BOLA

Best performance for your lab.

Professional High-Performance Fluoroplastic Labware

PTFE | PFA | FEP

All information in our catalogue **E 500** is based on current technical knowledge, experience and manufacturers' data. Users should check the suitability of parts and materials described in the catalogue before use.

Bohlender does not accept any warranty as to suitability and fitness of purpose of the materials and products described in this catalogue. Users should avoid making any assumptions on, or interpretations of, the data herein.

All products are subject to technical modification without prior notice.

All pressure and thermal resistance data are given in **no load conditions.**

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New products are shown with this icon.

The FDA icon means that all parts coming into contact with the fluid are from materials that correspond to FDA requirements. A certificate of conformity is included with each shipment.

Volume/Quantity discount available.

Our best sellers.

Dear Customer,

Continuous improvement has been one of Bohlender's basic principals since its founding.

You may have already noticed our "new look" that reflects this principal in both our products and the marketing materials. To make your selection of the right BOLA products as easy as possible we have paid special attention to a simple and clear layout in this our new product catalogue.

Our goal is to provide "More performance in your lab" by concentrating and promoting our widely recognised BOLA brand. During a transition period "by Bohlender" will emphasise continuity and the commitment of management.

Browse through this new catalogue and see for yourself. The new and innovative products as well as established favourites will show you Bohlender's path for the future. I am sure you will find it informative and useful and I look forward to hearing your comments.

Best regards,

Volker Bohlender

Managing Director

CONTENT

BOLA – Best performance for your lab.

If it's a matter of quality we,
as a manufacturing company,
will not leave anything to chance.

BOLA stands for: Construction, production, quality assurance, storage and service – you will get the whole package. Many advantages which help to create smooth and efficient work processes in your lab.

More flexibility.

Your desires set our benchmark. Having design and production in house makes it possible to realise efficiently your requirements. We are open to any special requests. Please send us a drawing or sketch and our design department will start work. The custom-made item will meet all your requirements, of course.

More expertise.

We understand what you are talking about. We concentrate on materials, shapes, products' properties as well as on the use under real conditions in the lab. Each of our products has been designed by ourselves, thoroughly tried and tested as well as continuously improved and adapted to your everyday requirements. Should you have any questions or requests, our professionals will give you expert advice. Who knows more about labware than the manufacturer?

More service.

Some enquiries are urgent. We are well prepared and keep the majority of our extensive product range in stock. Our efficient, well-established workflow assures shipment of your order at short notice. Waiting times and unnecessary shut downs can be prevented. You have no time to lose? We are here to help.

More reliability.

Reliability means to us high quality starting upon choosing the raw materials. We work exclusively with high performance plastics which offer the best product quality. Constantly high fabrication quality is provided by our modern in-house machinery, our highly qualified staff and a comprehensive quality assurance system. This results in laboratory devices which live up to their promise in all respects.

Made to measure.

Every lab is different. By offering an extensive range of established and sophisticated standard solutions we take into account the varied requirements of the respective branches and sectors.

You are in need of getting lab equipment for your special application? Special items which are not part of our standard product range?

Should you have a special request, we are able to offer an individual custom manufacture. This is easier and faster than you may expect. Discuss your idea with our professionals. They will give advice and support during design. Finally, your idea will become real: We produce to your requirements and in compliance with the chosen raw materials – starting with 1 piece.

We only need a drawing (a sketch is sufficient) and some further information.

» **You have a special request?**
Give us a call: +49 (0) 93 46-92 86-0.
Or complete the attached form for custom enquiries including your contact details and return it by fax.
We will contact you to discuss further details and will then provide you with a free quotation.

Checklist for your custom product.

» Please describe the product required.

» What is the application?

» Which are the critical dimensions and tolerances?

» Please specify material requirements.

» Please specify the operating temperature range.

» What is the chemical load?

» Please state quantities.

» What is the budgetary price range per piece?

Our basic principles.

» One contact person for all your questions.

Highly qualified staff and continuous product training assure professional consultancy also for technical problems.

» Fast and reliable delivery.

Our modern production technology combined with optimised processes from production planning up to despatch assure a fast execution of your order.

» Accuracy is our passion.

We have great experience in all kinds of processing of fluoroplastics and continuous quality assurance from choosing suitable raw materials and throughout the whole manufacturing process.

» Everything for the modern lab.

Extensive range of lab equipment to meet the requirements of modern labs for nearly every application.

» Virtually all your desires will be fulfilled.

We can make products to your specification starting with 1 piece up to large-scale production. A sketch or drawing is sufficient. Reproducibility is assured by accurate technical documentation.

» We understand your requirements.

Many years experience with processing of fluoroplastics.

Stirring and Mixing

Magnetic stirring bars and stirrer shafts have to feature many different qualities since they are used with many different products and in different vessels. The comprehensive BOLA range is offering the best possible solution – if not, we will manufacture according to your specifications.

PRODUCT TIPS

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Magnetic Stirring Bars

Page 14
Stirrer Shaft

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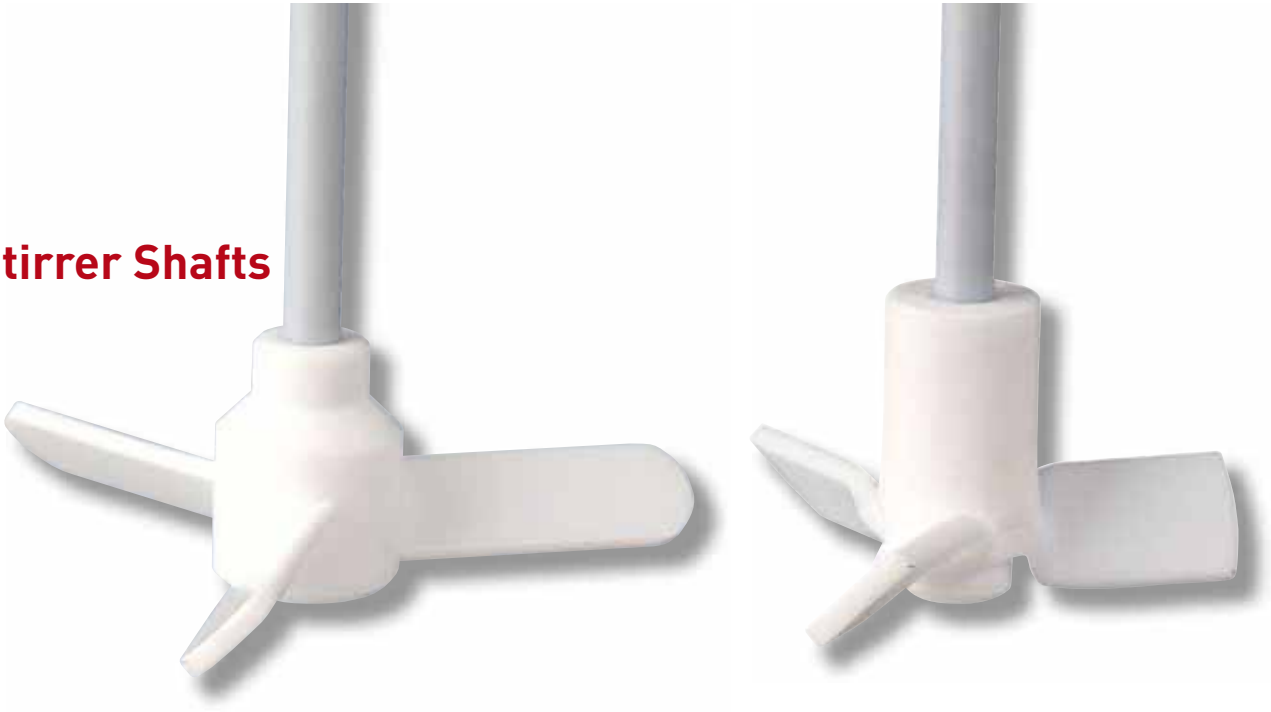
Stirrer Couplings

BOLA Stirrer Shafts



What you should know about BOLA Stirrer Shafts

BOLA Stirrer Shafts consist of a PTFE-jacketed stainless steel shaft and a stirrer blade made of solid PTFE. The stainless steel core provides high mechanical stability and allows a safe fixing in the agitator.

Unbreakable

All glass stirrer shafts which are commonly used in laboratories are very fragile. Dropping, stirring solid materials or too much power transmitted from the agitator to the product can cause broken glass. Due to their solid stainless steel core, BOLA Stirrer Shafts are protected against all these possibilities of breaking.

Universal chemical resistance

Due to the thick PTFE-jacket, the product which is stirred is only exposed to PTFE. This assures an almost universal chemical resistance. PTFE-jacketed stirrer shafts can be used whenever stirrer shafts made of PP (polypropylene), glass or stainless steel are not sufficient.

Temperature resistance

Stirrer shafts made of PP (polypropylene) are deformed at temperatures exceeding +100°C and cannot be used any longer. All BOLA PTFE-jacketed stirrer shafts can be used at temperatures of up to +250°C without any negative effects on their chemical resistance.

Non-adhesive

The surfaces of glass and stainless steel stirrer shafts allow adhesion of products (in particular such as dyes and glues). BOLA PTFE Stirrer Shafts, however, are non-adhesive and therefore eliminate adhesion of dyes and glues.

Interchangeability

At present, most stirrer shafts used in laboratories are made of glass. All BOLA Stirrer Shafts are available with the same diameters, lengths and surface qualities (KPG) as stirrer shafts made of glass. Thus, the user can easily replace the glass stirrer shaft with a PTFE-jacketed stirrer shaft and does not have to change agitators, couplings and guiding devices.

Safe fixing

The upper end of the BOLA Stirrer Shaft is not jacketed with PTFE and can therefore be fixed safely into the agitator or the stirrer coupling.

Solid stirrer blade

The stirrer blade is fixed tightly to the stirrer shaft and cannot be loosened by the product which is still turning after switching off the agitator. The stirrer shafts are suitable for clockwise and counterclockwise rotation.

Frequently asked: Why don't you coat stirrer shafts?

Coating with PTFE only provides a thin plastic layer. This layer can be damaged very easily by aggressive products, friction or rough handling during storage. A possible consequence is that parts of the layer are peeled off.

The BOLA solution: A solid PTFE jacket together with solid stirrer blades. BOLA Stirrer Shafts provide a long durability and an excellent mechanical resistance.

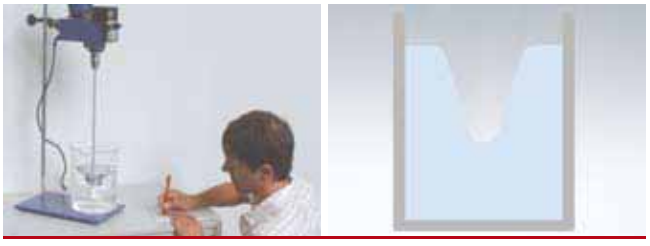
Suitable chucking diameter of stirrer shafts

Very long stirrer shafts need to have suitable diameters to be stable enough. All BOLA Stirrer Shafts have adequate diameters and lengths. If the chucking diameter of a stirrer shaft is too big, it can mostly be reduced by machining. This machining has to be made totally self-centring to avoid eccentricity of the stirrer shaft.
Please contact us if you need a reduced chucking diameter.

Results of stirring – tested for you

In order to help you choose the suitable stirrer shaft for your application, we have made tests with typical data. These graphs shall give you an indication for the stirring effects of the BOLA Stirrer Shafts.

- Speed: 500 rpm
- Volume: 2.000 ml
- Product: water
- Temperature: 20°C
- Vessel: glass beaker



BOLA Propeller Stirrer Shafts

BESTSELLER

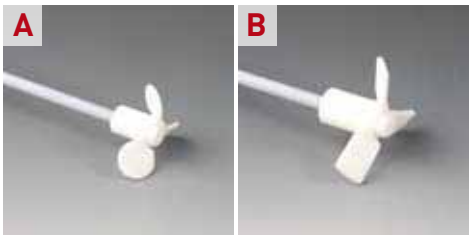
Material:	Temperature resistance:	Chemical resistance:	Stirring effect:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**bottom-up**

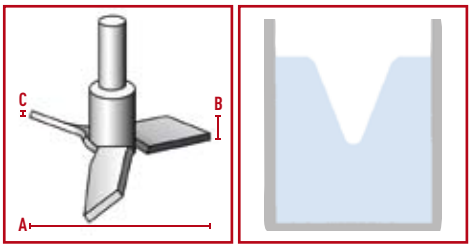
Product description:

PTFE-jacketed stainless steel shaft, propeller completely made of PTFE with three 45° angled round or angular blades. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

	Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C mm	Cat. No.:
A	250	6	4	50	18	1,5	C 378-04
	350	6	4	50	18	1,5	C 378-06
	450	6	4	50	18	1,5	C 378-08
B	350	8	6,5	75	18	3,0	C 378-12
	450	8	6,5	75	18	3,0	C 378-14
	600	8	6,5	75	18	3,0	C 378-16
	450	10	8,0	75	18	3,0	C 378-18
	600	10	8,0	75	18	3,0	C 378-20
	800	10	8,0	75	18	3,0	C 378-22





Applications:

The product is sucked bottom-up, good axial flow with low shear force.

BOLA Moon-Shaped Stirrer Shafts

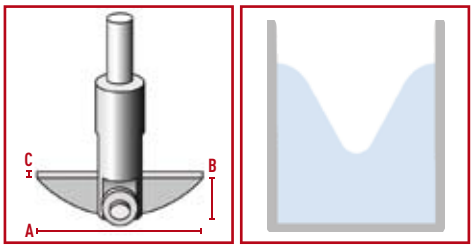
Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-jacketed stainless steel shaft, tilting half-moon stirrer blade with double-sided groove and access for the stirrer shaft completely made of PTFE. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	For ground joint NS	Dimensions according to drawing A	B	C mm	Cat. No.:
350	8	6,5	24/29	65	18	3	C 376-02
450	8	6,5	24/29	65	18	3	C 376-04
350	8	6,5	29/32	90	24	3	C 376-06
450	8	6,5	29/32	90	24	3	C 376-08
600	8	6,5	29/32	90	24	3	C 376-10
350	10	8,0	29/32	90	24	3	C 376-12
450	10	8,0	29/32	90	24	3	C 376-14
510	10	8,0	29/32	90	24	3	C 376-16
600	10	8,0	29/32	90	24	3	C 376-18
1.000	10	8,0	29/32	90	24	3	C 376-19
600	16	14,0	45/40	125	35	3	C 376-20
800	16	14,0	45/40	125	35	3	C 376-22



Applications:

Tangential flow with little turbulence. The tilting half-moon blade is ideal for stirring in round-bottom flasks with ground joint necks. Blades (see Cat. No. C 400-.. on page 35) are available separately and can be mounted additionally.

BOLA U-Shaped Stirrer Shafts

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

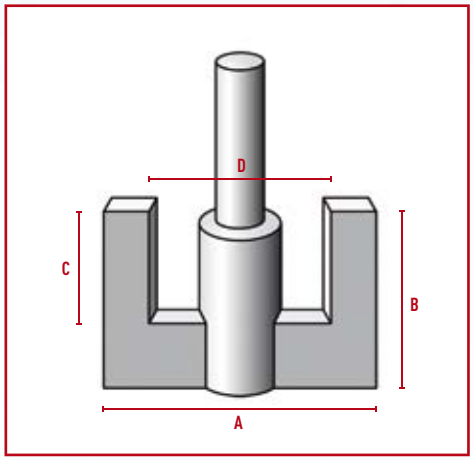
PTFE-jacketed stainless steel shaft, u-shaped stirrer blade completely made of PTFE. Universal chemical resistance since the product is only exposed to PTFE.

