	Intensivkühler		200	9782559
			300	9782560
E	Liebigkühler		150	9782561
			200	9782562
			300	9782563
			400	9782564

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Quartz Glass-Products from the company:

- Graduated Pipettes
- One-mark Pipettes
- Gas Washing Bottles
- Funnels
- Separating Funnels
- Bottles with NS
- Distillation Flasks
- More-Neck Round Bottom
- Volumetric Flasks
- Pear Shape Flasks
- Reaction Vessels Flat Flange with Lid Flat Flange
- Flanges-Systems
- Capillare
- Rods
- Tubes

Special products acc. to customer specifications on request.

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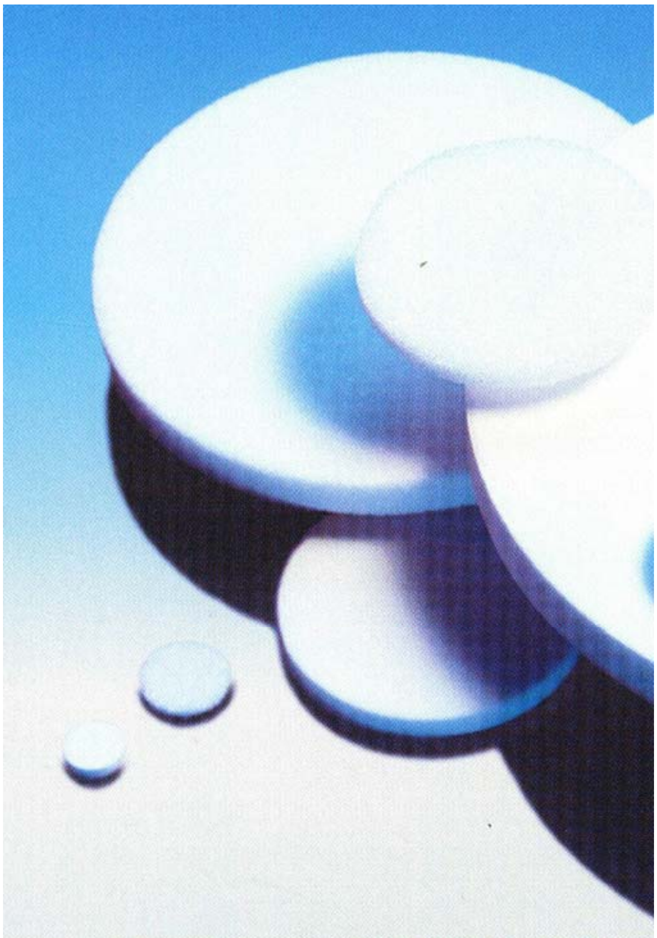
Sintered Disc

Porous Filter Disc made of Quartz Glass



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Filtering with Porous Filter Disc made of Quartz Glass -Sintered Discs

Quartz glass filters have multiple applications for analytical work in laboratories, in special-design laboratory equipment, and as component parts in technical apparatus.

The purpose of filtration is separation of parts with certain size from liquids or gases. We use filtration in chemical works, in order to separate the fall-out from the liquids. It is depending on the fall-out size, which filters are to be used. The finest filters (manufactured of quartz glass) are that fine, that even the bacteria get separated through such filters. There are 5 porosity grades from quartz glass filters.

The purity, chemical resistance and its high thermic endurance of quartz glass are realy its character and it allows us to apply it in great variety.

Innovative and powerful manufacturing secures the quality of the products during production and guarantees uniform properties even for the highest demands and exacting applications.

Next to a large variety of standard types, special designs also could be adjusted to your specific requirements.

Porosity

According to their pore sizes, quartzglass filters are divided into porosity grades from 0 to 5. Table 1 shows the porosity ranges and their main fields of application. The pore sizes indicated always refer to the largest pore in the disc. This also indicates the diameter of the particles which are only retained during filtration. Porosities are determined using the Bechhold bubblepressure method which has often been described in literature[1]. To achieve rapid filtration it is necessary to produce as many “passage” pores as possible without dead-ends or enclosed hollow spaces. The practical advantages stem from the well established properties of quartzglass and the special manufacturing techniques used in sintering the quartzglass particles, which are the starting material for filter discs.

An essential condition for successfuly working with quartzglass filters is the selection of the correct porosity. Table 1 snows six porosity ranges and indicates their main fieds of application. In selecting suitable filtration apparatus it should be remembered that the nominal maximum pore size should be slightly less than the size of the smallest particles to be separated. This prevents these particles from entering the pores. It also permits highest possible flow rates without making cleaning unnecessary difficult. This is specially important in the separation of fine-grained insoluble solid particles such as silicates and graphite.

Quartzglass filter apparatus of porosities 3 or 4 is used almost exclusively in quantitative analysis. Different porosities are sometimes recommended for the same substances. This is explained by the fact that differing precipitation techniques for gravimetric analysis often produce different particles sizes. In case of doubt, porosity 4 is preferred as it will always allow quantitative separation of the precipitate. Porosity 3 however, has proved itself completely satisfactory in all cases for substances such as silver chloride and nickel dimethylglyoxime.

[1] Frank, W.: GIT 11 (1967) H. 7, 683-688

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Table 1

Porosity	New identificationmark ISO 4793	Norminal max. pore size µm	Fields of applications, examples
0	P 250	160 – 250	Gas distribution. Gas distribution in liquids at low pressure. Filtration of coarsest precipitates.
1	P 160	100 – 160	Coarse filtration, Filtration of coarse precipitates, gas distribution in liquids. Liquid distribution, coarse gas filtration. Extraction apparatus for coarse grain materials. Loose filter layer substrates for gelatinous precipitates.
2	P 100	40 – 100	Preparative fine filtration. Preparative work with crystalline precipitates. Mercury filtration.
3	P 40	16 – 40	Analytic filtration. Analytic work with medium-fine precipitates. Preparative work with fine precipitates. Filtration in cellulose chemistry, fine gas filtration. Extraction apparatus for fine-grained materials.
4	P 16	10 – 16	Analytic fine filtration. Analytic work with very fine precipitates (e. g. $BaSO_4$, Cu_2O). Preparative work with precipitates of appropriate fineness. Non-return and stop valves for mercury.
5	P 1,6	1,0 – 1,6	Ultrafine filtration

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Flow Rates:

To determine possible application of quartzglass filter discs and apparatus, it is necessary to know not only the porosity, but also the flow rates of liquids and gases. These are shown for water and air in figures 1 and 2. The data applies to filter discs of 30 mm diameter. The flow rates for other disc diameters can be calculated by multiplying the value of a 30 mm disc by the conversion factor in table 2.

Table 2:

Filter disc Ø mm	10	20	30	40	60	90	120	150	175
Conversion factor	0,13	0,55	1	1,5	2,5	4,3	6,8	9,7	15

Example:

Filtration of an aqueous solution with a filter funnel of 60 mm disc diameter, porosity 4, under water-pump vacuum: Using the graph in figure 1, and with a pressure differential of about 900 mbar, read off the flow rate which is 200 ml/min. From table 2 select the conversion factor for 60 mm disc diameter and calculate the flow rate: 200 x 2.5 = 500 ml/min.
Since the flow rate varies greatly with the pore diameter (pore radius to the power of 4), deviations from the given values can occur. Flow obstruction can also be caused by the formation of a filter "cake" on the sintered disc. Further flow rate variations occur when working with liquids whose viscosities differ from that of water. In these cases the flow rate is inversely proportional to the viscosity.
Deviations in gas flow rates occur when filter discs are covered by a layer of water or other liquid (Gas flow in washing processes). More detailed information on this subject can be found in literature[1].