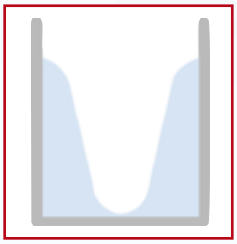
FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C	D mm	Cat. No.:
350	8	6,5	40	35	20	26	C 384-01
350	8	6,5	60	40	25	30	C 384-02
450	8	6,5	60	40	25	30	C 384-04
450	8	6,5	80	50	30	44	C 384-06
600	8	6,5	80	50	30	44	C 384-08
600	8	6,5	100	60	35	56	C 384-10
350	10	8,0	80	50	30	44	C 384-16
450	10	8,0	80	50	30	44	C 384-17
600	10	8,0	100	60	35	56	C 384-24
800	10	8,0	100	60	35	56	C 384-28
1.000	10	8,0	100	60	35	56	C 384-32
1.200	10	8,0	100	60	35	56	C 384-40
600	10	8,0	130	80	55	80	C 384-44
800	10	8,0	130	80	55	80	C 384-48
1.000	16	14,0	130	80	55	80	C 384-50
800	16	14,0	150	120	90	90	C 384-52
1.000	16	14,0	150	120	90	90	C 384-58
1.200	16	14,0	150	120	90	90	C 384-64

Applications:

Strong, tangential flow with high shear rate in the margin area, little sediments on the wall of the vessel. Ideal for mixing viscous liquids.





SUITABLE: page **25**
Additional stirrer blades

BOLA Globe Stirrer Couplings

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
POM	**from -20°C to + 110°C**	**++ very good**

Product description:

Made of POM, a plastic material with a good mechanical strength, powerful transmission of up to 300 Ncm, suitable for a speed of up to 1.200 rounds per minute, maximum misalignment of axes 10 mm.

NEW

	Opening for stirrer shaft mm	Upper dia. mm	Total length mm	Cat. No.:
A	Ø 6,5 and 10	10	190	C 398-08
B	Ø 8 and 10	10	190	C 398-12
C	Inner square SW6	SW8	180	C 399-12
D	GL 10	10	170	C 393-12

Product advantages:

- very low centrifugal forces due to low weight
- suitable for both left- and right-handed rotation (except for GL 10 thread: no left-handed rotation possible)
- no resonance
- simple assembly by means of screw joints with clamp rings
- pivot (length 90 mm) can be shortened by the user

Applications:

Ideal for balancing misalignment of axes between agitator and stirrer shaft, suitable for glass, metal or BOLA stirrer shafts.

A

B

C

D

BOLA Maxi Propeller Stirrer Shafts

BESTSELLER

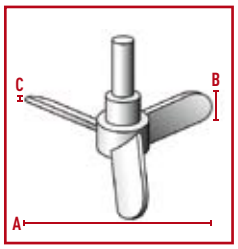
Material:	Temperature resistance:	Chemical resistance:	Stirring effect:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**bottom-up**

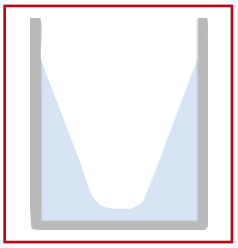
Product description:

PTFE-jacketed stainless steel shaft, propeller completely made of PTFE with three 45° angled blades. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C mm	Cat. No.:
450	10	8	140	20	4	C 392-28
600	10	8	140	20	4	C 392-34
800	10	8	140	20	4	C 392-40
1.200	10	8	140	20	4	C 392-42
800	16	14	140	26	6	C 392-44
1.000	16	14	140	26	6	C 392-46
600	16	14	200	26	6	C 392-52
800	16	14	200	26	6	C 392-58
1.000	16	14	200	26	6	C 392-64
1.200	16	14	200	26	6	C 392-70
1.600	16	14	200	26	6	C 392-74
1.200	16	14	280	26	8	C 392-80
1.600	16	14	280	26	8	C 392-84
1.200	16	14	400	26	8	C 392-90
1.600	16	14	400	26	8	C 392-94





Applications:

The product is sucked bottom-up, very good axial flow with low local shear force.

BOLA Stirrer Shafts with One Paddle

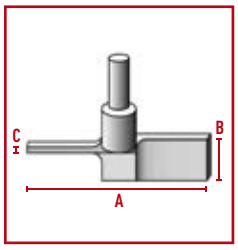
Material:	Temperature resistance:	Chemical resistance:	Stirring effect:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**bottom-up**

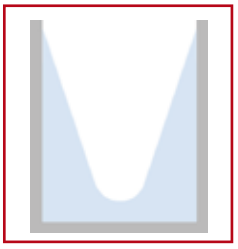
Product description:

PTFE-jacketed stainless steel shaft, paddle completely made of PTFE with two 45° angled blades. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C mm	Cat. No.:
450	8	6	80	18	4	C 379-02
600	8	6	80	18	4	C 379-04
800	8	6	80	18	4	C 379-06
600	10	8	110	20	5	C 379-08
800	10	8	110	20	5	C 379-10
1.000	10	8	110	20	5	C 379-12
1.000	16	14	140	25	12	C 379-18





Applications:

The product is sucked bottom-up, very good axial flow with low shear force.

SUITABLE: page **27**
Stirrer bearings for BOLA stirrer shafts

BOLA Impeller Stirrer Shafts

Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**

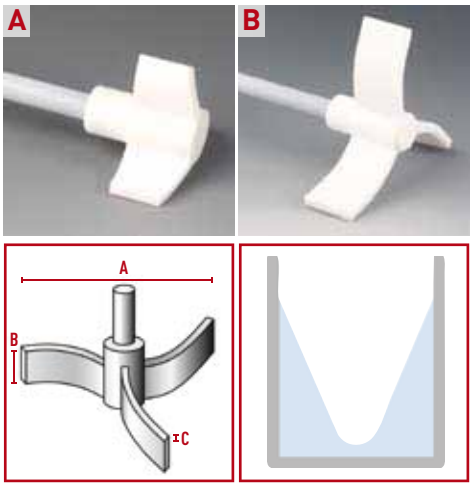
Product description:

PTFE-jacketed stainless steel shaft, impeller completely made of PTFE with three blades bent backwards, lower side of impeller either even or 15° angled. Universal chemical resistance since the product is only exposed to PTFE

NEW

FDA conform

	Length mm	Shaft dia. mm	Chucking dia. mm	Angle	Dimensions according to drawing A	B	C mm	Cat. No.:
A	350	10	8	15°	45	22	5	C 389-18
	350	10	8	15°	60	25	5	C 389-20
	450	10	8	15°	60	25	5	C 389-22
B	350	10	8	0°	100	25	5	C 389-24
	450	10	8	0°	100	25	5	C 389-28
	600	10	8	0°	100	25	5	C 389-32
	800	10	8	0°	100	25	5	C 389-36
	600	10	8	0°	150	25	5	C 389-62
	800	10	8	0°	150	25	5	C 389-66



Applications:

Very good and gentle stirring due to blades which are bent backwards, low shear force. The 15° angled impellers are ideal for stirring in vessels with round bottom.

BOLA Centrifugal Stirrer Shafts

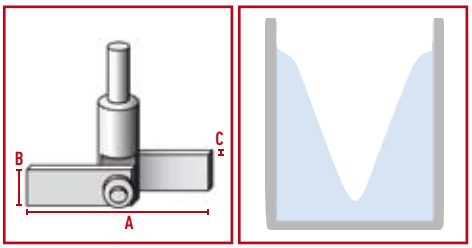
Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**

Product description:

PTFE-jacketed stainless steel shaft, stirring unit (movable paddles, bolt and receiver for paddles) completely made of PTFE. The paddles open up at increasing speed. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C mm	Cat. No.:
350	6	4	50	17	2,0	C 377-04
350	8	6,5	90	17	2,0	C 377-08
450	8	6,5	90	17	2,5	C 377-10
350	10	8,0	90	17	2,5	C 377-12
450	10	8,0	90	17	2,5	C 377-14
600	10	8,0	90	17	2,5	C 377-16




For ground joint starting at NS 24

Applications:

The stirrer shaft can be used for stirring in narrow mouth vessels or in vessels with ground joint opening (starting at size NS 24).

SUITABLE: page **36**
Additional stirrer paddles

BOLA Stirrer Shafts with Blade

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

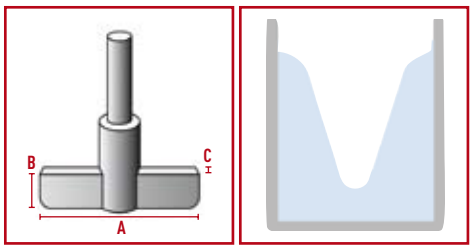
PTFE-jacketed stainless steel shaft, blade completely made of PTFE.
Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C mm	Cat. No.:
450	8	6,5	90	20	5	C 381-04
600	8	6,5	90	20	5	C 381-06
450	10	8,0	120	30	5	C 381-08
600	10	8,0	120	30	5	C 381-10
800	10	8,0	120	30	5	C 381-12
1.000	16	14,0	150	50	5	C 381-18

Applications:

Tangential flow with little turbulence, gentle stirring.



BOLA Stirrer Shafts with Two Paddles

Material:	Temperature resistance:	Chemical resistance:	Stirring effect:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**bottom-up**

Product description:

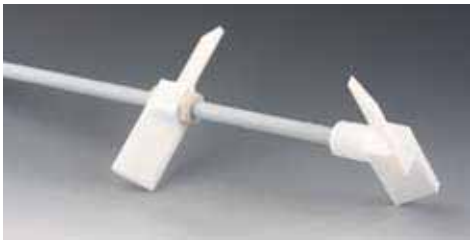
PTFE-jacketed stainless steel shaft, two PTFE paddles arranged crosswise at 90°. Upper paddle is fixed by means of clamp screws made of PEEK compound.

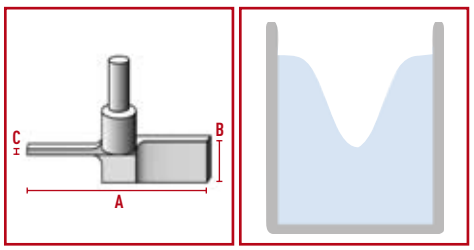
FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Distance of blades mm	Dimensions according to drawing A	B	C mm	Cat. No.:
450	8	6,5	50	80	18	4	C 380-02
600	8	6,5	50	80	18	4	C 380-04
800	8	6,5	50	80	18	4	C 380-06
600	10	8,0	100	110	20	5	C 380-08
800	10	8,0	100	110	20	5	C 380-10
1.000	10	8,0	100	110	20	5	C 380-12
600	16	14,0	150	140	25	12	C 380-14
800	16	14,0	150	140	25	12	C 380-16
1.000	16	14,0	150	140	25	12	C 380-18
1.200	16	14,0	150	140	25	12	C 380-20

Applications:

The product is sucked bottom-up, very good axial flow with low local shear force. The upper paddle can be positioned individually.





BOLA Fan-Shaped Stirrer Shafts

Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**

Product description:

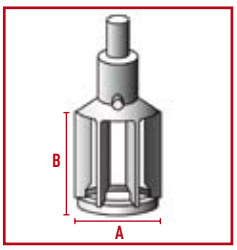
PTFE-jacketed stainless steel shaft, fan-shaped stirring unit completely made of PTFE.

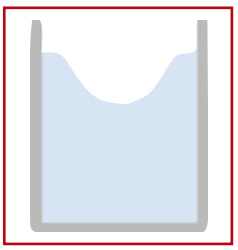
FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	For ground joint NS	Dimensions according to drawing A	B mm	Cat. No.:
300	8	6,5	29/32	24	35	C 382-02
300	8	6,5	45/40	38	45	C 382-06
450	8	6,5	45/40	38	45	C 382-08
450	10	8	60/46	53	55	C 382-12
600	10	8	60/46	53	55	C 382-14

Applications:

The mixture is drawn off from the bottom. Ideal mixing due to centrifugal forces. Ideal for stirring in narrow mouth vessels or in vessels with ground joint openings.





Helpful: page **232**
Information on maximum revolutions per minute for BOLA stirrer shafts

BOLA Propeller Stirrer Shafts with 4 Blades

Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**
Stirring effect: **bottom-up**

Product description:

PTFE-jacketed stainless steel shaft, propeller completely made of PTFE with four 45° angled angular blades. Universal chemical resistance since the product is only exposed to PTFE.

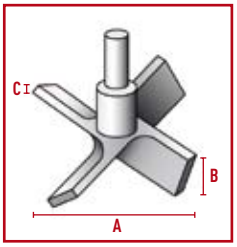
NEW

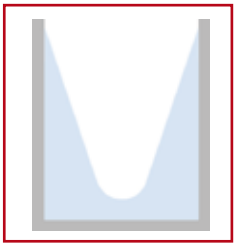
FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B	C mm	Cat. No.:
350	8	6,5	50	18	4	C 484-18
600	10	8,0	100	20	5	C 484-36

Applications:

The product is sucked bottom-up, good axial flow with low shear force.





SUITABLE: page **16**
Universal stirrer couplings

BOLA Discs Stirrer Shafts

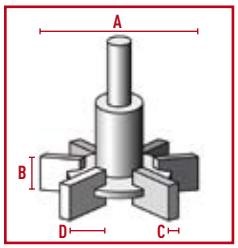
Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**

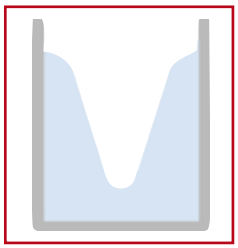
Product description:

PTFE-jacketed stainless steel shaft, discoidal stirrer blade with six radial paddles completely made of PTFE, similar to a "Rushton Turbine" stirrer shaft. Universal chemical resistance since the product is only exposed to PTFE.

NEW

FDA conform





Length mm	Shaft dia. mm	Chucking dia. mm	Suitable for NS	Suitable for NW	Dimensions according to drawing A	B	C	D mm	Cat. No.:
350	6	4	29/32		25	5	2	6,3	C 598-12
350	6	4	45/40		38	8	2	10	C 598-16
350	10	8		60	50	10	2	12,5	C 598-22
600	10	8		60	50	10	2	12,5	C 598-26
350	10	8		100	75	15	3	18,8	C 598-32
600	10	8		100	75	15	3	18,8	C 598-36
600	10	8		150	140	28	4	35	C 598-42
1.000	10	8		150	140	28	4	35	C 598-46
600	10	8		200	180	36	4	45	C 598-52
1.000	10	8		200	180	36	4	45	C 598-56
600	16	14		200	180	36	4	45	C 598-62
1.200	16	14		200	180	36	4	45	C 598-66

Applications:

Axial suction of mixture, strong radial flow. Ideal for aerating liquids.

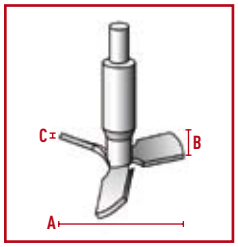
BOLA Mini-Propeller Stirrer Shafts

Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**
Stirring effect: **bottom-up**

Product description:

PTFE-jacketed stainless steel shaft, propeller completely made of PTFE with three 45° angled angular blades. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform



Length mm	Shaft dia. mm	Chucking dia. mm	Suitable for NS	Dimensions according to drawing A	B	C mm	Cat. No.:
350	6	4	29/32	25	8	2	C 482-12
350	6	4	45/40	40	12	2	C 482-24

Applications:

The product is sucked bottom-up, good axial flow with low shear force. The small stirring diameter allows stirring in narrow mouth vessels or in vessels with ground joint openings.

BOLA Micro Surface Stirrer Shafts

Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**

Product description:

PTFE-jacketed stainless steel shaft, blade completely made of PTFE with four round paddles. Universal chemical resistance since the product is only exposed to PTFE.

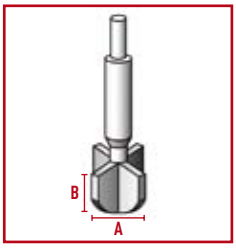
NEW

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Dimensions according to drawing A	B mm	Cat. No.:
120	3,5	2,5	8	8	C 486-08
180	3,5	2,5	12	12	C 486-12
200	4,0	3,0	14	14	C 486-16
200	4,0	3,0	16	16	C 486-20

Applications:

Ideal for stirring in test tubes or narrow-mouth vessels, optimum mixture in round vessels and in vessels with low fill level.



BOLA Double Impulse Stirrer Shafts

Material: **PTFE**
Temperature resistance: **from -200°C to + 250°C**
Chemical resistance: **+++ universal**
Stirring effect: **bottom-up**

Product description:

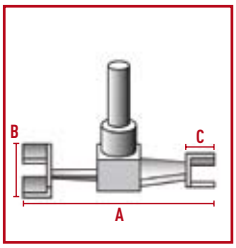
PTFE-jacketed stainless steel shaft, two paddles arranged crosswise at 90° completely made of PTFE. Upper paddle is fixed by means of clamp screws made of PEEK compound. Universal chemical resistance since the product is only exposed to PTFE.

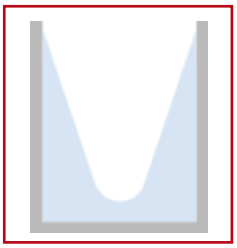
FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Distance of blades mm	Dimensions according to drawing A	B	C mm	Cat. No.:
600	10	8	150	140	34	19	C 391-18
800	16	8	150	140	34	19	C 391-28
1.200	16	14	300	240	56	32	C 391-34

Applications:

The inner stirring surfaces provide an upswing, while the parallel paddle ends provide a downward movement. Even viscous liquids are mixed ideally. The upper paddle can be positioned individually.

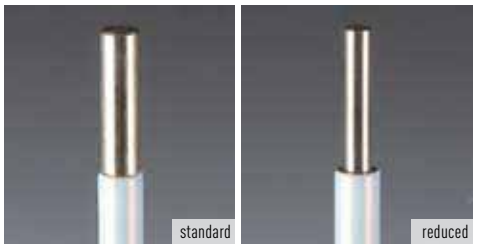




BOLA Stirrer Shafts with Reduced Chucking Diameter (RCD)

For some applications, it is necessary to use very long stirrer shafts. These stirrer shafts must have suitable diameters to be stable enough. It can occur that the chucking diameter of these long stirrer shafts is too big for the agitator. All BOLA Stirrer Shafts listed below have a professionally reduced chucking diameter of 10 mm and can be fixed safely in all common agitators.

You need a smaller diameter, or a different stirrer shaft? No problem: Simply indicate the requested diameter and the catalogue number of the stirrer shaft.



Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

A BOLA Stirrer Shafts with Blade RCD

PTFE-jacketed stainless steel shaft, blade completely made of PTFE. Universal chemical resistance since the product is only exposed to PTFE. Blade dimensions see Cat. No. C 381-.. on page 19.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
1.000	16	10	C 581-18

Applications:

Tangential flow with little turbulence, gentle stirring.

B BOLA Moon-Shaped Stirrer Shafts RCD

PTFE-jacketed stainless steel shaft, tilting half-moon stirrer blade with double-sided groove and access for the stirrer shaft completely made of PTFE. Universal chemical resistance since the product is only exposed to PTFE. Blade dimensions see Cat. No. C 376-.. on page 14.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
600	16	10	C 576-20
800	16	10	C 576-22

Applications:

Tangential flow with little turbulence. The tilting half-moon blade is ideal for stirring in round-bottom flasks with ground joint necks. Blades are available separately and can be mounted additionally.

C BOLA Maxi Propeller Stirrer Shafts RCD

PTFE-jacketed stainless steel shaft, propeller completely made of PTFE with three 45° angled blades. Universal chemical resistance since the product is only exposed to PTFE. Blade dimensions see Cat. No. C 392-.. on page 17.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
600	16	10	C 592-52
800	16	10	C 592-58
1.000	16	10	C 592-64
1.200	16	10	C 592-70

Applications:

The product is sucked bottom-up, very good axial flow with low local shear force.

BOLA Stirrer Shafts with Reduced Chucking Diameter (RCD)

D BOLA Stirrer Shafts with One Paddle RCD

PTFE-jacketed stainless steel shaft, paddle completely made of PTFE with two 45° angled blades. Universal chemical resistance since the product is only exposed to PTFE. Blade dimensions see Cat. No. C 379-.. on page 17.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
1.000	16	10	C 579-18
1.200	16	10	C 579-20

Applications:

The product is sucked bottom-up, very good axial flow with low shear force.

E BOLA Stirrer Shaft with Two Paddles RCD

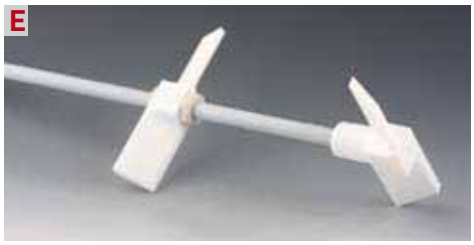
PTFE-jacketed stainless steel shaft, two paddles arranged crosswise at 90° completely made of PTFE. Upper paddle is fixed by means of clamp screws made of PEEK compound. Blade dimensions see Cat. No. C 380-.. on page 19.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
600	16	10	C 580-14
800	16	10	C 580-16
1.000	16	10	C 580-18
1.200	16	10	C 580-20

Applications:

The product is sucked bottom-up, very good axial flow with low local shear force. The upper paddle can be positioned individually.



F BOLA U-Shaped Stirrer Shafts RCD

PTFE-jacketed stainless steel shaft, U-shaped stirrer blade completely made of PTFE. Universal chemical resistance since the product is only exposed to PTFE. Blade dimensions see Cat. No. C 384-.. on page 15.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
800	16	10	C 584-52
1.000	16	10	C 584-58
1.200	16	10	C 584-64

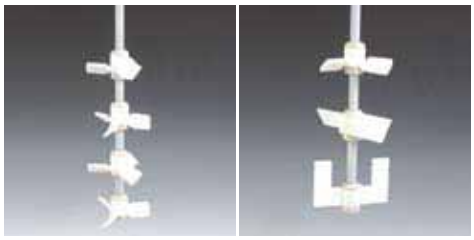
Applications:

Strong, tangential flow with high shear rate in the margin area, little sediments on the wall of the vessel. Ideal for mixing viscous liquids.

SUITABLE: page **27**
Stirrer bearings for BOLA Stirrer Shafts

BOLA Stirrer Blades

These solid stirrer blades are made of PTFE and have a set of clamp screws made of a PTFE/PEEK compound. The blades can be fixed tightly on BOLA Stirrer Shafts by means of the clamp screws. A spanner wrench is included for easy assembly.



Applications:

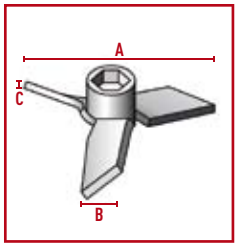
For flexible testing of optimum geometry and arrangement of blades on stirrer shafts. Usable to create stirrers with one single stage or with several stages.

Material:	Temperature resistance:	Chemical resistance:	Stirring effect:
PTFE / PEEK	**from -200°C to + 250°C**	**+++ universal**	**bottom-up**

A Type: BOLA Propeller Blades

FDA conform

Shaft dia. mm	Dimensions according to drawing A	B	C mm	Wrench size	Cat. No.:
8	75	18	3	15	C 440-08
10	75	18	3	19	C 440-10



Applications:

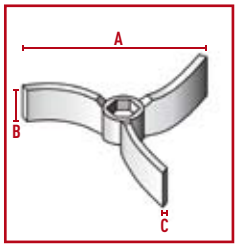
The product is sucked bottom-up, good axial flow with low shear force.

B Type: BOLA Impeller Blades

FDA conform

NEW

Shaft dia. mm	Dimensions according to drawing A	B	C mm	Wrench size	Cat. No.:
10	60	25	6	19	C 443-08
10	100	25	6	19	C 443-10
10	150	25	6	19	C 443-14



Applications:

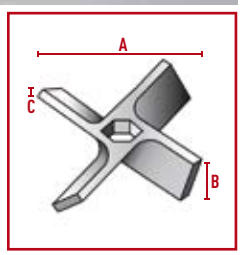
Very good and gentle stirring due to blades which are bent backwards, low shear force.

C Type: BOLA Propeller with 4 Blades

FDA conform

NEW

Shaft dia. mm	Dimensions according to drawing A	B	C mm	Wrench size	Cat. No.:
8	50	22	4	15	C 448-08
10	100	25	5	19	C 448-10
10	140	30	5	19	C 448-20
10	200	30	5	19	C 448-28
16	140	30	12	32	C 448-36
16	200	30	12	32	C 448-42



Applications:

The product is sucked bottom-up, good axial flow with low shear force.

BOLA Stirrer Blades

D Type: BOLA U-Shaped Blades

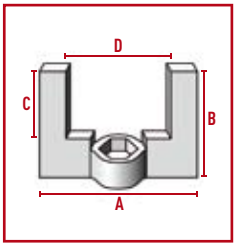
FDA conform

Shaft dia. mm	Dimensions according to drawing A	B	C	D mm	Wrench size	Cat. No.:
8	60	40	22	30	15	C 445-08
8	100	60	35	56	15	C 445-12
10	80	50	30	44	19	C 445-16
10	100	60	35	56	19	C 445-20
10	130	80	55	80	19	C 445-30
NEW 10	150	120	90	90	19	C 445-34
16	130	80	55	80	32	C 445-40
16	150	120	90	90	32	C 445-44

Applications:

Strong, tangential flow with high shear rate in the margin area, little sediments on the wall of the vessel. Ideal for mixing viscous liquids.

D



E Type: BOLA Paddle

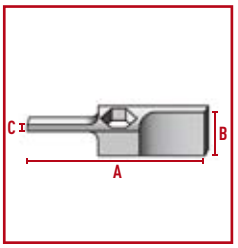
FDA conform

Shaft dia. mm	Dimensions according to drawing A	B	C mm	Wrench size	Cat. No.:
8	80	24	4	15	C 446-08
NEW 10	80	25	5	19	C 446-10
10	110	25	5	19	C 446-12
NEW 10	140	25	5	19	C 446-14
16	140	30	12	32	C 446-16

Applications:

The product is sucked bottom-up, very good axial flow with shear force.

E



F Type: BOLA Maxi Propeller Blades

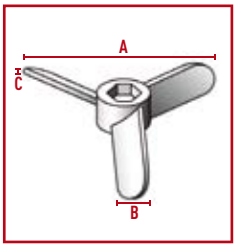
FDA conform

Shaft dia. mm	Dimensions according to drawing A	B	C mm	Wrench size	Cat. No.:
10	140	20	4	19	C 441-10
NEW 10	200	20	6	19	C 441-12
NEW 16	140	26	6	32	C 441-14
16	200	26	6	32	C 441-16

Applications:

The product is sucked bottom-up, very good axial flow with local shear force.

F



BOLA Solo Stirrer Shafts

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-jacketed stainless steel shaft with fused lower end. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Length mm	Shaft dia. mm	Chucking dia. mm	Cat. No.:
350	8	6,5	C 472-08
600	8	6,5	C 472-20
350	10	8,0	C 474-08
600	10	8,0	C 474-20
800	10	8,0	C 474-30
1.000	10	8,0	C 474-34
1.200	10	8,0	C 474-40
1.200	16	14,0	C 476-40
1.600	16	14,0	C 476-60

Applications:

Ideal for use together with BOLA Stirrer Blades which can be fixed individually on the Solo Stirrer Shaft. Also usable as stirring staff for manual stirring.

BOLA Stirrer Bearings

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**suitable**

Product description:

The sealing rings on these bearings ensure a perfect sealing. The ground joint no longer sticks, the danger of breaking is reduced and the cone can be removed easily from the socket. A special gasket made of PTFE and an FPM o-ring which is compressed by a GL screw cap provide a good sealing of the stirrer shaft. This gasket can be exchanged after wearing.

FDA conform

Cone NS European standard	For stirrer shaft dia. mm	Total length mm	Thread of screw cap GL	Cat. No.:
19/26	6	63	18	C 424-04
19/26	8	65	25	C 424-05
24/29	8	69	25	C 424-08
24/29	10	70	25	C 424-09
29/32	6	72	18	C 424-12
29/32	8	74	25	C 424-13
29/32	10	72	25	C 424-14
45/40	10	80	25	C 424-16
45/40	16	86	32	C 424-18
Cone US standard	**For stirrer shaft dia. mm**	**Total length mm**	**Thread of screw cap GL**	**Cat. No.:**
24/40	8	80	25	C 429-14
24/40	10	80	25	C 429-18

Applications:

Suitable for vacuum, perfect bearing for stainless steel, glass and BOLA Stirrer Shafts

BOLA Glass Stirrer Bearings

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**suitable**

Product description:

Combination of a borosilicate glass piece with ground joint, an interior PTFE shaft guide with integrated special gasket and a GL screw cap made of PPS. The special gasket made of PTFE and an FPM o-ring which is compressed by a GL screw cap provide a good sealing of the stirrer shaft. This gasket can be exchanged after wearing.

FDA conform

Cone NS European standard	For stirrer shaft dia. mm	Total length mm	Thread of screw cap GL	Cat. No.:
29/32	8	90	25	**C 425-08**
29/32	10	90	25	**C 425-09**
45/40	10	110	25	**C 425-12**
45/40	16	118	32	**C 425-14**
Cone US standard	**For stirrer shaft dia.** mm	**Total length** mm	**Thread of screw cap** GL	**Cat. No.:**
24/40	8	103	25	**C 428-08**
24/40	10	103	25	**C 428-12**

Applications:

Suitable for vacuum, perfect bearing for stirrer shafts made of stainless steel, glass and for BOLA Stirrer Shafts

BOLA Ultra Stirrer Bearings

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**suitable**

Product description:

Combination of a borosilicate glass piece with ground joint, an interior PTFE shaft guide with integrated special gasket and a pressure screw made of PTFE with glass fibre.