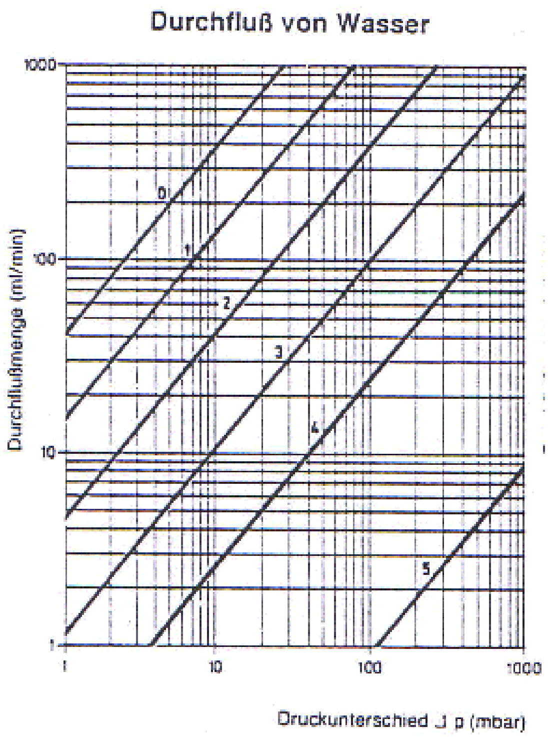

Fig. 1:

Water flow rate through filter discs of various porosities as a function of pressure differential. For disc diameter 30 mm Gültig für Filterplatten von 30 mm Ø.

[1] Frank, W.: GIT 11 (1967) H. 7, S. 683-688

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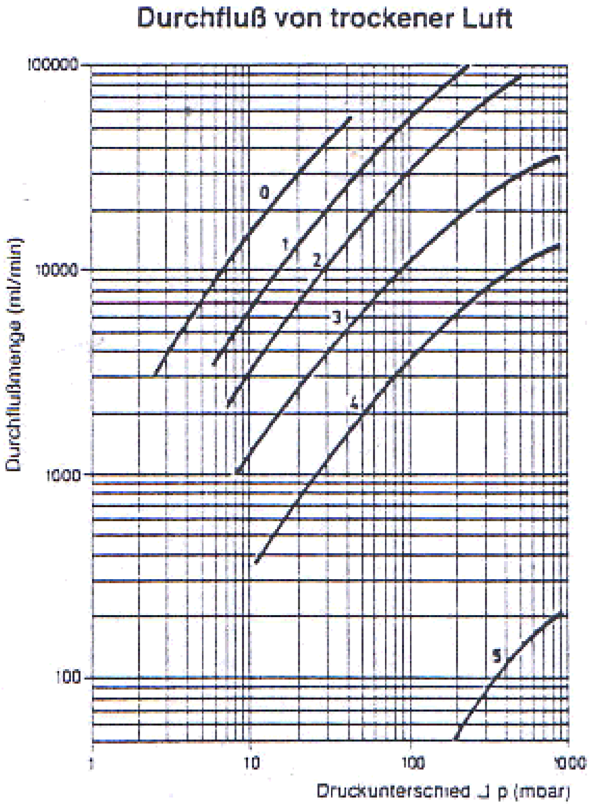

Fig. 2:
Air flow rate through Filter Discs of different porosities given by pressure difference. Valid for Filter Discs Ø 30 mm.

Ultrafine Filtration:

For Ultrafine filtration quartzglass filter apparatus with sintered discs of porosity 5 are used. Here the nominal value ot the maximum pore size lies between 1.0 and 1.6 µm. Experiments with bacterium prodigiosum, most commonly used for the test purposes in this field, have shown that a bacteriumfree filtrate is obtained with a nominal maximum pore size of 2 µm, even when filtering very dense suspensions. A strain of nearly spherical bacteria was used. Experiments with spore-producing bacillus mesentericus led to the same result.

It is interesting to note that diluted suspensions of these bacteria (15000 to 90000 per millilitre) could still be filtered sterile through porosity 3 filters. A bacterium-free filtrate could not be obtained however when filtering dense suspensions through them. The pores are already so narrow that all bacteria in dilute suspensions adhere to the pore walls. In the case of dense suspensions, bacteria can still pass through once the pore walls become saturated. Real straining is only effected with a maximum pore size of 2 µm and below; i. e. it is only here that the pores are smaller than the bacteria to be separated.

Ultrafine filtration is one of the most important methods for treatment of biological solutions without using high temperatures which in many cases would lead to a change in, or decomposition of, the active ingredients in the solution. For liquid filtration, sintered quartzglass filter funnels of standard design are used. For bacterium-free filtration of gases, e. g. in ventilation of fungal and bacterial cultures, pipeline filters are used. Here, porosity 3 is adequate, providing the space in front of the dry filter disc, on the air inlet side, is stuffed evenly and loosely with cotton wool.

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Care and Cleaning

Temperature Change, Drying and Sterilizing:

Sudden temperature change and uneven heating should be avoided. Sintered quartzglass filter funnels, pipeline filter tubes and other sintered quartzglass apparatus with disc diameters exceeding 50 mm, which are to be dried or sterilized, should be placed in cold ovens or sterilizers. The rate of heating should not be more than 2°C/min. This is the only way of preventing internal strains which are caused by excessive temperature differences between the surrounding quartzglass vessel and the sintered filter disc, and which can lead to fracture of apparatus.

Filtration apparatus should, whenever possible, stand on its rim (stem upwards) in the oven or sterilizer. A perforated support base is advantageous since it allows air convection between the inside of the vessel and the body of the oven. If angled positioning of the filtration apparatus in the oven is unavoidable (pipeline filter tubes), then any point of support which is near to the filter seal position should be protected against premature heatings. This is done by using an underlay of heat-insulating material.

The apparatus should remain in the oven or sterilizer during cooling. Due to the thermal inertia of this type of oven, the cooling time is adequate.

Cleaning new Sintered Quartzglassware:

Before using sintered quartzglass filter apparatus for the first time, hot hydrochloric acid followed by several rinses of distilled water should be sucked through the filter disc under a good vacuum. This removes dust particles and powdered quartzglass. It is important that each successive water rinse be started only after the preceding one has been completely flushed through. This so-called “tear through” method must only be used for cleaning filters. It should never be adopted for preparative or analytical filtration.

Mechanical Cleaning:

(Sintered quartzglass filters should always be cleaned immediately after use.)

If no precipitate has entered the pores, surface rinsing under the tap or with a wash bottle is often sufficient. The filter disc surface can be wiped clean with a small brush or squeegee.

Where some ot the precipitate has entered the pores, backflushing is necessary. In the case of porosities 0 to 2 this can be done simply by using a water tap, connecting it with rubber tubing to the stem of the sintered quartzglass piece and allowing water to run backwards through the filter disc. The water pressure must not exceed 1 kp/cm^2.

For porosities 3, 4 and 5 the precipitate is flushed or wiped off the disc, and water is sucked through in the opposite direction to filtration.

Filters clogged by dust and dirt during gas filtration can be restored by treatment with a warm detergent solution followed by blowing through clean air from the clean side of the filter. Dirt particles are brought to the surface by the foam and removed by rinsing with water.

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Chemical Cleaning:

If, after mechanical cleaning, some of the pores still remain clogged, or if it is desirable to make sure that no residue from previous work remains before filtering a new substance, then thorough chemical cleaning is required. The choice of solvent obviously depends on the nature of the contamination. For example:

Barium sulphate	hot conc. sulphuric acid (100°C)
Silver chloride	hot ammonia liquor
Red copper oxide	hot hydrochloric acid and potassium chlorate
Mercury residue	hot conc. nitric acid
Mercury sulphide	hot aqua regia
Albumen	hot ammonia liquor or hydrochloric acid
Grease, oil	carbon tetrachloride
Other organic substances	hot conc. sulphuric acid with an addition of nitric acid, sodium nitrate or potassium dichromate
Animal charcoal	careful heating with a mixture of 5 volumes of conc. sulphuric acid + 1 volume conc. nitric acid to about 200°C

Prolonged rinsing with water must obviously follow.