FDA conform

Cone NS	For stirrer shaft dia. mm	Total length mm ca.	Cat. No.:
29/32	8	108	**C 426-08**
29/32	10	108	**C 426-09**

Applications:

Suitable for vacuum, perfect bearing for stirrer shafts made of stainless steel, glass and for BOLA Stirrer Shafts

BOLA Replacement Glass Parts

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
Glass	**from -200°C to + 250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

Borosilicate glass with ground joint and GL thread.

Size NS	Thread GL			Cat. No.:
29/32	25			C 425-50
24/40	25			C 425-51
45/40	25			C 425-53
45/40	32			C 425-55

Applications:

Spare part for BOLA Glass Stirrer Bearings

BOLA Replacement Shaft Guides

Material:	Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**FPM**	**from -200°C to + 250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

With integrated, exchangeable special gasket made of PTFE and an FPM o-ring.

For stirrer shaft dia. mm	Total length mm			Cat. No.:
8	57			C 425-58
10	57			C 425-59
16	66			C 425-60

Applications:

Spare part for BOLA Glass Stirrer Bearings and BOLA Ultra Stirrer Bearings

BOLA Special Gaskets

Material:	Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**FPM**	**from -200°C to + 250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

Easily exchangeable combination of PTFE gasket with FPM o-ring for PTFE shaft guides. The gaskets provide sealing of the stirrer shafts.

For stirrer shaft dia. mm				Cat. No.:
6				C 425-69
8				C 425-70
10				C 425-71
16				C 425-72

Applications:

Spare part for BOLA Glass Stirrer Bearings and BOLA Ultra Stirrer Bearings

BOLA Replacement Screw Caps

Material:	Temperature resistance:	Chemical resistance:
PPS	**from -200°C to + 250°C**	**++ very good**

Product description:

Screw caps compress the o-ring of the special gasket and provide sealing of the stirrer shaft.

FDA conform

For stirrer shaft dia. mm	Thread GL			Cat. No.:
6	18			C 425-82
8	25			C 425-84
10	25			C 425-86
16	32			C 425-88
16	25			C 425-90
22	32			C 425-92

Applications:

Spare part for BOLA Glass Stirrer Bearings

BOLA Special Stirrer Bearings

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to + 250°C**	**+++ universal**	**low**	**suitable**

Product description:

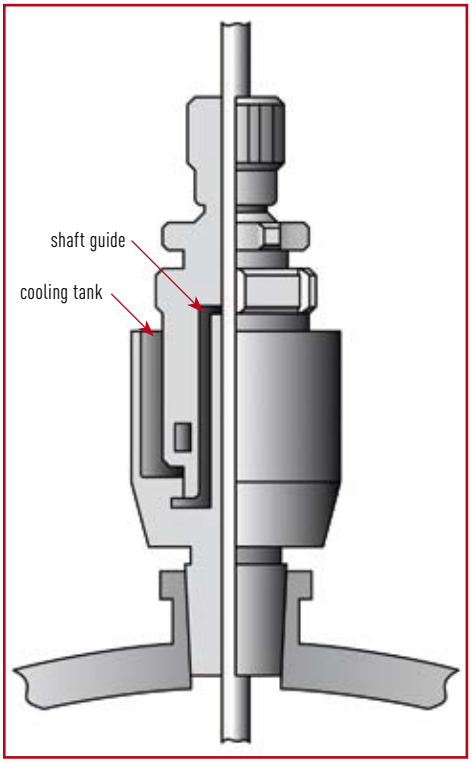
The 29/32 ground joint of these bearings provides a safe seat in the reactor lid. The stirrer shaft is held by an invisible shaft guide made of borosilicate glass which has an adjustable vacuum sealing. The stirrer can be adjusted in height by means of a lock nut. There is no abrasion. A cooling tank for an optional lubricant against overheating is also included. Suitable for vacuum up to at least 700 mm Hg and for low overpressure. Speeds of up to 500 rpm – temporarily even 1000 rpm - are admissible.

FDA conform

Ground Joint NS	For stirrer shafts dia. mm		Cat. No.:
29/32	8		C 430-20
29/32	10		C 430-28

Applications:

Particularly suitable for long-term use. For all stirrer shafts made of stainless steel, glass or for BOLA Stirrer Shafts with a diameter of 8 or 10 mm.



BOLA Magnetic Stirrer Heads with Ground Joint

Material:	Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**PFA**	**from -200°C to + 250°C**	**+++ universal**	**suitable**

Product description:

Gastight permanent magnetic coupling with ball bearing encapsulated in ceramics and square connection for cardan joint. PTFE cone size 29 with release nut made of PTFE with glass fibre for easy removal of the ground joint. All products which are exposed to the medium do not contain any metals. The 8 mm shaft guide provides guidance without friction of stirrer shafts up to a speed of 800 rpm. The stirrer head can also be fixed directly into the chuck by mounting the included metal adaptor on the square connection (6 mm).

FDA conform

Torque Ncm	Ground joint NS	Viscosity up to mPas	Volume up to ml	Speed rpm max.	Total length mm	Cat. No.:
20	29/32	1.500	2.000	800	203	**C 450-16**
40	29/32	2.500	4.000	800	215	**C 450-24**

Applications:

For absolute vacuum.

BOLA Magnetic Stirrer Heads with Flange

Material:	Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**PFA**	**from -200°C to + 250°C**	**+++ universal**	**suitable**

Product description:

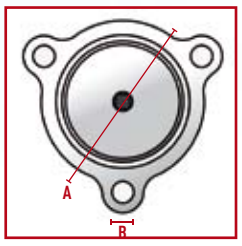
Gastight permanent magnetic coupling with ball bearing encapsulated in ceramics, square connection for cardan joint and flange NW 25. All products which are exposed to the medium do not contain any metals. The 8 mm shaft guide provides guidance without friction of stirrer shafts up to a speed of 800 rpm. The stirrer head can also be fixed directly into the chuck by mounting the included metal adaptor on the square connection (6 mm). Universal chemical resistance, since the product is only exposed to PTFE and PFA.

FDA conform

Torque Ncm	Ground joint NS	Viscosity up to mPas	Volume up to ml	Bolt circle dia. A mm	Bore dia B mm	Length mm	Cat. No.:
60	25	3.500	6.000	75	9	215	**C 454-24**

Applications:

For absolute vacuum.



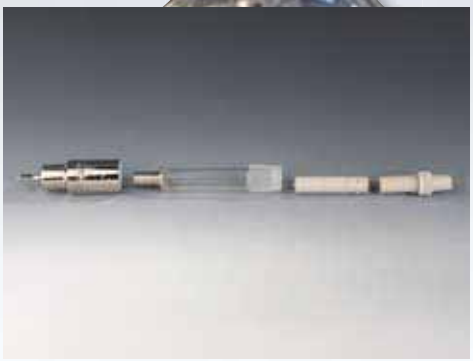
BESTSELLER

BOLA Magnetic Stirrer Heads

Material:	Material:	Temperature resistance:	Chemical resistance:
PTFE / compound	**Glass**	**from -200°C to + 250°C**	**+++ universal**

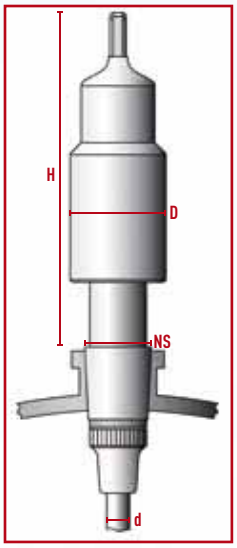
Product description:

Perfect combination of drive shaft with ball bearings, rotor and lower bearing made of PTFE/PEEK and a conductor made of borosilicate glass. Requires little space due to compact construction. No leakage or memory effects due to non-porous, welded rotor. This rotor holds the stirrer shaft by means of three stud screws which are fixed in the counterbores of the stirrer shaft. This provides optimum power transmission and a safe fixing. The 6 mm square can be fixed into the stirrer coupling or into the agitator.



FDA conform

	For stirrer shaft dia. d mm	Height H mm	Conductor NS	Torque Ncm	Drive shaft O.D D mm	Cat.No.:
NEW	6	90	19/26	15	28	C 512-08
	8	148	29/32	50	38	C 502-08
	10	148	29/32	50	38	C 502-16
NEW	8	140	45/40	50	38	C 504-08
NEW	10	140	45/40	50	38	C 504-16
	8		for fusing	50	38	C 500-08
	10		for fusing	50	38	C 500-16



Product advantages:

- » powerful transmission of up to 50 Ncm
- » no grease required
- » all products which are exposed to the medium do not contain any metals
- » high speed of up to max. 1.500 rpm
- » high working temperatures up to +250°C are possible
- » excellent chemical resistance
- » safe to run dry
- » high durability

Applications:

Ideal for reactor lids with a center ground joint, suitable for stirrer shafts made of glass or stainless steel with counterbores for a safe fixing into the rotor.

BOLA Conductors for Magnetic Stirrer Heads

Material:	Temperature resistance:	Chemical resistance:
Glass	**from -200°C to + 250°C**	**+++ universal**

Product description:

Borosilicate glass with ground joint and glued upper bearing. Alternatively without ground joint for fusing on the reactor lid (upper bearing to be glued is included).

FDA conform

	Ground joint NS				Cat.No.:
A	19/26				C 463-19
	29/32				C 463-29
	45/40				C 463-45
B	for fusing				C 461-08

Applications:

Accessory for BOLA Magnetic Stirrer Head

A

B

BOLA Stirrer Shafts for Magnetic Stirrer Heads

Material:	Temperature resistance:	Chemical resistance:
Glass	**from -200°C to + 250°C**	**+++ universal**

Product description:

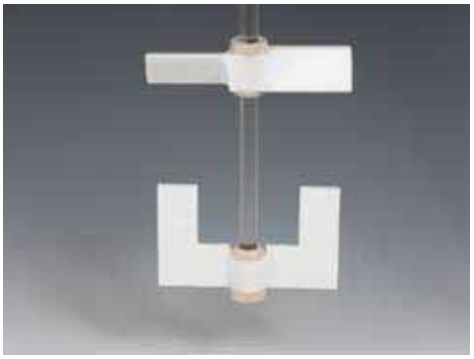
Ground and polished borosilicate stirrer shaft with integrated counterbores for the three stud screws of the rotor of the BOLA Magnetic Stirrer Head.

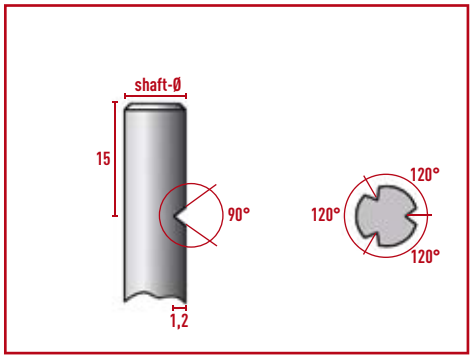
FDA conform

Length mm	Stirrer shaft dia. mm		Cat.No.:
400	10		C 492-16
600	10		C 492-24

Applications:

Accessory for BOLA Magnetic Stirrer Head. Ideal for use together with BOLA Stirrer Blades which can be fixed individually. Shaft can be shortened on demand.





BOLA GT Glass Stirrer Shafts

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

KPG stirrer shaft made of borosilicate glass, tiltable moon-shaped stirrer blade with angular groove and clamping bolts completely made of PTFE. For vessels with a 29/32 ground joint. Universal chemical resistance since the product is only exposed to PTFE and glass.

FDA conform

Length mm	Shaft dia. mm	Blade dimensions mm	Cat.No.:
290	10	50 x 24 x 3	**C 375-02**
340	10	68 x 24 x 3	**C 375-04**
390	10	68 x 24 x 3	**C 375-06**
490	10	90 x 24 x 3	**C 375-08**
560	10	90 x 24 x 3	**C 375-10**

Applications:

Tangential flow with little turbulence. The tilting half-moon blade is ideal for stirring in round-bottom flasks with ground joint necks. Blades are available separately and can be mounted additionally.

For ground joint NS 29/32

BOLA KPG Glass Stirrer Shafts

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

KPG stirrer shaft with double pivot made of ground and polished borosilicate glass, tiltable moon-shaped stirrer blade with double-sided groove completely made of PTFE. For vessels with a 29/32 ground joint. Universal chemical resistance since the product is only exposed to PTFE and glass.

FDA conform

Length mm	Shaft dia. mm	Blade dimensions mm	Cat.No.:
350	10	50 x 24 x 3	**C 387-05**
350	10	75 x 24 x 3	**C 387-07**
350	10	90 x 24 x 3	**C 387-09**
400	10	50 x 24 x 3	**C 387-11**
400	10	75 x 24 x 3	**C 387-13**
400	10	90 x 24 x 3	**C 387-15**

Applications:

Tangential flow with little turbulence. The tilting half-moon blade is ideal for stirring in round-bottom flasks with ground joint necks. Blades are available separately and can be mounted additionally.

For ground joint NS 29/32

BOLA Moon-Shaped Stirrer Blades

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Completely made of PTFE, with double-sided groove.

FDA conform

Suitable for ml	Bore dia. mm	For ground joint NS	Blade dimensions mm	Cat.No.:
100	8,5	24/29	50 x 18 x 3	C 400-06
100	8,5	29/32	50 x 24 x 3	C 400-08
250	8,5	24/29	65 x 18 x 3	C 400-12
250	8,5	29/32	68 x 24 x 3	C 400-14
500	8,5	24/29	75 x 18 x 3	C 400-16
500	8,5	29/32	75 x 24 x 3	C 400-18
1.000	8,5	29/32	90 x 24 x 3	C 400-20
2.000	8,5	29/32	110 x 24 x 3	C 400-22
2.000	12,5	45/40	125 x 35 x 3	C 400-24
4.000/6.000	8,5	29/32	125 x 24 x 3	C 400-26
4.000/6.000	12,5	45/40	145 x 35 x 4	C 400-28

Applications:

For glass stirrer shafts with double pivot, KPG glass stirrer shafts (Cat.No. C 387- ...) and PTFE-jacketed stainless steel stirrer shafts (Cat. No. C 376-...).

BOLA Moon-Shaped Stirrer Blades

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Completely made of PTFE, with angular groove. For vessels with a 29/32 ground joint.

FDA conform

Suitable for ml	Bore dia. mm	Blade dimensions mm	Cat.No.:
100	5,8	50 x 24 x 3	C 401-02
250	5,8	68 x 24 x 3	C 401-04
1.000	5,8	90 x 24 x 3	C 401-08

Applications:

For glass stirrer shafts and KPG glass stirrer shafts (Cat.No. C 375- ...).

BOLA Moon-Shaped Stirrer Blades

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Completely made of PTFE, with one-sided groove and bore dia. 10 mm.

FDA conform

Suitable for ml	For ground joint NS	Blade dimensions mm	Cat. No.:
100	24/29	50 x 18 x 3	**C 402-07**
100	29/32	50 x 24 x 3	**C 402-09**
250	24/29	65 x 18 x 3	**C 402-14**
250	29/32	68 x 24 x 3	**C 402-16**
500	24/29	75 x 18 x 3	**C 402-19**
500	29/32	75 x 24 x 3	**C 402-21**
1.000	29/32	90 x 24 x 3	**C 402-24**
2.000	29/32	110 x 24 x 3	**C 402-26**
4.000/6.000	29/32	125 x 24 x 3	**C 402-31**

Applications:

For glass stirrer shafts with one-sided pivot.