For biochemical work, cleaning with dichromate sulphuric acid should be avoided, since trivalent chromium compounds, present or newly formed by reduction, are absorbed on the surface of the filter disc. When they are released during subsequent use, biological substances can be seriously damaged. This danger is eliminated by using sulphuric acid with a nitrate or perchlorate addition. Only easily soluble reduction products are formed which can be completely removed by re-washing with water.
Since hot, concentrated phosphoric acid and hot alkaline solutions attack the quartzglass surface, they are unsuitable as cleaning agents. If they have to be filtered, an increase in pore size and thus reduced life of the apparatus is unavoidable.

Chemical behaviour from quartzglass

Transparent fused silicia is outstandingly resistant to water, salt solutions and acids. It is therefore always at the top of the German Standard Classification List for the chemical stability of glasses, i. e. its stability is second to none; the same applies to its resistance to alkaline solutions.

In contrast to ordinary glass, fused silicia is not hygroscopic, and therefore does not effloresce. It is only attacked by hydrofluoric acid. Metals which are free from oxide, with the exception of alkali and alkaline-earth metals, cannot react with fused silicia, and can be distilled and melted in vessels made of fused silicia.

Fused silicia is sensitive to all alkali and alkaline-earth compounds, because even slight traces of them hasten devitrification at high temperatures.

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Behaviour of various elements and compounds towards transparent and opaque fused silica

The symbols used in the tables have the following significance:

○ the element or compound does not react with transparent or opaque fused silica

◴ it reacts only above the indicated temperature

◐ only the melt of the compound reacts with transparent and opaque fused silica

● the element or the compound reacts with transparent and opaque fused silica

Element/ Compound	Symbol	Remarks
Metals and non-metals		
Ag	○	
Al	◴	from 700 to 800°C rapid reaction
Au	○	
Br	○	
C	◴	only above 1500°C
Ca	◴	only above 600°C
Cd	○	
Ce	◴	only above 800°C
Cl	○	also with heat and humidity no reaction
F	●	only in humid state
Hg	○	
J	○	
Li	●	only above 250°C
Mg	◴	from 700 to 800°C rapid reaction
Mn	○	
Mo	○	
Na	○	reacts only in vapour state
P	●	
Pb	○	
Pt	○	
S	◴	above 1000°C very weak rection
Si	◐	
Sn	○	
Ti	○	
W	○	
Zn	○	

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Oxide		
Al_2O_3	◴	only above 1200°C
BaO	◴	only above 900°C
CaO	◴	only above 1000°C
CuO	◴	only above 950°C
Fe-oxides	◴	only above 950°C
MgO	◴	only above 950°C
PbO	◐	
ZnO	◴	only above 800°C
Basic oxides	◴	only above 800°C acceleration of devitrification
Acids		
H_2SO_4	○	
HNO_3	○	
HCl	○	
HF	●	but weaker than with ordinary glass
H_3PO_4	●	but weaker than with ordinary glass
Organic acids	○	
Gases and vapours		
HCl	○	
H_2; N_2; O_2	○	
NO_2; SO_2	○	
CO	○	
Salts		
$BaCl_2$	◐	
$BaSO_4$	◴	only above 700°C
Borate	◐	
BCl_3	◴	only above 900°C
KCl	◐	promotes devitrification
KF	◐	
NaCl	◐	
Na-metaphosphate	●	
Na-polyphosphate	●	
Na_2SO_4	○	
Na-tungstate	●	promotes devitrification
Nitrate	◐	
Platinum-ammoniumchloride	◴	only above 900°C
$ZnCl_2$	◐	
Zn-phosphate	◴	slight at 200°C considerable at 1000°C
Zn-silicate	◴	only above 1000°C

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Typical impurities in quartzglass
- in weight-ppm -

Symbol	HSQ 100...400
Al	10...22
As	<0,002
Au	<0,0001
Ca	0,2...1
Cr	<0,06
Cu	<0,02
Fe	0,1...0,3
K	0,1...0,5
Li	0,5...1
Mg	0,1...0,2
Na	0,1...0,2
Sb	<0,0002

Hydrolytic resistance as per DIN 12111

1. Hydrolysis class:

Base discharge < 0.01 $\frac{\text{mg } Na_2O}{\text{2g Grains}}$

Resistance to acids as per DIN 12116

1. Acid class:

Weight loss < 0.1 mg/dm^2
surface area

Resistance to alkaline solutions as per DIN 52322

1. Alkaline solution class:

Weight loss approx. 50 mg/dm^2
surface area

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Sinterd Discs
Porous Filter Disc made Quartzglass

Nom. Dia. mm	Thickness mm	Tol. +- mm	Por. Typ	Item-no.
10	2,5	0,5	0	F-0100250
10	2,5	1,0	1	F-0100251
10	2,5	1,0	2	F-0100252
10	2,5	1,0	3	F-0100253
10	2,5	1,0	4	F-0100254
15	2,5	1,0	0	F-0150250
15	2,5	1,0	1	F-0150251
15	2,5	1,0	2	F-0150252
15	2,5	1,0	3	F-0150253
15	2,5	1,0	4	F-0150254
20	4,0	1,0	0	F-0200400
20	4,0	1,0	00	F-02004000
20	4,0	1,0	1	F-0200401
20	4,0	1,0	2	F-0200402
20	4,0	1,0	3	F-0200403
20	4,0	1,0	4	F-0200404
25	4,0	1,0	0	F-0250400
25	4,0	1,0	00	F-02504000
25	4,0	1,0	1	F-0250401
25	4,0	1,0	2	F-0250402
25	4,0	1,0	3	F-0250403
25	4,0	1,0	4	F-0250404
30	4,0	1,0	0	F-0300400
30	4,0	1,0	00	F-03004000
30	4,0	1,0	1	F-0300401
30	4,0	1,0	2	F-0300402
30	4,0	1,0	3	F-0300403
30	4,0	1,0	4	F-0300404

QCS

Nom. Dia. mm	Thickness mm	Tol. +- mm	Por. Typ	Item-no.
35	4,0	1,0	0	F-0350400
35	4,0	1,0	00	F-03504000
35	4,0	1,0	1	F-0350401
35	4,0	1,0	2	F-0350402
35	4,0	1,0	3	F-0350403
35	4,0	1,0	4	F-0350404
40	4,0	1,0	0	F-0400400
40	4,0	1,0	00	F-04004000
40	4,0	1,0	1	F-0400401
40	4,0	1,0	2	F-0400402
40	4,0	1,0	3	F-0400403
40	4,0	1,0	4	F-0400404
45	4,0	1,0	0	F-0450400
45	4,0	1,0	00	F-04504000
45	4,0	1,0	1	F-0450401
45	4,0	1,0	2	F-0450402
45	4,0	1,0	3	F-0450403
45	4,0	1,0	4	F-0450404
50	5,0	1,0	0	F-0500500
50	5,0	1,0	00	F-05005000
50	5,0	1,0	1	F-0500501
50	5,0	1,0	2	F-0500502
50	5,0	1,0	3	F-0500503
50	5,0	1,0	4	F-0500504
55	5,0	1,0	0	F-0550500
55	5,0	1,0	00	F-05505000
55	5,0	1,0	1	F-0550501
55	5,0	1,0	2	F-0550502
55	5,0	1,0	3	F-0550503
55	5,0	1,0	4	F-0550504