BOLA Centrifugal Stirrer Blades

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

For ground joint starting at NS 24/29

Product description:

Completely made of PTFE, consisting of 2 paddles, bolt and clamp ring. For vessels with a 24/29 ground joint (or bigger).

FDA conform

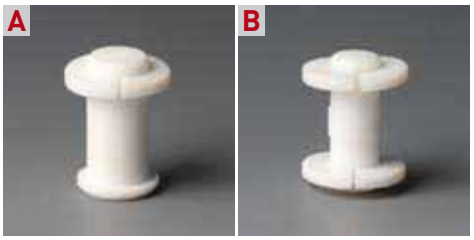
Stirring dia. mm	Blade dimensions mm		Cat. No.:
50	2		**C 407-04**
70	2		**C 407-06**
90	2,5		**C 407-08**

Applications:

For centrifugal stirrer shafts (Cat. No. C 377-.. on page 18)

BOLA Bolts and Clamp Rings

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**



Product description:

Completely made of PTFE, bolts are available in 2 different versions:

A Cylindrical shape

FDA conform

Bolt dia. mm	Usable length mm	For blades with bore dia. mm	Cat. No.:
6	12	6,5	**C 410-02**
12	16	12,5	**C 410-06**

B With a distance piece between blade and stirrer shaft. The blade remains movable.

Bolt dia. mm	Usable length mm	For blades with bore dia. mm	Cat. No.:
8	12	8,5	**C 410-04**

Applications:

For moon-shaped stirrer blades with double-sided groove (Cat. No. C 400- .. on page 35)



BOLA Stirring Bars

What you should know about magnetic stirring and mixing

For optimum results, both drive magnet and stirring bar are decisive. For optimum efficiency, the distance between the magnetic poles of the drive magnet and the length of the stirring bar should be equal. A magnetic stirring bar which is too small will eventually gravitate toward one of the poles of the drive magnet. Stirring efficiency is influenced by the material, by the thickness of the cover plate and the thickness of the vessel. For the best magnetic coupling, the distance between the magnets should be minimized.

HELPFUL: page **233**
Detailed information on magnetic stirring

What you should know about the choice of stirring bars

Improperly selected stirring bars are often cause flickering of the bars in the vessel, respectively ineffective mixing of the product.
You can find an overview of the most common stirring bars here below:

Cylindrical Magnetic Stirring Bars:
They are the most commonly used magnetic stirring bars. Due to their simple shape they can be offered at very attractive prices. Cylindrical magnetic stirring bars offer excellent centering and smooth running characteristics.

Glass Magnetic Stirring Bars:
They have a non-porous and smooth glass-coating. All following processes are not affected by any carry-over. There is an increased abrasion between glass vessels and glass stirring bars.

Ultra Magnetic Stirring Bars:
These magnetic stirring bars have very smooth and seamless surfaces. No substance can penetrate into their surfaces and thus, all following processes are not affected by any „carry-over". They are mainly used for high-purity work or trace analysis

Power Magnetic Stirring Bars:
Due to special magnetic material, their torque loads are larger than those of conventional magnetic stirring bars. Power magnetic stirring bars are mainly used for agitating viscous liquids or for bridging larger distances between the magnetic stirring machine and the magnetic stirring bar.

Square Magnetic Stirring Bars:
They are particularly suitable for big vessels due to the high magnetic force. Solids are released or removed from the bottom of the vessel.

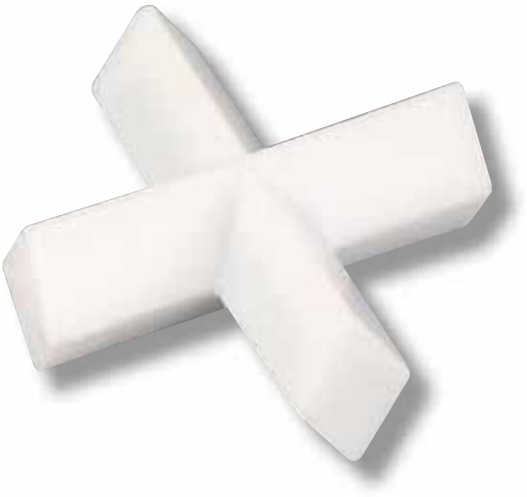
Egg-Shaped Magnetic Stirring Bars:
They are particularly suitable for round-bottom flasks. Their shape mimics that of the flasks and assures complete mixing. Those magnetic stirring bars have an egg-shaped magnetic core which assures a better force transmission than a cylindrical core.

Triangular Magnetic Stirring Bars:
Such magnets are useful for mixing reagents which resist dissolving or for avoiding any residues at the bottom of the vessels. They provide strong turbulence at relatively low speeds.

Magnetic Stirring Bars with Pivot Ring:
Their interrupted surface provides greater surface area and added turbulence. Only their pivot ring and one end of the magnetic stirring bar touch the bottom of the vessel. Therefore these magnetic stirring bars have a more steady spinning position and a better longevity.

Star Head Magnetic Stirring Bars:
Optimum stirring in tall, narrow diameter vessels. Ideal stirring bar for cuvettes or test tubes.

Center Magnetic Stirring Bars:
These magnetic stirring bars provide better stirring action and a more stable spinning position due to the punctual position.



Tolerances of the magnetic stirring bars

» The dimensions of the magnetic stirring bars are nominal dimensions which can have a tolerance of +/- 5% in length and +/- 10% in diameter.

Results of stirring – tested for you

In order to help you choose the suitable magnetic stirring bar for your application, we have made tests with these data under real conditions. You will find graphs for each magnetic stirring bar on the next pages.

» **Speed:** 500 rpm
» **Volume:** 2.000 ml
» **Product:** water
» **Temperature:** 20°C
» **Vessel:** glass beaker

We "meliorate" your specific magnetic stirring bars

» These stirring bars can for example be built in devices or can be used for special applications

» The diameter of the magnetic stirring bars can be machined with a tolerance of up to +/- 0,02 mm

» The magnetic stirring bars are ground to obtain a seamless amplitude

» The ends are polished to receive a round or any other shape

» The surface is becoming extremely smooth and even, so that contaminations cannot adhere

» Reproducibility both in diameter and surface are granted

BOLA Cylindrical Magnetic Stirring Bars

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), standard magnetic stirring bar, universal chemical resistance.

FDA conform

Length mm	Dia. mm	Cat. No.:	Length mm	Dia. mm	Cat. No.:
2	2	C 350-01	30	7	C 350-22
3	3	C 350-02	30	10	C 350-41
5	2	C 350-03	35	6	C 350-23
6	3	C 350-04	40	7	C 350-24
7	2	C 350-05	40	8	C 350-25
8	2	C 350-06	40	10	C 350-26
8	3	C 350-07	45	8	C 350-27
10	3	C 350-08	50	7	C 350-28
10	6	C 350-09	50	8	C 350-29
12	4,5	C 350-10	55	12	C 350-30
13	3	C 350-11	60	7	C 350-31
15	2	C 350-12	60	9	C 350-32
15	4,5	C 350-13	70	9	C 350-33
15	6	C 350-14	70	13	C 350-34
20	3	C 350-15	80	10	C 350-35
20	6	C 350-16	110	27	C 350-36
20	7	C 350-17	120	12	C 350-37
25	5	C 350-18	127	12	C 350-38
25	6	C 350-19	155	27	C 350-39
25	7	C 350-20			
30	6	C 350-21			

Applications:

Cylindrical magnetic stirring bars offer excellent centering and smooth running characteristics.

BOLA Square Magnetic Stirring Bars

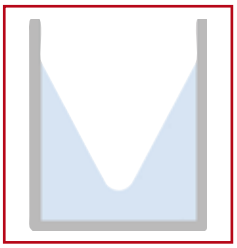
Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), universal chemical resistance.

FDA conform

Dimensions mm			Cat. No.:
14 x 14 x 45			C 361-03
14 x 14 x 90			C 361-06



Applications:

They are particularly suitable for big vessels, strong turbulences at low speed; solids are released or even avoided.

BOLA Magnetic Stirring Bars with Pivot Ring

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), cylindrical shape with pivot ring, universal chemical resistance.

FDA conform

Length mm	Dia. mm	Cat. No.:	Length mm	Dia. mm	Cat. No.:
8	3	C 354-02	35	6	C 354-20
12	5	C 354-05	40	8	C 354-23
15	5	C 354-08	45	8	C 354-26
20	6	C 354-11	50	8	C 354-29
25	6	C 354-14	60	9	C 354-32
30	6	C 354-17	70	9	C 354-35

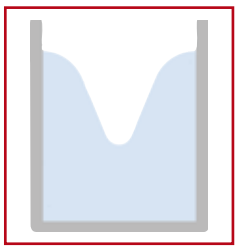
Applications:

They provide a bigger surface area. Very steady spinning position with additional turbulences.

SUITABLE: page **43**
Powerful magnetic stirring bar retrievers

BOLA Triangular Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**



Product description:

PTFE-encapsulated magnetic core (Alnico 5), universal chemical resistance.

FDA conform

Length mm	Dia. mm	Edge length mm	Cat. No.:
12	8	6	C 357-03
20	8	8	C 357-06
25	8	8	C 357-09
25	14	15	C 357-12
35	10	10	C 357-15
40	14	15	C 357-18
50	12	12	C 357-21
55	14	15	C 357-24
80	17	16	C 357-27
130	38	44	C 357-30

Applications:

For big vessels, strong turbulence at relatively low speeds. Useful for mixing reagents which resist dissolving or for avoiding any residues at the bottom of the vessels.

BOLA Egg-Shaped Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

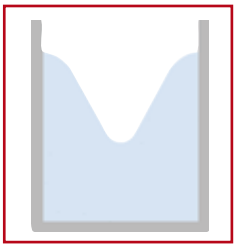
PTFE-encapsulated magnetic core (Alnico 5), universal chemical resistance.

FDA conform

Length mm	Dia. mm	Suitable for round bottom flasks (DIN 12 348) ml	Cat. No.:
20	10	25	**C 358-02**
25	12	50	**C 358-04**
30	15	100	**C 358-06**
35	15	250	**C 358-08**
40	20	500	**C 358-10**
50	20	1.000	**C 358-12**
65	20	4.000	**C 358-14**
70	20	10.000	**C 358-16**

Applications:

Ideal for stirring in round bottom flasks. Shape mimics that of the flasks and assures complete mixing.



BOLA Power Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core made of a very strong magnetic material (rare earth magnet samarium-cobalt), torque loads transmitted are about 4 times larger than those of conventional magnetic stirring bars. No risk of demagnetization, sterilisable, extremely smooth surface avoiding contaminations, universal chemical resistance.

FDA conform

Length mm	Dia. mm		Cat. No.:
20	8		**C 365-20**
40	14		**C 365-40**
50	19		**C 365-50**

Applications:

They are mainly used for agitating viscous liquids or for bridging larger distances between the magnetic stirring machine and the magnetic stirring bar. Optimum mixing in vessels with a big volume or in tall graduated cylinders.

BOLA Ultra Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), extremely smooth and seamless surfaces, no substance can penetrate, universal chemical resistance.

FDA konform

Length mm	Dia. mm		Cat. No.:
10	6		C 353-10
15	5		C 353-15
20	7		C 353-20
25	5		C 353-25
30	5		C 353-30
40	7		C 353-40

Applications:

They are mainly used for high-purity work or trace analysis.

BOLA Magnetic Stirring Bar Retrievers

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated stirring bar retriever with strong permanent magnet (Alnico 5), universal chemical resistance.

FDA conform

Length mm	Lower end dia. mm	Bar dia. mm	Cat. No.:
150	10	8	C 372-02
200	10	8	C 372-04
250	10	8	C 372-06
300	10	8	C 372-08
350	10	8	C 372-10
400	10	8	C 372-12
600	10	8	C 372-18

Applications:

For the removal of stirring bars from aggressive liquids, prevents loss of stirring bars.

BOLA Magnetic Stirring Bar Set

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Consisting of the most common magnetic stirring bars and a retriever with a length of 150 mm. Each one piece of:

Cylindrical 10 x 6, 15 x 4,5, 20 x 6, 25 x 6, 30 x 6, 40 x 8, 50 x 8, 60 x 9;
Pivot ring 15 x 5, 25 x 6, 40 x 8;
Triangular 25 x 8, 40 x 14

FDA conform

Dimensions of box mm			Cat. No.:
175 x 110 x 30			C 348-10

Applications:

Ideal for beginners, for testing different kinds and dimensions of magnetic stirring bars

BOLA Glass Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
Glas	**from -200°C to + 250°C**	**+++ universal**

Product description:

Magnetic core (Alnico 5) encapsulated in borosilicate glass, cylindrical shape, extremely smooth surface prevents from penetration of substances, non-porous, non-contaminating, universal chemical resistance.

FDA conform

Length mm	Dia. mm		Cat. No.:
15	8		C 351-03
20	8		C 351-06
25	8		C 351-09
30	8		C 351-12
40	8		C 351-15
55	8		C 351-19

Applications:

They are mainly used for high-purity work or trace analysis.

BOLA Star Head Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
Glas	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), universal chemical resistance.

FDA conform

Dia. mm	Height mm		Cat. No.:
10	8		C 360-04
14	10		C 360-07
17	13		C 360-10
22	15		C 360-13
30	12		C 360-16
35	12		C 360-19
40	14		C 360-22
58	15		C 360-25

Applications:

Optimum stirring in tall, narrow diameter vessels due to symmetrical fins on both sides. Ideal stirring bar for cuvettes or test tubes.

BOLA Dumbbell-Shaped Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), universal chemical resistance.

FDA conform

Length mm	Dia. of discs mm		Cat. No.:
37	20		C 359-03
55	20		C 359-06

Applications:

Stable discs on both sides provide an excellent stirring.

BOLA Center Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), conically tapered ends, universal chemical resistance.

FDA conform

Length mm	Dia. mm		Cat. No.:
20	7		C 367-20
30	8		C 367-30
40	8		C 367-40
50	8		C 367-50

Applications:

Extremely steady mixing due to small center seat.

BOLA Crosshead Magnetic Stirring Bars

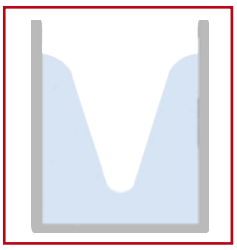
Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic core (Alnico 5), universal chemical resistance.

FDA conform

Length x Width mm	Height mm		Cat. No.:
10 x 10	5		**C 369-10**
19 x 19	9		**C 369-19**
25 x 25	13		**C 369-25**
32 x 32	14		**C 369-32**
38 x 38	15		**C 369-38**



Applications:

Safe and quiet mixing, optimum stirring due to stable position

BOLA Colour Magnetic Stirring Bars

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Magnetic core (Alnico 5) encapsulated with coloured PTFE, universal chemical resistance.

Length mm	Dia. mm	Colour	Cat. No.:
13	8	yellow	**C 368-08**
25	8	yellow	**C 368-12**
38	8	yellow	**C 368-16**
50	8	yellow	**C 368-20**
13	8	blue	**C 368-28**
25	8	blue	**C 368-32**
38	8	blue	**C 368-36**
50	8	blue	**C 368-40**
13	8	red	**C 368-48**
25	8	red	**C 368-52**
38	8	red	**C 368-56**
50	8	red	**C 368-60**

Applications:

For better distinction.

BOLA Tandem Magnetic Stirring Bars

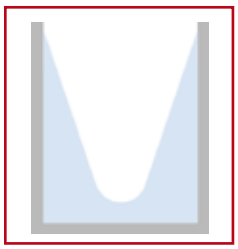
Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

PTFE-encapsulated magnetic cores (Alnico 5), center bore for receiving the BOLA Bearing Neck or a glass neck (available from a glassblower), universal chemical resistance. Bearing neck not included in delivery.

FDA conform

Magnetic stirring bar length x O.D. mm	Bearing neck dia. mm	Recommended height of neck mm	Block dimensions mm	Cat. No.:
40 x 10	8	15	34 x 14 x 14	**C 363-26**
55 x 12	8	19	44 x 18 x 14	**C 363-30**
110 x 24	12	37	84 x 36 x 36	**C 363-36**
155 x 24	12	37	84 x 36 x 36	**C 363-39**



Extremely strong mixing of the product, ideal transmission of the magnetic force of the stirrer to the tandem magnetic stirring bar. Reduction of running surface to a ring minimizes friction and increases lifespan. Tandem magnetic stirring bars do not touch the bottom and therefore do not wear.

BOLA Bearing Necks

Material:	Temperature resistance:	Chemical resistance:
PTFE / compound	**from -200°C to + 250°C**	**+++ universal**

Product description:

Very hard PTFE-PEEK compound, for receiving a BOLA Tandem Magnetic Stirring Bar, center fixing on the bottom of the vessel by means of glue (we recommend silicone; hardened in water), universal chemical resistance.

FDA conform

Dia. of neck mm	Lower dia. mm	Usable height mm	Suitable for Cat. No.:	Cat. No.:
8	25	19	C 363-26 and C 363-30	**C 364-08**
12	25	37	C 363-36 and C 363-39	**C 364-16**

BOLA Culture Bottles

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

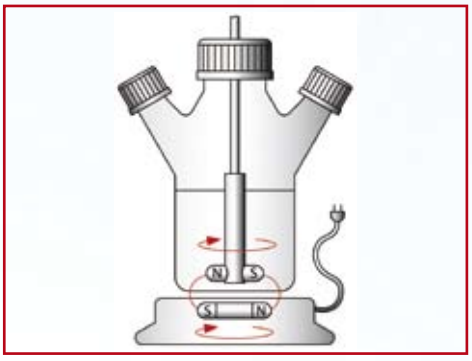
- » Bottle made of borosilicate glass
- » Screw cover for center neck made of PP with glass fibre
- » Screw caps for sidearms made of PPS
- » Stirrer made of PTFE and stainless steel is continuously adjustable in height from the outside
- » Complete unit can be sterilized
- » Universal chemical resistance
- » Suitable for both low and high speeds (max. 1000 rpm)

FDA conform

Usable volume ml	I.D. of center neck mm	Thread of bottle GL	Thread of sidearms GL	Cat. No.:
50	30	45	2 x 14	**C 420-03**
125	30	45	2 x 18	**C 420-05**

Applications:

- » Stirring unit is driven by a common magnetic stirrer
- » Magnetism causes rotation
- » For gentle mixing of cell cultures
- » The sidearms can be connected to tubing, probes or sensors (suitable laboratory screw joints can be found on page 55)



BOLA Tweezers

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Precast tweezers made of PTFE with pointed or blunt ends. Universal chemical resistance.

FDA conform

	Length mm			Pointed end Cat. No.:
A	100			**H 909-02**
	150			**H 909-04**
	200			**H 909-06**

	Length mm			Blunt end Cat. No.:
B	100			**H 912-02**
	150			**H 912-04**
	200			**H 912-06**

A

B

BOLA Double Spatulas

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Spatulas made of PTFE with tapered ends. Universal chemical resistance.

FDA conform

Length mm	Width of ends mm		Cat. No.:
120	16		**H 915-02**
150	16		**H 915-04**
180	16		**H 915-06**

BOLA Scrapers

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to + 250°C**	**+++ universal**

Product description:

Scrapers made of PTFE with tapered end. Ideal handling due to big handle and wide blade. Universal chemical resistance.

FDA conform

Total length mm	Width of blade mm	Dia. of handle mm	Cat. No.:
160	50	20	**H 916-02**
200	90	20	**H 916-06**
200	120	20	**H 916-08**

Applications:

For a very gentle peeling of products.

Screw Joints / Components with GL Thread

Tailored equipment in a few quick and incomplex steps: with easily combinable screw joint elements from BOLA you can flexibly react to all current requirements.

PRODUCT TIPS

Page 60
GL Distributors for Bottles

Page 55
GL Laboratory Screw Joints

The Modular Construction System

What you should know about the GL screw joint system.

A universal screw joint system, developed for connecting tubes or tubing (PTFE, PFA, FEP) with glass or metal tubes. The system provides a pressure resistance of up to 10 bar at room temperature.

The fittings and stopcocks are made of pure PTFE. Assembled with the BOLA HT Laboratory Screw Joints, they are resistant to temperatures up to +250°C.

The universal chemical resistance of the fluoroplastic materials allows the application of the GL screw joint components with almost every liquid and gas.

You can combine different components with GL thread to create a complete equipment:

e.g. Basic Scrubber Bottle

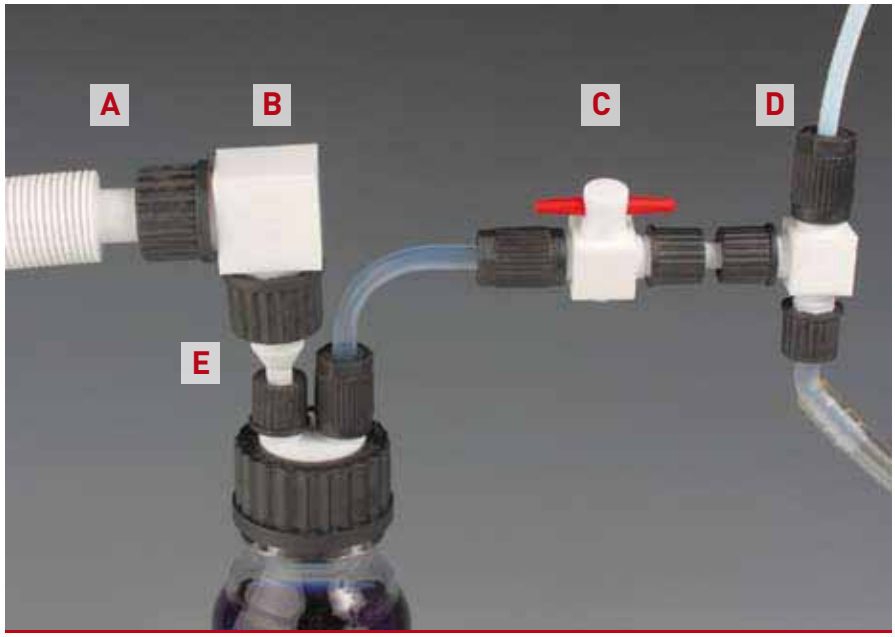
A GL Bellow
Cat. No.: H 902-05
see page 81

B GL Tube Fitting Elbow
Artikel-Nr.: D 539-25
see page 85

C GL Stopcock
Cat. No.: E 684-14
see page 87

D GL Tube Fitting T
Cat. No.: D 540-14
see page 84

E Reducing Screw Thread
Adaptor Coupling
Cat. No.: H 904-03
see page 80



e.g. Sampling Unit

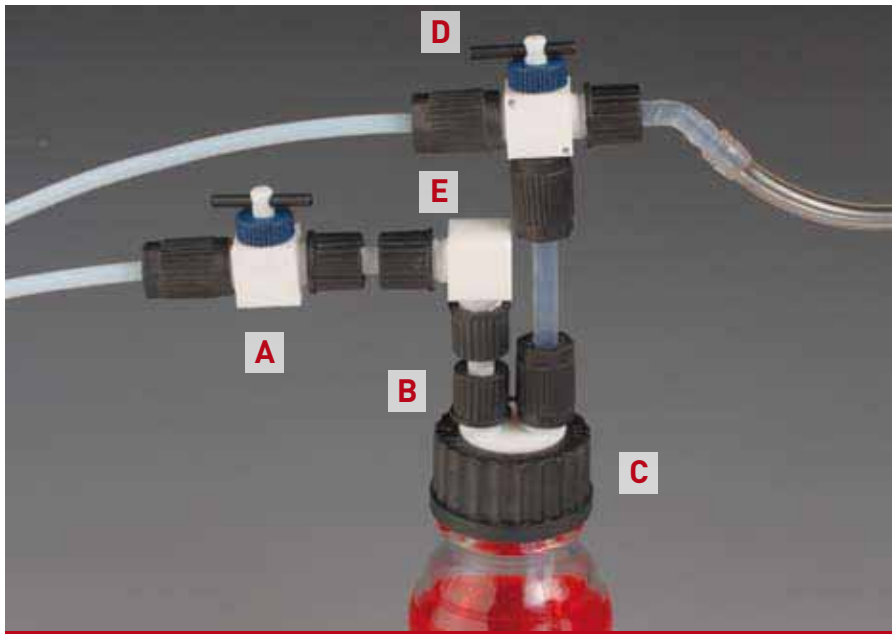
A GL Ball Valve
Cat. No.: E 664-10
see page 87

B Threaded Coupling
Cat. No.: H 900-01
see page 80

C Multiple Distributor for Bottles
Cat. No.: D 614-08
see page 60

D GL Ball Valve
Cat. No.: E 667-10
see page 87

E GL Tube Fitting Elbow
Cat. No.: D 539-14
See page 85



All advantages at a glance:

» easily screwable without any tooling

» optionally extensible

» independent from tubing diameters

» compatible with glass equipment with GL thread

» many creative possibilities

» no determination at the beginning of assembly

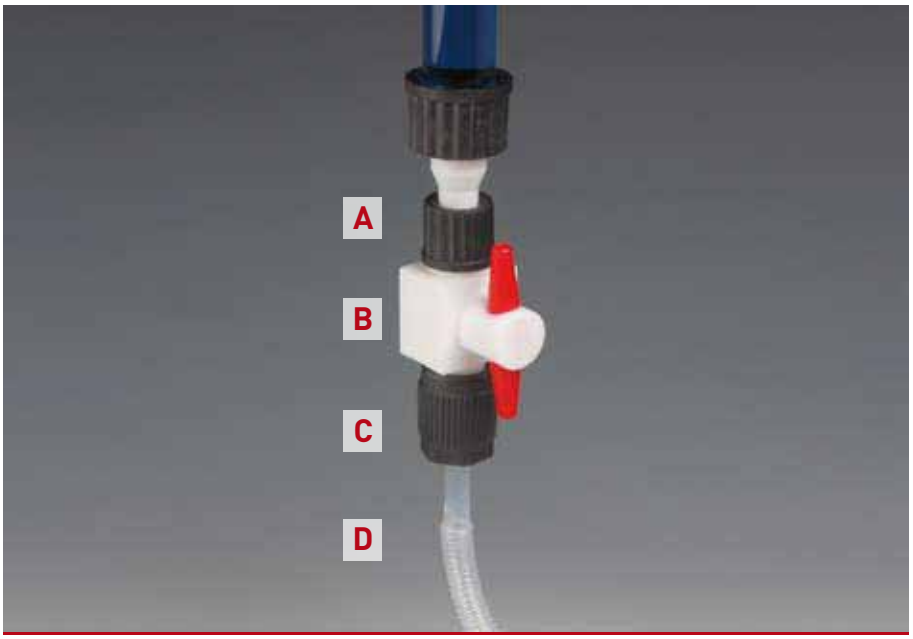
e.g. Dosing Column

A Reducing Screw Thread Adaptor Coupling
Cat. No.: H 904-03
see page 80

B GL Stopcock
Cat. No.: E 684-14
see page 87

C HT Laboratory Screw Joint
Cat. No.: D 628-82
see page 57

D Flexible Tubing
Cat. No.: S 1822-20
see page 114



e.g. Basic Distillation

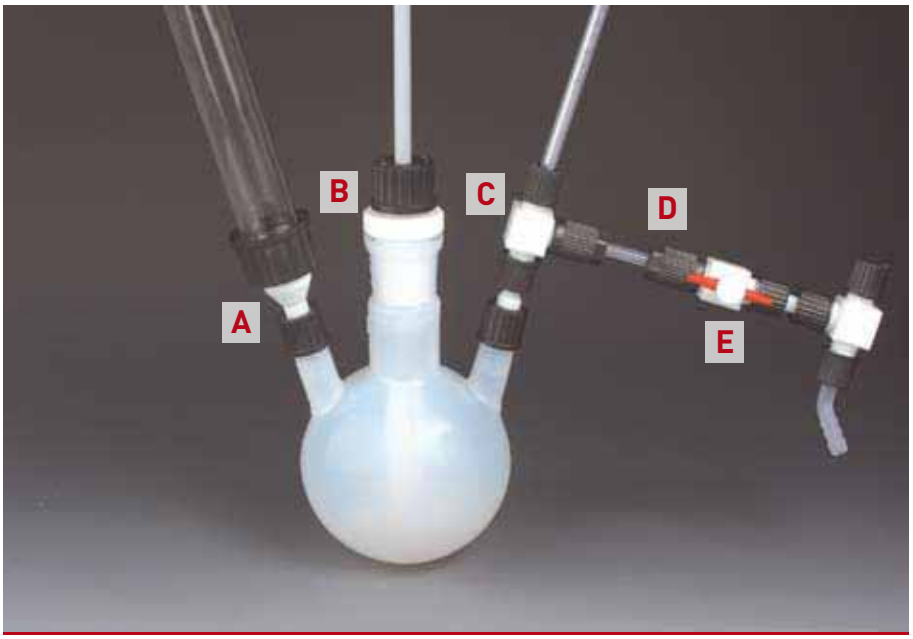
A Reducing Screw Thread Adaptor Coupling
Cat. No.:H 904-05
see page 80

B Ground Joint Stirrer Bearings
Cat. No.: C 424-13
see page 27

C GL Tube Fitting T
Cat. No.: D 540-14
see page 84

D HT Laboratory Screw Joint
Cat. No.: D 628-74
see page 57

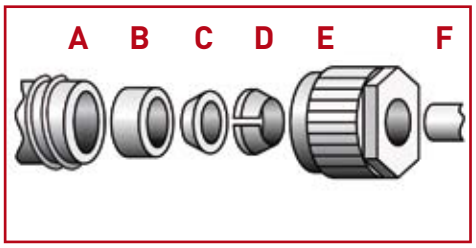
E GL Stopcock
Cat. No.: E 684-14
see page 87

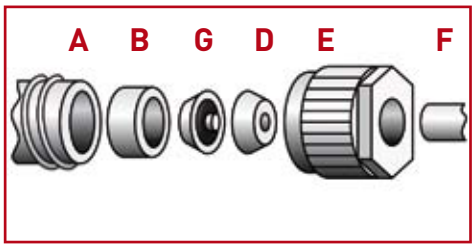


The GL Screw Joint System

Component parts:

- **A** GL-threaded neck
- **B** Sealing ring
- **C** Tapered ring
- **D** V-ring
- **E** Screw cap with internal cone
- **F** Tubing or tube
- **G** (only for screw joints for tubing dia. under 3 mm)





Assembly:

1. Push the screw cap on the tubing/tube
2. Push V-ring, tapered ring and then sealing ring on the tubing/tube
3. Tighten the screw cap on the GL-threaded neck – ready

How to make your order:

A screw joint always consists of two elements

1. Fitting (straight, elbow, T-shape or a GL thread of a glass device)
2. Laboratory screw joint as connection between fitting and tubing/tube

Example 1:

If you want to connect three tubes/ tubings with O.D. 6 mm you will need:

- **A** 1 piece of GL tube fitting T GL 14 – Cat. No. D 540-14, see page 84
- **B** 3 pieces of HT laboratory screw joints GL 14 for tubing O.D. 6 mm, Cat. No. D 628-74, see page 57

Example 2:

If you want to connect tubing with different O.D. (2 mm and 6 mm) in an angle of 90°, you will need:

- **A** 1 piece of GL tube fitting elbow GL 14 – Cat. No. D 539-14, see page 85
- **B** 1 piece of HT laboratory screw joints GL 14 for tubing O.D. 6 mm, Cat. No. D 628-74, see page 54
- **C** 1 piece of HT laboratory screw joints GL 14 for tubing O.D. 2 mm, Cat. No. D 628-34, see page 57

BOLA Laboratory Screw Joints

In practice, there are many applications where it is necessary to connect hard-walled tubing (e.g. made of PTFE, PFA, FEP) or tubes (e.g. made of glass, metal, plastic) with devices with GL thread (glass thread).
BOLA Laboratory Screw Joints are ideal for making these connections.