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Nom. Dia. mm	Thickness mm	Tol. +- mm	Por. Typ	Item-no.
60	5,0	1,0	0	F-0600500
60	5,0	1,0	00	F-06005000
60	5,0	1,0	1	F-0600501
60	5,0	1,0	2	F-0600502
60	5,0	1,0	3	F-0600503
60	5,0	1,0	4	F-0600504
70	5,0	1,0	0	F-0700500
70	5,0	1,0	00	F-07005000
70	5,0	1,0	1	F-0700501
70	5,0	1,0	2	F-0700502
70	5,0	1,0	3	F-0700503
70	5,0	1,0	4	F-0700504
80	5,0	1,0	0	F-0800500
80	5,0	1,0	00	F-08005000
80	5,0	1,0	1	F-0800501
80	5,0	1,0	2	F-0800502
80	5,0	1,0	3	F-0800503
80	5,0	1,0	4	F-0800504
90	5,0	1,0	0	F-0900500
90	5,0	1,0	00	F-09005000
90	5,0	1,0	1	F-0900501
90	5,0	1,0	2	F-0900502
90	5,0	1,0	3	F-0900503
90	5,0	1,0	4	F-0900504
100	8,0	2,0	0	F-1000800
100	8,0	2,0	00	F-10008000
100	8,0	2,0	1	F-1000801
100	8,0	2,0	2	F-1000802
100	8,0	2,0	3	F-1000803
100	8,0	2,0	4	F-1000804

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Nom. Dia. mm	Thickness mm	Tol. +- mm	Por. Typ	Item-no.
110	8,0	2,0	0	F-1100800
110	8,0	2,0	00	F-11008000
110	8,0	2,0	1	F-1100801
110	8,0	2,0	2	F-1100802
110	8,0	2,0	3	F-1100803
120	8,0	2,0	0	F-1200800
120	8,0	2,0	00	F-12008000
120	8,0	2,0	1	F-1200801
120	8,0	2,0	2	F-1200802
120	8,0	2,0	3	F-1200803
125	8,0	2,0	0	F-1250800
125	8,0	2,0	1	F-1250801
130	8,0	2,0	0	F-1300800
130	8,0	2,0	00	F-13008000
130	8,0	2,0	1	F-1300801
130	8,0	2,0	2	F-1300802
130	8,0	2,0	3	F-1300803
135	8,0	2,0	0	F-1350800
135	8,0	2,0	1	F-1350801
135	8,0	2,0	2	F-1350802
140	8,0	2,0	0	F-1400800
140	8,0	2,0	00	F-14008000
140	8,0	2,0	1	F-1400801
140	8,0	2,0	2	F-1400802
140	8,0	2,0	3	F-1400803
150	8,0	2,0	0	F-1500800
150	8,0	2,0	00	F-15008000
150	8,0	2,0	1	F-1500801
150	8,0	2,0	2	F-1500802
150	8,0	2,0	3	F-1500803

QCS

Nom. Dia. mm	Thickness mm	Tol. +- mm	Por. Typ	Item-no.
160	12,5	2,5	00	F-16012500
160	12,5	2,5	1	F-1601251
160	12,5	2,5	2	F-1601252
175	12,5	2,5	00	F-17512500
175	12,5	2,5	1	F-1751251
175	12,5	2,5	2	F-1751252
200	19,0	3,0	00	F-20019000
200	19,0	3,0	1	F-2001901
200	19,0	3,0	2	F-2001902
225	20,0	3,0	00	F-22520000
225	20,0	3,0	1	F-2252001
250	20,0	3,0	00	F-25020000
250	20,0	3,0	1	F-2502001
Rect.:				
360*200	20,0	3,0	1	F-3602001
400*200	20,0	3,0	1	F-4002001

Porosity:

00 = 200 – 300 µm (Diameter von 20 bis ca. 400 mm)
0 = 150 – 200 µm (Diameter bis ca. 400 mm)
1 = 90 – 150 µm (Diameter bis ca. 300 mm)
2 = 40 – 90 µm (Diameter bis ca. 150 mm)
3 = 15 – 40 µm (Diameter bis ca. 150 mm)
4 = 4 – 15 µm (Diameter bis ca. 100 mm)

QCS

Quartz glass wool

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Chemical Properties of Quartz glass wool

Quartz glass is extremely resistible against water, salt dilutions and acids. In the class qualification of the German Industrial Norms for the chemical stability of the glass it is set in the first stability class, i.e. among the best, which includes also stability against bases.

Quartz glass, unlike the ordinary glass, is not a hygroscope, i.e. it does not crumble. It can be disintegrated by hydrofluoric acid only. Oxide free metals, alkali and earth alkali metals excluded, do not chemically react to quartz glass, which means, the quartz glass dishes are suitable places for their distillation and fusion. Quartz glass is sensitive against all alkali and earth alkali connections, because even the small traces of it lead to accelerated deglassing at high temperatures.

- Hydrolytic resistivity upon DIN 12111
  1. Hydrolyze class:
  Declaration of bases

  $< 0{,}01 \ \frac{\text{mg } Na_2O}{\text{2g Grit}}$

- Acid resistivity upon DIN 12116
  1. Acid class:
  Loss of weight < 0,1 mg/dm^2
  Surface

- Base resistivity upon DIN 52322
  1. Base class:
  Loss of weight ca. 50 mg/dm^2
  Surface

Typical external elements in Quartz glass - in weight-ppm -

Symbol	HSQ 100...400
Al	10...22
As	<0,002
Au	<0,0001
Ca	0,2...1
Cr	<0,06
Cu	<0,02
Fe	0,1...0,3
K	0,1...0,5
Li	0,5...1
Mg	0,1...0,2
Na	0,1...0,2
Sb	<0,0002

Heat Conductivity of Quartz glass wool

Temperature	**Density of the Quartz glass wool package** 40 kg/m³ = 0,04 g/cm³ $\frac{W}{K \cdot m}$	100 kg/m³ = 0,1 g/cm³ $\frac{W}{K \cdot m}$
50 °C	0,044	0,047
100 °C	0,057	0,056
200 °C	0,091	0,074
300 °C	0,135	0,098
400 °C	0,188	0,126
500 °C	0,247	0,156
600 °C	0,316	0,189
700 °C	0,397	0,227
800 °C	0,488	0,273

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Reactions of diverse Elements and Connections to Quartz glass

The symbols in this table mean:

x the element or the connection does not react to quartz glass
xx it reacts above the shown temperature only
xxx the fusion flow of the connection reacts to quartz glass only
xxxx the element or the connection reacts to quartz glass

Metals and Non- Metals

x	Ag	
xx	Al	at 700 till 800 °C fast reaction
x	Au	
x	Br	
xx	C	1500°C plus
xx	Ca	600°C plus
x	Cd	
xx	Ce	800°C plus
x	Cl	Even at heat or humidity without reaction
xxxx	F	Only if moist
x	Hg	
x	J	
xxxx	Li	250°C plus
xx	Mg	at 700 till 800°C fast reaction
x	Mn	
x	Mo	
x	Na	reacts if vapored only
xxxx	P	
x	Pb	
x	Pt	
xx	S	1000°C plus, very weak reaction
xxx	Si	
x	Sn	
x	Ti	
x	W	
x	Zn	

Oxide

xx	AL203	1200°C plus
xx	BaO	900°C plus
xx	CaO	1000°C plus
xx	CuO	950°C plus
xx	Fe-Oxide	950°C plus
xx	MgO	950°C plus
xxx	PbO	
xx	ZbO	800°C plus
xx	Basic Oxides	800°C plus speeds up the deglassing

Acids

x	H2SO4	
x	HNO3	
x	HCl	
xxxx	HF	lower reaction than to ordinary gas
xxxx	H3PO4	lower reaction than to ordinary gas
x	Organic acids	

Gases and Vapors

x	HCl	
x	H2; N2; O2	
x	NO2; SO2	
x	Co	

Salts

xxx	BaCl2	
xx	BaSO4	700°C plus
xxx	Borate	
xx	BCl3	900°C plus
xxx	KCl	speeds up the deglassing
xxx	KF	
xxx	NaCl	
xxxx	Na-Metaphosphate	
xxxx	Na-Polyphosphate	
x	Na2SO4	
xxxx	Na-Wolframate	speeds up the deglassing
xxx	Nitrate	
xx	Platinum ammonium chloride	900°C plus
xxx	ZnCl2	
xx	Zn-Phosphate	200°C, weak reaction 1000°C, strong reaction
xx	Zn-Silicate	1000°C plus

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Quartz glass wool

Quartz glass wool- bulk					
Name / Order-No.	Fiber thickness	Dimensions	Weight g	~ Density kg/m³	~ Volume dm³
0000124/1	5-30 µm	(Bag)	10	1	10
0000124/2	5-30 µm	(Bag)	50	1	50
0000124	5-30 µm	(Bag)	100	1	100
0000124/3	5-30 µm	(Bag)	250	1	250
0000124/4	5-30 µm	(Bag)	500	1	500
0000124/5	5-30 µm	(Bag)	1000	1	1000
0000124/6	8 µm	(Bag)	227	1	227
0000124/7	15 µm	(Bag)	227	1	227
0000124/9	2-12 µm	(Bag)	500	1	500
0000124/13	2-12 µm	(Bag)	1000	1	1000
Quartz glass wool- mat					
Name / Order-No.	Fiber thickness	Dimensions	Weight g	~ Density kg/m³	~ Volume dm³
0000124/10	5-30 µm	1,42 x 1 x 0,05 m	500	7	70
0000124/11	5-30 µm	2,85 x 1 x 0,05 m	1000	7	140
0000124/12	9-12 µm	2,80 x 0,305 x 0,005 m	43	15	3
9788546	9-12 µm	0,455 x 0,317 x 0,005 m	15,6	15	1

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Material specification

Quartz Glass and Opaque Quartz Glass

Material for the fulfilment of special demands of industry and research

Produced as Rod, Cylinder, Tube, Capillary Tube, Fibres, Wool, Block and Plate.

Using modern grinding- and cutting technology such as CNC grinding as well as laser- and water-jet – cutting for the manufacture of high precision parts for the

Semiconductor-
Optical-
Chemical-
Communication- and
Aerospace Industry as well as for
IR-Heating
Photovoltaic and
Laboratory

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Quartz Glass and Opaque Quartz

Vitreous silica, made from fusing or vitrifying naturally occurring materials, can appear clear or opaque depending on whether clear crystalline quartz or white quartzite sand is used. Both naturally occurring raw materials are highly pure forms of silica or silicon dioxide. These materials can also be used to manufacture, through distillation, the highly pure chlorosilanes such as silicon tetrachloride which in turn are the raw material for a form of vitreous silica commonly called “synthetic quartz glass”.

Quartz and the quartz glass form of vitreous silica have the same basic chemical composition but are, of course, structurally very dissimilar, the one being crystalline and the other a glass. For this reason a piece of crystalline quartz cannot withstand a sudden quench cooling from a high temperature without cracking due to temperature dependent phase changes, whereas quartz glass can withstand such processes. Vitreous silica in all its various forms has a variety of properties rarely found in a single material; extremely low thermal expansion, excellent elastic and thermal shock characteristics, high transformation and softening points, low thermal conductivity, low dielectric losses, good optical transmission from ultra-violet to infra-red, chemical purity, corrosion resistance and a trace impurity diffusion barrier. The technology for welding and shaping the material is well advanced as is that for cold working and laser cutting.

Manufacture/ Quality Assurance/ Application

Raw Materials

Quartz glass for use in the semiconductor industry is made from the purest naturally occurring raq materials. Despite high initial purity levels, major additional processing steps are included in raw material preparation in order to produce a glass product which is suitable for modern requirements.

The raw materials are usually rock crystal and pegmatitic quartz. Various chemical purification processes involving wet etching and high temperature treatments are used and the final raw material is a granulate of specific crystalline shape and size and virtually free from trace impurities.

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Vitrification Process

Tubes, rods and plates are the basic products from the vitrification process. The first and most important stage is the fusing of the crystalline grains to an amorphous glass structure which is, even in the initial process stages, largely bubble and inclusion free and physically isotropic and homogeneous.

There are 2 principal production methods for continuous grain fusing:

- oxy-hydrogen flame fusing;
- fusing in an electrically heated crucible from which the glass, in the form of a tube, can be drawn.

Both methods allow the controlled, high volume production of large size tubes.

By allowing the grains to dwell in the oxy-hydrogen flame the crucible-free flame fusing method enables the production of a bubble free and extremely homogeneous glass.

On the other hand electrical fusing can eliminate the hydroxyl (OH) content within the crystal raw material, a factor which is significant for the production of glasses with mechanical stability at high temperatures and for increased infra-red optical transmission.

The initial basic glass shapes produced by these production methods are transformed by subsequent forging processes into semi-manufactured shapes with:

- Low trace element contamination
- Low bubble content
- High homogeneity
- Low OH-content
- High optical transmission

Chemical Analysis

Trace element contamination in quartz glass can be divided into elements which have a high and low diffusivity at operational temperatures. To the former belong the alkali metals and copper, and through specific raw material preparation steps it is possible to reduce their concentration to ppm or even to fractions of this.

It is difficult to determine the precise influence such trace impurities have in semiconductor processes. However, in view of the other sources of contamination present in high temperature processing, the quartz glass can be considered as extremely pure.

Aluminium concentrations in quartz glass can exceed 10 ppm but since it is bound strongly in the silicon-oxygen lattice it is very immobile.

No semiconductor process has been known to have been affected by aluminium conta-mination from quartz glass. An exception to this however is in the use of quartz glass crucibles in the CZ-process for producing single crystal silicon. Here molten silicon reacts with the crucible wall resulting in aluminium (+ oxygen) being introduced into the melt.

QCS materials are subjected to permanent incoming and production controls for conta-mination, using standard AAS/NAA methods.

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Chemical Behaviour towards other Materials

Transparent fused silicia is outstandingly resistant to water, salt solutions and acids. It is therefore always at the top of the DIN Standard list for the chemical stability of glasses, i. e. its stability is second to none; the same applies to its resistance to alkaline solutions.

In contrast to ordinary glass, fused silicia is not hygroscopic and therefore does not effloresce. It is only attacked by hydrofluoric acid. Metals which are free from oxide, with the exception of alkali and alkaline-earth metals, cannot react with fused silicia, and can be distilled and melted in vessels made of fused silicia.

Fused silicia is sensitive to all alkali and alkaline-earth compounds, because even slight traces of them hasten devitrification at high temperatures. It is therefore always advisable to wipe off fingerprints (traces of alkali) from fused silicia equipment, with alcohol, before heating it to over 900°C.

The following tables indicate, as far as possible, the behaviour of the various elements and compounds towards transparent and opaque fused silicia. Thes tables were drawn up from information contained in technical literature, so that the conclusions are not always exactly comparable.

- Hydrolytic resistance as per DIN 12111

1. Hydrolysis class:
Base discharge

$$< 0.01 \quad \frac{\text{mg } Na_2O}{\text{2g Grains}}$$

- Resistance to acids as per DIN 12116

1. Acid class:
Weight loss < 0.1 mg/dm^2
Surface area

- Resistance to alkaline solutions as per DIN 52322

1. Alkaline solution class:
Weight loss approx. 50 mg/dm^2
Surface area

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Peculiarities

Purity

Basins and plants in the high-purity field under consideration of the hydrolytic resistance of < 0,01 mg Na^2O according to DIN 12111 for medicine, analysis and chemistry.