Components

Each laboratory screw joint consists of a screw cap with a female GL thread and bore as well as three inner parts: v-ring, tapered ring and sealing ring

Assembly and function

Assembly can easily be made by hand:
First, the inner parts are pushed on the tubing. After that, the tubing has to be put into the counterpiece and the screw cap has to be tightened. The screw cap presses the sealing ring and tapered ring tightly on the counterpiece. At the same time, the v-ring is compressed and the tubing is fixed tightly. The connection is absolutely tight and even suitable for vacuum. The laboratory screw joints for GL 14, GL 18 and GL 25 resist pressures of max. 10 bar at room temperature.

Choice

It is easy to choose the suitable laboratory screw joint:
First of all, the outer diameter of the tubing or tube and the size of the GL thread to which the laboratory screw joint shall be connected have to be determined. The size of the GL thread corresponds to the outer diameter of the thread, i.e. a GL 25 thread has an outer diameter of 25 mm. Further assistance for the determination of threads can be found in our technical appendix.
Also the application is decisive: Will there be temperatures of more than +150°C? If so, the BOLA HT Laboratory Screw Joints (page 57), which also provide a good chemical resistance, are the right choice. Or is it more important to have a very high chemical resistance? Then you have to choose BOLA Laboratory Screw Joints made of ETFE (red). These can be used up to temperatures of +150°C.

For big flexibility, all screw caps and inner parts are available separately.

You will find suitable tubing on page 110.

BOLA Laboratory Screw Joints

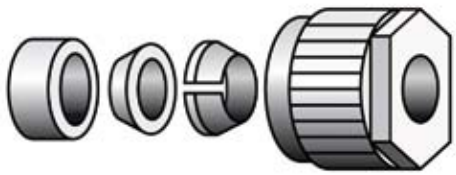
Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**ETFE**	**from -50°C to +150°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

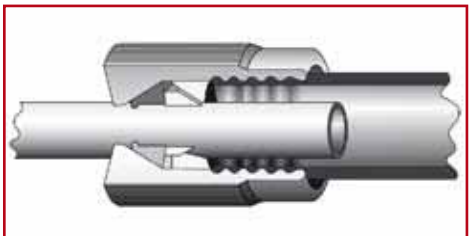
Red screw cap made of glass-fibre reinforced ETFE, inner parts consisting of a v-ring (ETFE), a tapered ring and a sealing ring (both PTFE) as well as an o-ring (for tubing diameters under 3 mm, not exposed to the medium). Very good chemical resistance, suitable for temperatures from -50°C to + 150°C.

FDA conform

For tubing O.D. mm	Thread GL 14 Cat. No.:	Thread GL 18 Cat. No.:	Thread GL 25 Cat. No.:
(1/32") 0,8	D 593-02		
1,0	D 593-04		
(1/16") 1,6	D 593-06	D 593-26	
2,0	D 593-10	D 593-30	
2,4	D 593-12		
3,0	D 590-02	D 590-10	D 590-22
(1/8") 3,2	D 590-08	D 590-20	D 590-24
4,0	D 590-04	D 590-12	D 590-26
6,0	D 590-06	D 590-14	D 590-28
(1/4") 6,35	D 590-62		
8,0		D 590-16	D 590-30
10,0		D 590-18	D 590-32
12,0			D 590-34
14,0			D 590-36



Scope of delivery



Applications:

Connecting equipment and fittings with GL threads with hard-walled tubing or tubes made of glass, plastic or metal. Fixing probes, thermometers, dip tubes or cables in reaction vessels. Ideal for use in aggressive ambiance (e.g. with aggressive vapours or evaporation)

BOLA Replacement Inner Parts

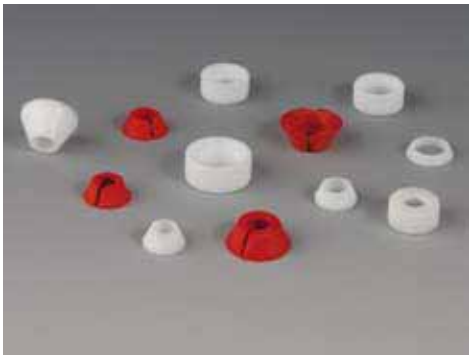
Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**ETFE**	**from -50°C to +150°C**	**+++ universal**	**10 bar**	**suitable**

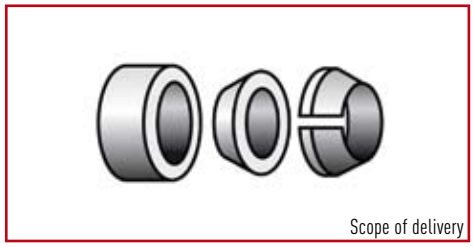
Product description:

Consisting of a v-ring (ETFE), a tapered ring and a sealing ring (both PTFE) as well as an o-ring (for tubing diameters under 3 mm, not exposed to the medium). Very good chemical resistance, suitable for temperatures from -50°C to + 150°C.

FDA conform

For tubing O.D. mm	Thread GL 14 Cat. No.:	Thread GL 18 Cat. No.:	Thread GL 25 Cat. No.:
(1/32") 0,8	**D 598-02**		
1,0	**D 598-04**		
(1/16") 1,6	**D 598-06**	**D 598-26**	
2,0	**D 598-10**	**D 598-30**	
2,4	**D 598-12**		
3,0	**D 597-02**	**D 597-10**	**D 597-22**
(1/8") 3,2	**D 597-08**	**D 597-20**	**D 597-24**
4,0	**D 597-04**	**D 597-12**	**D 597-26**
6,0	**D 597-06**	**D 597-14**	**D 597-28**
(1/4") 6,35	**D 597-62**		
8,0		**D 597-16**	**D 597-30**
10,0		**D 597-18**	**D 597-32**
12,0			**D 597-34**
14,0			**D 597-36**





Scope of delivery

BOLA Replacement Caps

Material:	Temperature resistance	Chemical resistance:
ETFE	**from -50°C to +150°C**	**+++ universal**

Product description:

Red screw cap made of glass-fibre reinforced ETFE, with handy knurl and hexagon. Very good chemical resistance, suitable for temperatures from -50°C to + 150°C.

Thread GL	Tubing/tube O.D. mm		Cat. No.:
14	up to 6,35		**D 600-04**
18	up to 10,0		**D 600-08**
25	up to 10,0		**D 600-12**
25	bigger than 10,1		**D 600-16**

BOLA Laboratory Screw Joints HT (High Temp)

Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**PPS**	**from -50°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

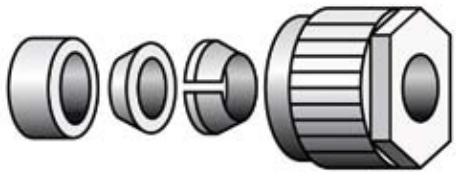
Black screw cap made of PPS, inner parts consisting of a v-ring (PPS), a tapered ring and a sealing ring (both PTFE) as well as an o-ring (for tubing diameters under 3 mm, not exposed to the medium). Good chemical resistance, suitable for temperatures from -50°C to + 250°C.

FDA conform

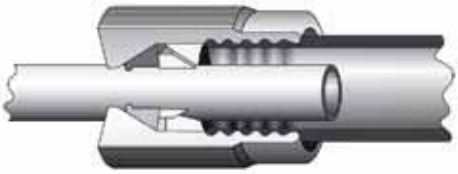
For tubing O.D. mm	Thread GL 14 Cat. No.:	Thread GL 18 Cat. No.:	Thread GL 25 Cat. No.:	Thread GL 32 Cat. No.:	Thread GL 45 Cat. No.:
(1/32") 0,8	D 628-10				
1,0	D 628-18				
(1/16") 1,6	D 628-26	D 629-18	D 630-18		
2,0	D 628-34	D 629-22	D 630-22		
3,0	D 628-50	D 629-34	D 630-34		
(1/8") 3,2	D 628-58	D 629-42	D 630-42		D 632-18
4,0	D 628-66	D 629-46	D 630-46		
5,0	D 628-70				
6,0	D 628-74	D 629-54	D 630-54	D 631-38	D 632-26
(1/4") 6,35	D 628-78	D 629-56	D 630-58	D 631-42	
8,0	D 628-82	D 629-62	D 630-62	D 631-46	D 632-32
(3/8") 9,52		D 629-68	D 630-68	D 631-52	
10,0		D 629-74	D 630-74	D 631-56	D 632-40
12,0			D 630-80	D 631-60	D 632-44
(1/2") 12,7			D 630-84	D 631-66	
14,0			D 630-90	D 631-72	D 632-48
16,0				D 631-78	D 632-54
18,0				D 631-82	D 632-56
20,0				D 631-88	D 632-60
22,0					D 632-68
(1") 25,4					D 632-74
26,0					D 632-76
30,0					D 632-84
32,0					D 632-90

Applications:

Connecting equipment and fittings with GL threads with hard-walled tubing or tubes made of glass, plastic or metal. Fixing probes, thermometers, dip tubes or cables in reaction vessels.



Scope of delivery



SUITABLE: page **110**
Tubing for all screw joints.

BOLA Replacement Inner Parts HT (High Temp)

Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**PPS**	**from -50°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

Consisting of a v-ring (PPS), a tapered ring and a sealing ring (both PTFE) as well as an o-ring (for tubing diameters under 3 mm, not exposed to the medium). Good chemical resistance, suitable for temperatures from -50°C to + 250°C.

FDA conform

Scope of delivery

For tubing O.D. mm	Thread GL 14 Cat. No.:	Thread GL 18 Cat. No.:	Thread GL 25 Cat. No.:	Thread GL 32 Cat. No.:	Thread GL 45 Cat. No.:
(1/32") 0,8	D 638-10				
1,0	D 638-18				
(1/16") 1,6	D 638-26	D 639-18	D 640-18		
2,0	D 638-34	D 639-22	D 640-22		
3,0	D 638-50	D 639-34	D 640-34		
(1/8") 3,2	D 638-58	D 639-42	D 640-42		D 642-18
4,0	D 638-66	D 639-46	D 640-46		
5,0	D 638-70				
6,0	D 638-74	D 639-54	D 640-54	D 641-38	D 642-26
(1/4") 6,35	D 638-78	D 639-56	D 640-58	D 641-42	
8,0	D 638-82	D 639-62	D 640-62	D 641-46	D 642-32
(3/8") 9,52		D 639-68	D 640-68	D 641-52	
10,0		D 639-74	D 640-74	D 641-56	D 642-40
12,0			D 640-80	D 641-60	D 642-44
(1/2") 12,7			D 640-84	D 641-66	
14,0			D 640-90	D 641-72	D 642-48
16,0				D 641-78	D 642-54
18,0				D 641-82	D 642-56
20,0				D 641-88	D 642-60
22,0					D 642-68
(1") 25,4					D 642-74
26,0					D 642-76
30,0					D 642-84
32,0					D 642-90

BOLA Fork Wrenches

Material:	Temperature resistance	Chemical resistance:
PA	**from -10°C to +140°C**	**+ good**

Product description:

Made of glass-fibre reinforced polyamide, black, low weight

For thread GL	Wrench size mm		Cat. No.:
14/ 18/ 25	17/ 22/ 27		D 647-08
32/ 45	32/ 42		D 647-24

Applications:

For tightening or opening BOLA Laboratory Screw Joints also at high working temperatures. Low weight reduces risk of injury or damage.

BOLA Replacement Caps HT (High Temp)

Material:	Temperature resistance	Chemical resistance:
PPS	**from -50°C to +250°C**	**+++ universal**

Product description:

Black screw cap made of glass-fibre reinforced PPS, with handy knurl and hexagon. Good chemical resistance, suitable for temperatures from -50°C to + 250°C.

FDA conform

Thread GL	From tubing O.D. to tubing O.D. mm		Cat. No.:
14	0,8 - 6,0		**D 634-10**
14	6,1 - 8,0		**D 634-14**
18	0,8 - 10,0		**D 634-20**
25	0,8 - 10,0		**D 634-30**
25	10,1 - 14,0		**D 634-34**
32	0,8 - 10,0		**D 634-40**
32	10,0 - 16,0		**D 634-44**
32	18,0 - 20,0		**D 634-48**
45	1,6 - 10,0		**D 634-50**
45	11,0 - 16,0		**D 634-54**
45	17,0 - 22,0		**D 634-58**
45	23,0 - 32,0		**D 634-62**

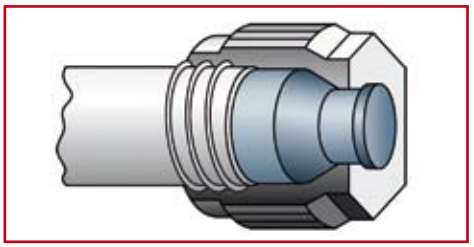
BOLA Plugs for Screw Caps

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Plugs completely made of PTFE, suitable for replacement caps made of ETFE and PPS. The plug is inserted into the cap and snaps in as soon as the cap is tightened. It can easily be removed for cleaning.

FDA conform



Thread GL	Bore dia. mm	Suitable for cap Cat. No.:	Suitable for cap Cat. No.:	Cat. No.:
14	6	D 600-04	D 634-10	**D 549-14**
18	10	D 600-08	D 634-20	**D 549-18**
25	10	D 600-12	D 634-30	**D 549-25**
32	16		D 634-44	**D 549-32**
45	22		D 634-58	**D 549-45**

Applications:

Safe plugging of unused ports of glass devices or GL connecting parts.