Chemical resistance

to the most mediums no matter if solid, liquide or gaseous. For production of reagents and the therefore needed plants.

High resistance to sudden changes of termperature

is granted by the coefficient of expansion of a 0…900°C, K^{-1} 0,48 × 10^{-6} and is requested for many chemical-physical processes.

UV- and IR-permeability

in the area of 200 to 3500 nm makes the material very useful for heating or radiation of materials of every physical condition.

Electrical isolation property

of $10^{18}\Omega \times cm$ at 20°C offers a wide application for insulators in electric and electronics.

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Physical and optical Properties

		Name of Standard Grade			
		HSQ 100 HSQ 300	HSQ 351	OM100	Rotosil
Kind of Material		Electric Fused	Flame Fused	Opaque	Quarzgut
Properties	unit				
PHYSICAL					
Density	kg/dm^3	2.203	2.203	~ 2.18	~ 2,02
Young´s modulus (20°C)	N/mm^2	7.25E04	7.25E04		~ 6E04
Young´s modulus (1100°C)	N/mm^2	8.2E04	8.2E04		
Tensile strength	N/mm^2	50	50		~ 40
Compressive strength	N/mm^2	1150	1150		~ 500
Bending strength	N/mm^2	67	67	115	~ 67
Torsional strength	N/mm^2	30	30		
Knoop hardness 1N load	N/mm^2	5800 – 6100	5800 – 6100		
Mohs hardness		5.5 – 6.5	5.5 – 6.5		
Micro-hardness	N/mm^2	8600 – 9800	8600 – 9800		
Internal damping		1E – 05	1E – 05		
Poisson´s ratio		0.17	0.17		
Velocity of sound					
Shear wave (50°C)	m/s	3774	3774		
Compression wave (20°C)[4]	m/s	5720	5720		
Permanently constants: $\frac{\text{Normal-cm}^3 * \text{mm}}{\text{s} * \text{cm}^2 * \text{mbar}}$					
Helium (He) 150°C		0.55	0.55		
Helium (He) 700°C		16.4	16.4		
Hydrogen (H) 150°C		< 0.01	< 0.01		
Hydrogen (H) 700°C		1.89	1.89		

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Physical and optical Properties

		Name of Standard Grade			
		HSQ 100 HSQ 300	HSQ 351	OM100	Rotosil
Kind of Material		Electric Fused	Flame Fused	Opaque	Quarzgut
Properties	**unit**				
PHYSICAL					
Diffusion Coefficient at 1100°C, element	cm^2/S				
Sodium (Na)		1E – 05	1E – 05		
Potassium (K)		1E – 08	1E – 08		
Aluminium (Al)		1E – 13	1E – 13		
Oxygen (O_2)		1E – 13	1E – 13		
Mean linear expansion coefficient Temp. Interval (°C)	°C				
0-100°C		0.51E – 06	0.51E – 06	0.53E – 06 (20-200°C)	0,51 E06
0-200°C		0.58E – 06	0.58E – 06	0.56E – 06 (20-400°C)	
0-300°C		0.59E – 06	0.59E – 06	0.54E – 06 (20-600°C)	0,6 E06
0-600°C		0.54E – 06	0.54E – 06	0.54E – 06 (20-800°C)	0,5 E06
0-900°C		0.48E – 06	0.48E – 06		0,4 E06
-50-0°C		0.27E – 06	0.27E – 06		
Mean Specific Heat at Temp.	J/(kg K)				
0-100°C		772	772	995 (200°C) 1082 (400°C)	
0-500°C		964	964	1166 (200°C) 1226 (800°C)	
0-900°C		1052	1052	1270 (1000°C)	
Heat Conductivity at Temp. (°C)	W/(km)				
-263		0.10	0.10		
-223		0.50	0.50		
20		1.38	1.38		1,1
100		1.47	1.47		
200		1.55	1.55		1,5
300		1.67	1.67		
400		1.84	1.84		1,8
950		2.68	2.68		2,3
Strain Point (logη=13,0)	°C	1080...1125[3]	1075	1070	
Annealing Point (logη=7,5)		1180...1220[3]	1180	1180	
Softening Point (logη=7,5)			1730	1230 (logη=12,5)	

OPTICAL					
n_d(He, 587.56 nm)		1.45857	1.45857		
n_F(He, 486.13 nm)		1.46324	1.46324		
n_c(H, 656.27 nm)		1.45646	1.45646		
$v_d=n_d-1/(n_F-n_c)$ Abbé´s ratio		67.6 +- 0.5	67.6 +- 0.5		
n_F-n_c		0.00678	0.00678		

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Electrical Properties

		Name of Standard Grade			
		HSQ 100 HSQ 300	HSQ 351	OM100	Rotosil
Kind of Material		Electric Fused	Flame Fused	Opaque	Quarzgut
Properties	**unit**				
ELECTRICAL					
electrival resistivity (20°C)[2]	Ω cm	E20	E20		~ 3.2 E15
electrival resistivity (1200°C)[2]	Ω cm	1.3 E07	1.3 E07		E4
at 20°C	kV / m	2.5 - 4 E04	2.5 - 4 E04		1.5 E04
at 500°C	kV / m	4 – 5 E03	4 – 5 E03		2-3 E03
Dielectric constant ε					
at 20°C	0-10^6Hz	3.70	3.70		3.5
23°C	9E08Hz	3.77	3.77		3.58
23°C	3E10Hz	3.81	3.81		3.62

DIELECTRIC LOSS ANGLES		
Frequency	Clear fused silica	Opaque fused silica
1 kHz	< 5 x 10^{-4} (ca. 1,5 x 10^{-4})	6 . . . 20 x 10^{-4}
1 MHz	< 5 x 10^{-4}	5 . . . 15 x 10^{-4}
10^7	< 5 x 10^{-4}	4 . . . 12 x 10^{-4}
10^8	< 5 x 10^{-4}	4 . . . 12 x 10^{-4}
10^9	< 5 x 10^{-4}	4 . . . 12 x 10^{-4}
3 x 10^{10} Hz	4 x 10^{-4}	-

Dielectric loss angles is practically constant at a frequency of 1 MHz bis 200° C, but then increases as the temperature rises, at 110 Hz the dielectric loss angles falls off slowly with rising temperature up to 350° C, but then, as the temperature rises still futher, it begins to climb again slightly.

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Fig. 1
Modulus of elasticity of transparent fused silica dependent on temperature.

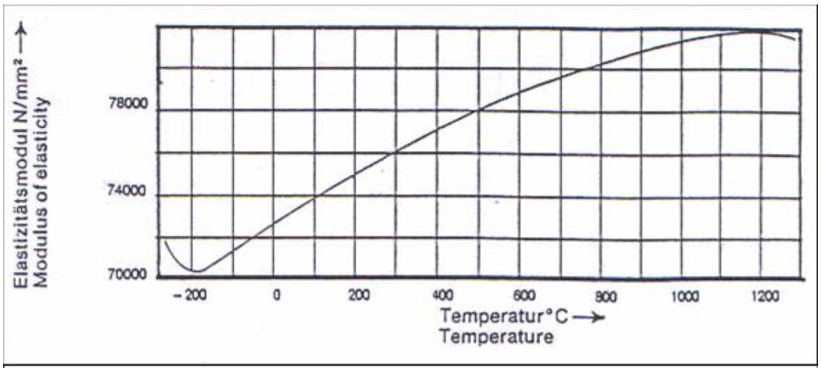

Fig. 2
Internal damping of transparent fused silica dependent on temperature.

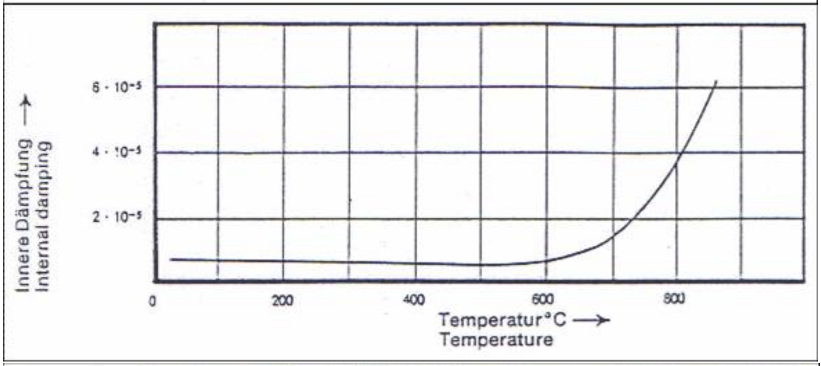

Fig. 3
Sound velocity in transparent fused silica for longitudinal waves dependent on temperature.

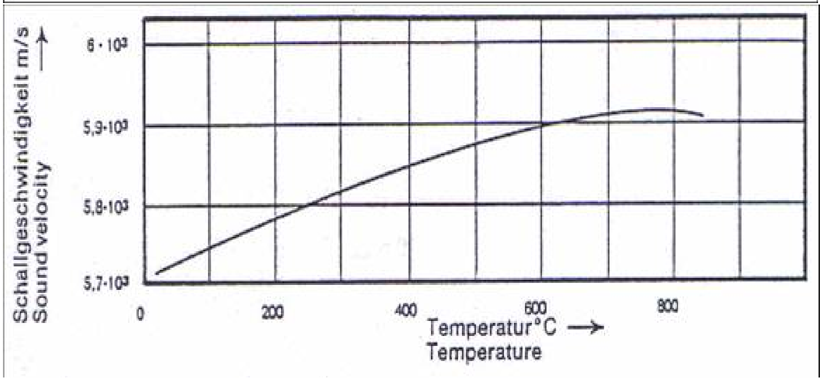

Fig. 4
Tensile strength of fused silica fibres as a function of fibre diameter

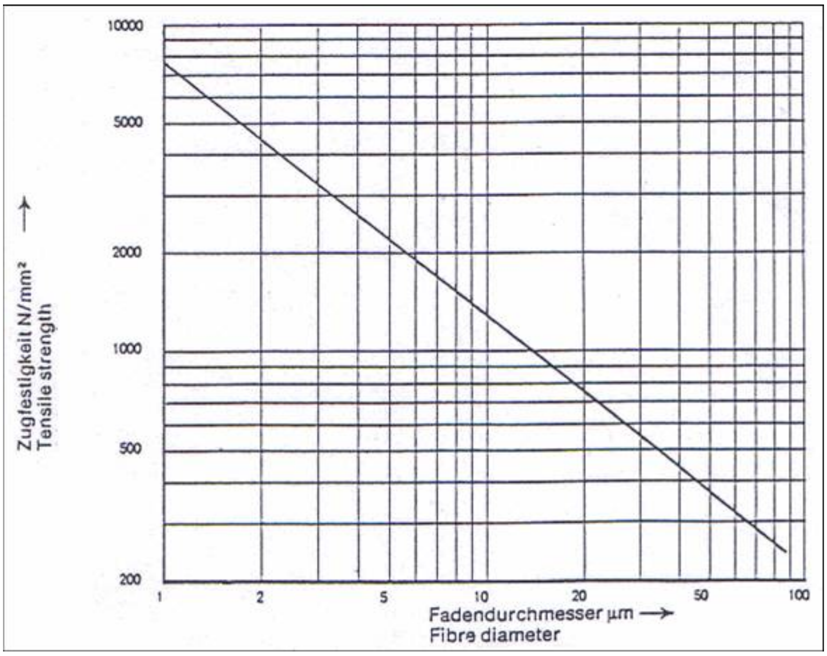

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Fig. 5

Viscosity of transparent fused silica and of synthetic fused silica as a function of temperature.

Transparent fused silica:

———————————

Synthetic fused silicia:

—·—·—·—·—·—·—

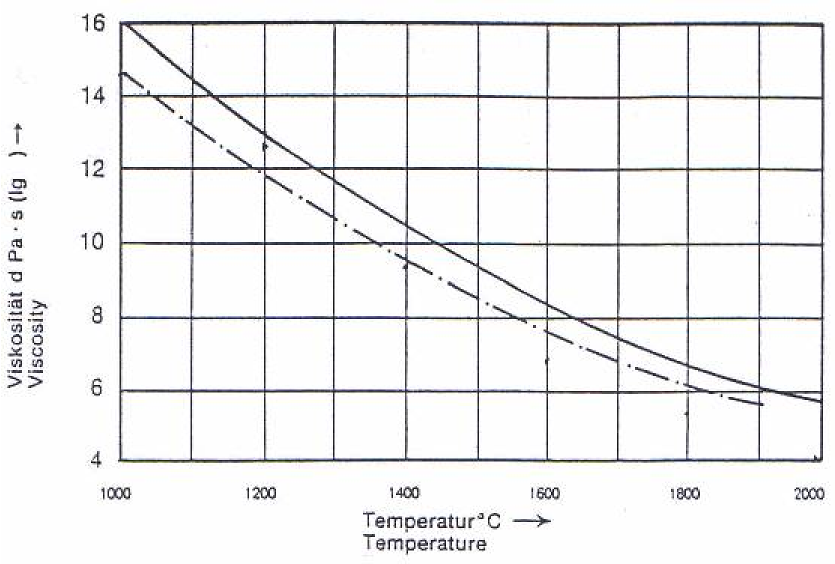


Fig. 6

Coefficient of expansion of transparent fused silica as a function of temperature.

Definition:

$$\alpha_{0,t} = \frac{1}{L0} \times \frac{Lt - L0}{t}$$

L_0 = Length at 0°C
L_t = Length at t °C
t = Temperature in °C

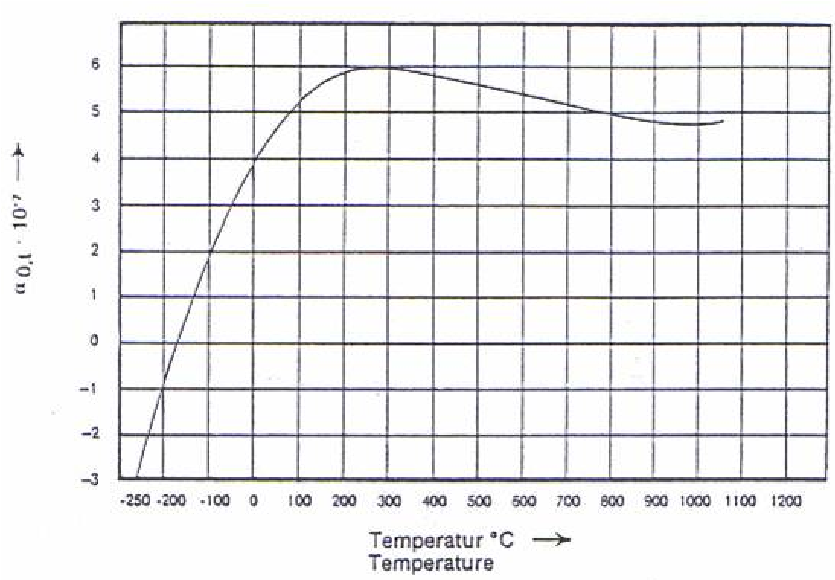
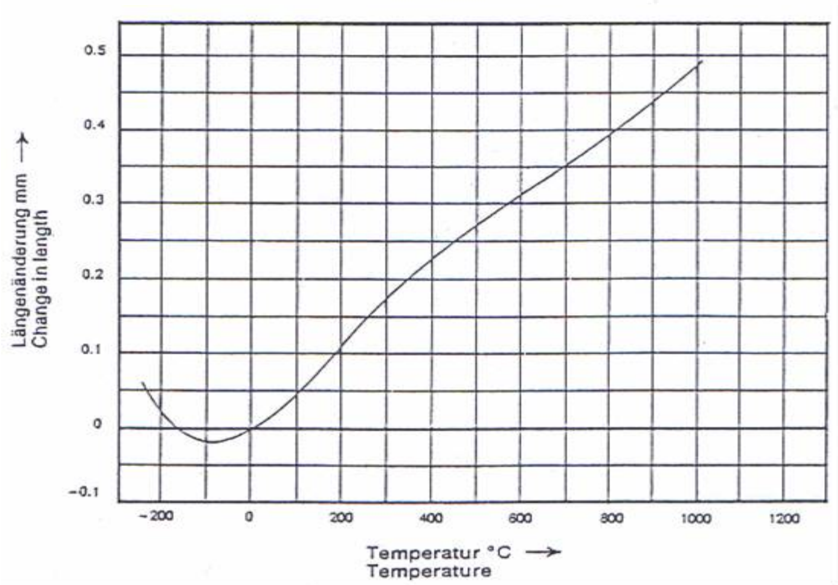


Fig. 7

Change in length of a 1 m long rod of transparent fused silica as a function of temperature.



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Typical Trace Elements

		Name of Standard Grade			
		HSQ 100 HSQ 300	HSQ 351	OM100	Rotosil
Kind of Material		Electric Fused	Flame Fused	Opaque	Quarzgut
Type Trace Elements					
Aluminium (Al)	ppm	10...22	10-45 (10-22)	15	ca. 180
Arsenic (As)	ppm	< 0.002	< 0.1 (< 0.01)		
Gold (Au)	ppm	< 0.0001	< 0.0003		
Calcium (Ca)	ppm	0.2...1	0.2...1.0	2.0	ca. 28
Chromium (Cr)	ppm	< 0.06	< 0.06	< 0.05	ca. 0,4
Copper (Cu)	ppm	< 0.02	< 0.5 (< 0.07)	< 0.06	0,4
Iron (Fe)	ppm	0.1...0.3	0.5...2.0	0.2	ca. 40
Potassium (K)	ppm	0.1...0.5	0.1...0.5	0,4	31
Lithium (Li)	ppm	0,5...1	1.2...6 (1.5)	0.6	4
Magnesium (Mg)	ppm	0.1...0.2	0.1...0.3	0.05	8
Sodium (Na)	ppm	0.1...0.2	0.5...2.0 (1.0)	0.2	24
Antimony (Sb)	ppm	< 0.0002	< 0.2 (0.002)		
Manganese (Mn)	ppm			< 0.03	1
Titanium (Ti)	ppm		0.8	1.2	123
OH-content	ppm	5...30	130-180		

Hydrolytic resistance as per DIN 12111

1. Hydrolytic class:

Base discharge **< 0.01** **mg Na2O / 2g Grains**

Resistance to acids as per DIN 12116

1. Acid class:
Weight loss surface area **< 0.1 mg/dm²**

Resistance to alkaline solution as per DIN 52322

1. Alkaline solution class:
Weight loss surface area **approx. 50 mg/dm²**

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Behaviour of various elements and compounds towards transparent and opaque fused silicia

The symbols used in the tables have the following significance:

x	the element or compound does not react with transparent or opaque fused silicia
xx	it reacts only above the indicated temperature
xxx	only the mell of the compound reacts with transparent and opaque fused silicia
xxxx	the element of the compound reacts with transparent and opaque fused silicia

Metals and non-metals

x	Ag	
xx	Al	from 700 to 800 °C rapid reaction
x	Au	
x	Br	
xx	C	only above 1500°C
xx	Ca	only above 600°C
x	Cd	
xx	Ce	only above 800°C
x	Cl	also with heat and humidity no reaction
xxxx	F	only in humid state
x	Hg	
x	J	
xxxx	Li	only above 250°C
xx	Mg	from 700 to 800°C rapid reaction
x	Mn	
x	Mo	
x	Na	reacts only in vapour state
xxxx	P	
x	Pb	
x	Pt	
xx	S	above 1000°C very weak reaction
xxx	Si	
x	Sn	
x	Ti	
x	W	
x	Zn	

Oxides

xx	AL203	only above 1200°C
xx	BaO	only above 900°C
xx	CaO	only above 1000°C
xx	CuO	only above 950°C
xx	Fe-oxides	only above 950°C
xx	MgO	only above 950°C
xxx	PbO	
xx	ZbO	only above 800°C
xx	Basic oxides	only above 800°C acceleration of devitrification

Acids

x	H2SO4	
x	HNO3	
x	HCl	
xxxx	HF	but weaker than with ordinary glass
xxxx	H3PO4	but weaker than with ordinary glass
x	Organic acids	

Gases and vapours

x	HCl	
x	H2; N2; O2	
x	NO2; SO2	
x	Co	

Salts

xxx	BaCl2	
xx	BaSO4	only above 700°C
xxx	Borate	
xx	BCl3	only above 900°C
xxx	KCl	promotes devitrification
xxx	KF	
xxx	NaCl	
xxxx	Na-metaphosphate	
xxxx	Na-polyphosphate	
x	Na2SO4	
xxxx	Na-tungstate	promotes devitrification
xxx	Nitrate	
xx	Platinum-ammoniumchloride	only above 900°C
xxx	ZnCl2	
xx	Zn-phosphate	slight at 200°C considerable at 1000°C
xx	Zn-silicate	only above 1000°C

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Behaviour of alkaline solutions towards transparent and opaque fused silica

Solution:	Concentration	Temp. of reaction	Dissolution of transparent or opaque fused silica	Period of time in hours
NH_4 (OH)	10%	20°C	0,019 mg/ cm^2	100
NaOH	1%	20°C	0,031 mg/ cm^2	100
NaOH	10%	18°C	0,0095 mg/ cm^2	100
KOH	1%	20°C	0,019 mg/ cm^2	100
KOH	30%	18°C	0,027 mg/ cm^2	100
Na_2CO_3	5%	18°C	0,0015 mg/ cm^2	100
NaOH	5%	100°C	1,50 mg/ cm^2	10
NaOH	8%	100°C	1,21 mg/ cm^2	10
KOH	10,2%	100°C	1,13 mg/ cm^2	10
Na_2CO_3	10%	100°C	0,37 mg/ cm^2	10

The first line of this table thus predicates that a 10% solution of NH_4(OH) at 20°C will in 100 houres resolve 0.019 mg transparent or opaque fused silicia from a surface of 1 cm^2.

In addition there is chemical resistance to most of electroplating baths. More information on request.
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QCS

Partner for Laboratory and Industry

- Hydrogen-Oxygen Combustion Apparatus V5
- Distillation Apparatus for pure water production
- Surface Evaporators for evaporation of liquids
- Immersion Heaters for the heating of aggressive media
- Crucibles, Beaker, Test Tubes, Basins and Flasks as well as
- Grount joints, Stopcocks, Screw Threads made out of quartz glass
- Quartz Glass Wool, Filtering disks
- Rods, Tubes, Capillary Tubes made out of quartz glass
- Special products acc. to customer specifications
- Quartz glass products for the chemical Industry
- Products made for Laboratory and Industry
- Quartz products for Optics
- Quartz glass for the communication Industry
- Quartz glass for photo voltaic
- Quartz glass for Infrared Applications