BOLA Multiple Distributors for Bottles

How can liquids be taken out of a bottle or reaction vessel and simultaneously be distributed to several recipients without spillage? How can I pour different liquids into my vessel without loss?
These questions were the beginning of BOLA Multiple Distributors for Bottles.
They consist of a screw cap with GL thread and a movable body with GL-threaded necks. These necks allow the connection and insertion of hard-walled tubing (e.g. PTFE, PFA, FEP) or tubes made of different materials (glass, metal, plastic) by means of BOLA Laboratory Screw Joints.

The distributors are not only the basis of a distribution system which can be operated under pressure and vacuum. It is also possible to insert probes or electrodes into the GL-threaded necks and to fix them by means of laboratory screw joints. A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the distributor. The special feature: the body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another bottle without the risk of disarranging the tubing.

BOLA Multiple Distributors for Bottles

BESTSELLER

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PFA	**PTFE**	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Black screw cap made of PPS for bottle thread GL 45, body made of PTFE or PFA. Insertion of tubing with a max. O.D. of 8,5 mm. Very good chemical resistance, for working temperatures up to +250°C

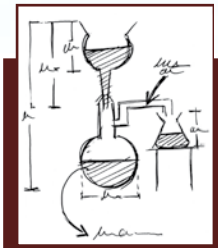
FDA conform

NEW

Material	Necks GL		Cat. No.:
PFA	2 x 14		D 614-08
PTFE	3 x 14		D 615-08

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into vessels.



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BESTSELLER

BOLA Multiple Distributors for Bottles

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PP	**from -20°C to +110°C**	**++ very good**	**suitable**	**121°**

Product description:

Green screw cap made of PP for bottle thread GL 45 and body made of PP. Insertion of tubing with a max. O.D. of 8,5 mm. Restricted chemical resistance, for working temperatures up to +110°C.

FDA conform

Necks GL			Cat. No.:
2 x 14			**D 612-08**
3 x 14			**D 613-08**

Applications:

Drawing or inserting liquids. Inserting tubing, tubes and probes into vessels.

BOLA Multiple Distributors with Stopcocks

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -20°C to +110°C**	**+++ universal**	**suitable**	**121°**

Product description:

Black screw cap made of PPS for bottle thread GL 45, body made of PTFE. Each neck with stopcock. Tubing can not be inserted through the stopcocks. Bores with press fit on the lower side allow the connection of tubing with O.D. 6 mm so that a connection to the bottom can be made. Very good chemical resistance, for working temperatures up to +250°C

NEW

FDA conform

For tubing O.D. max. mm	Stopcocks	Stopcock bore dia. mm	Necks GL	Cat. No.:
8	2	4	2 x 14	**D 616-08**
8	3	4	3 x 14	**D 616-16**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into vessels.

BOLA Multiple Distributors for Bottles

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Black/blue screw cap for thread according to chart below.
Body made of PTFE

FDA conform

	For thread	For tubing O.D. max. mm	Necks	Cat. No.:
A	GL 25	2 x 6	2 x GL 14	D 619-04
	GL 25	3 x 6	3 x GL 14	D 619-08

	For thread	For tubing O.D. max. mm	Necks	Cat. No.:
A	GL 32	2 x 8	2 x GL 14	D 621-04
	GL 32	3 x 8	3 x GL 14	D 621-08

	For thread	For tubing O.D. max. mm	Necks	Cat. No.:
A	S 40	2 x 8	2 x GL 14	D 624-04
	S 40	3 x 8	3 x GL 14	D 624-08

	For thread	For tubing O.D. max. mm	Necks	Cat. No.:
B	GL 45	3 x 10	3 x GL 18	D 618-16
	GL 45	2 x 6 / 1 x 14	2 x GL 14 / 1 x GL25	D 618-24
	GL 45	2 x 14	2 x GL 25	D 618-44
	GL 45	3 x 14	3 x GL 25	D 618-46
	GL 45	4 x 14	4 x GL 25	D 618-48

	For thread	For tubing O.D. max. mm	Necks	Cat. No.:
NEW C	GLS 80	4 x 12,7	4 x GL 18	D 754-16
NEW	GLS 80	3 x 12,7 / 1 x 14	3 x GL 18 / 1 xGL 25	D 754-24

	For thread	For tubing O.D. max. mm	Necks	Cat. No.:
NEW D	38/430	2 x 6	2 x GL 14	D 651-08

BOLA Multiple Distributors for Bottles

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Blue screw cap made of PPS for bottle thread 38/430, body made of PTFE. One GL 18 neck for inserting tubing with a max. O.D. of 10 mm, additional opening for aeration. Very good chemical resistance, for working temperatures up to max. +250°C

NEW

FDA conform

For thread	For tubing O.D. max. mm	Necks	Cat. No.:
38/430	10	1 x GL 18 **and aeration**	**D 650-08**

Applications:

Drawing or inserting of aggressive or pure liquids. Inserting tubing, tubes and probes into vessels.

BOLA Multiple Distributors for Bottles

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PP	**from -20°C to +110°C**	**++ very good**	**suitable**	**121°**

Product description:

Black/blue screw cap for thread according to chart below. Body made of PP.

NEW

FDA conform

For thread	For tubing O.D. max. mm	Necks	Cat. No.:
38/430	2 x 6	2 x GL 14	**D 652-08**
For thread GLS	**For tubing O.D.** max. mm	**Necks**	**Cat. No.:**
80	4 x 12,7	4 x GL 18	**D 750-16**
80	3 x 12,7 / 1 x 14	3 x GL 18 / 1 x GL 25	**D 750-24**

BOLA Flexible Distributors

BOLA Flexible Distributors have been developed especially for the connection of elastic tubing. They consist of a screw cap with GL thread and a movable body with hose connectors for attaching tubing. Hose connectors on the lower side also allow a connection of tubing to reach the bottom of the bottle.

The flexible distributors are the basis of a distribution system and can also be operated under pressure and vacuum. The bent hose connectors prevent bends in the tubing. A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the distributor. The special clou: the body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another bottle without the risk of disarranging the tubing.

BOLA Flexible Distributors

BESTSELLER

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PP	**from -20°C to +110°C**	**++ very good**	**suitable**	**121°**

Product description:

Green screw cap made of PP for bottle thread GL 45 and body with hose connectors made of PP. Bent hose connectors on upper side, straight hose connectors on lower side. Restricted chemical resistance, for working temperatures up to max. +110°C.

NEW

FDA conform

Number of hose connectors	For tubing I.D. mm	Bore of hose connectors mm	Cat. No.:
2	6 - 9	6	**D 800-24**
3	6 - 9	6	**D 800-36**
2	7 - 11	7	**D 800-48**

Applications:

Drawing or inserting liquids. For elastic tubing (e.g. Vitron®, Tygon®, silicone).

BOLA Distributors for Bottles

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -50°C to +200°C**	**+++ universal**

Product description:

Black screw cap made of PPS for bottle thread GL 45. Without stopcocks: body made of PTFE with 2 or 4 ports with female thread UNF ¼" 28 G on upper and lower sides. With stopcocks: body made of PTFE with 2 or 3 ports with female thread UNF ¼" 28 G on upper and lower sides and stopcock made of FEP for each port. The body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another bottle without the risk of disarranging the tubing. Very good chemical resistance, for working temperatures up to +200°C.

FDA conform

	Number of stopcocks	For tubing I.D. x O.D. mm	Bore dia. mm	Cat. No.:
A	without	0,8 x 1,6	0,8	F 745-02
	without	1,6 x 3,2	1,6	F 745-04
	without	0,8 x 1,6	0,8	F 745-10
	without	1,6 x 3,2	1,6	F 745-12
B	2	0,8 x 1,6		F 746-02
	2	1,6 x 3,2		F 746-04
	3	0,8 x 1,6		F 746-10
	3	1,6 x 3,2		F 746-12

Applications:

HPLC

A

B

BOLA Threaded Adaptors

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -200°C to +200°C**	**+++ universal**

Product description:

Allow the use of BOLA Multiple Distributors for Bottles with female thread GL 45 also on bottles with GL 32, GL 40 and S 40 threads.

FDA conform

Example 1 for Cat. No. H 978-30:

Transition from GL40/S40 to GL 45
Suitable for Merck® bottles with GL 40 thread or for all PFA-, PTFE bottles and jars with thread GL 40 and S 40

Example 2 for Cat. No. H 978-40:

Transition from GL 32 to GL 45
Suitable for bottles with GL 32 thread, e.g. from company Duran Group (formerly Schott AG)

	Bottle thread GL / S	Top thread GL		Cat. No.:
NEW A	GL 32	45		H 978-30
B	GL/S 40	45		H 978-40

A

B

BOLA Chromatography Adaptors

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -50°C to +200°C**	**+++ universal**

Product description:

Black screw cap made of PPS with GL thread. Body made of PTFE with one port with female thread UNF ¼"28G for connection of mini fittings. A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the adaptor. Very good chemical resistance, for working temperatures up to max. +200°C.

FDA conform

Thread of screw cap GL	For tubing I.D. x O.D. mm	Bore dia. mm	Cat. No.:
14	0,8 x 1,6	0,8	F 755-03
18	0,8 x 1,6	0,8	F 755-06
25	0,8 x 1,6	0,8	F 755-09
32	0,8 x 1,6	0,8	F 755-12
45	0,8 x 1,6	0,8	F 755-15
Thread of screw cap GL	**For tubing I.D. x O.D. mm**	**Bore dia. mm**	**Cat. No.:**
14	1,6 x 3,2	1,6	F 757-03
18	1,6 x 3,2	1,6	F 757-06
25	1,6 x 3,2	1,6	F 757-09
32	1,6 x 3,2	1,6	F 757-12
45	1,6 x 3,2	1,6	F 757-15

Applications:

HPLC

BOLA Screw Caps High Chem

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**PP**	**from -20°C to +140°C**	**+++ universal**	**suitable**	**121°**

Product description:

Knurled blue screw cap made of PP with GLS 80 thread. Sealing insert made of PTFE with elastic sealing lip and an o-ring for balancing unevenness on the bottle neck. Very good chemical resistance, the product is only exposed to PTFE.

NEW

FDA conform

Thread GLS			Cat. No.:
80			H 998-18

Applications:

- suitable for glass bottles with GLS 80 thread
- for the storage of highly aggressive or pure chemicals
- tight sealing even at high thermal fluctuations

BOLA Multiple Distributors with Ground Joint

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Completely made of PTFE. With ground joint size 29/32 and two GL-threaded necks. Integrated special nut for easy unlocking of the ground joint. For the connection of tubing or tube made of glass, plastic or metal by means of laboratory screw joints.

FDA conform

For ground joint NS	For tubing O.D. max. mm	Necks GL	Cat. No.:
29/32	2 x 8	2 x 14	**D 620-08**

Applications:

For bottles or reaction vessels with ground joint. For transferring liquids without contamination. For connection to a liquid source or a pressure or vacuum system.

BOLA Ground Joint-GL-Adaptors

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**PPS**	**from -50°C to +250°C**	**+++ universal**	**suitable**

Product description:

Black screw cap made of PPS with GL 45 thread or blue screw cap made of PP with GLS 80 thread, movable insert with ground joint made of PTFE. Transition from a ground joint to a glass thread. The body can be turned independently from the screw cap. The completely assembled adaptor can be removed and fixed on another bottle without the risk of disarranging the tubing. Very good chemical resistance, for working temperatures up to max. +250°C.

FDA conform

	For bottle thread GL	Ground joint NS		Cat. No.:
A	45	29/32		**D 734-40**
	45	45/40		**D 734-44**

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**PP**	**from -50°C to +250°C**	**+++ universal**	**suitable**

NEW

	For bottle thread GLS	Ground joint NS		Cat. No.:
B	80	29/32		**D 734-50**
	80	45/40		**D 734-54**

Applications:

Assembly of components with ground joint (condensers, stirrer bearings etc.) on glass bottles or GL-threaded necks.

BOLA Distributors for Reaction Vessels

Suitable for bottles with GLS 80 thread from Duran Group (formerly Schott AG).

Consisting of a screw cap with GLS 80 thread and a movable body with several lateral necks and one central neck.

The GL-threaded necks allow the connection of hard-walled tubing (PTFE, PFA, FEP) or tubes (glass, metal, plastic) by means of BOLA Laboratory Screw Joints. It is also possible to insert and fix probes or electrodes. In addition, the connection of elastic tubing can be made by means of BOLA Hose Connectors.

The type "Center Neck with Ground Joint" allows the use of a stirrer bearing which assures a centrical position of a stirrer shaft in the vessel. Other components with ground joint (e.g. condensers, funnels etc.) can also be connected easily.

The type "Center Neck with GL Thread" is supplied with an exchangeable stirrer bearing for the center neck.

A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the distributor. The special clou: the body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another bottle without the risk of disarranging the tubing.

BOLA Distributors for Reaction Vessels (S)

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**PP**	**from -20°C to +140°C**	**+++ universal**	**suitable**	**121°**

Product description:

Blue screw cap made of PP with GLS 80 thread, body made of PTFE with center ground joint and lateral GL-threaded or ground joint necks. Very good chemical resistance, for working temperatures up to max. +250°C (PP screw cap max. +140°C)

NEW

FDA conform

Lateral necks GL	Lateral necks NS	Center neck NS	For tubing O.D. max. mm	Cat. No.:
4 x 18		1 x 29/32	4 x 10	**D 748-16**
2 x 18	2 x 29/32	1 x 29/32	2 x 14	**D 748-40**
	2 x 29/32 2 x 14/23	1 x 29/32		**D 748-60**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into vessels. Use of a stirrer bearing in center neck for centrical position of a stirrer shaft.

BOLA Distributors for Reaction Vessels (R)

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**PP**	**from -20°C to +140°C**	**+++ universal**	**suitable**	**121°**

Product description:

Blue screw cap made of PP with GLS 80 thread, body made of PTFE. Center neck with GL 25 thread for connecting tubing or tube up to a max. O.D. of 15 mm, four lateral necks with GL 18 thread. Exchangeable shaft guide (PTFE) with screw cap (PPS) for inserting and fixing a stirrer shaft in the center neck included. Very good chemical resistance, for working temperatures up to max. +250°C (PP screw cap max. +140°C)

NEW

FDA conform

Lateral necks GL	Center neck GL	For tubing O.D. max. mm	Dia. of stirrer shaft mm	Cat. No.:
4 x 18	1 x 25	4 x 10	8	**D 744-16**
4 x 18	1 x 25	4 x 10	10	**D 744-24**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into vessels. Use of a stirrer bearing in center neck for centrical position of a stirrer shaft.

BOLA Distributors for Reaction Vessels (S)

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PP	**from -20°C to +110°C**	**++ very good**	**suitable**	**121°**

Product description:

Blue screw cap made of PP with GLS 80 thread, body made of PP with center ground joint and lateral GL-threaded necks. Restricted chemical resistance, for working temperatures up to max. +110°C

NEW

FDA conform

Lateral necks GL	Center neck NS	For tubing O.D. max. mm	Cat. No.:
4 x 18	29/32	4 x 10	**D 746-16**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into vessels. Use of a stirrer bearing in center neck for centrical position of a stirrer shaft.

SUITABLE: page **110**
Tubing for all screw joints

BOLA Distributors for Canisters

These distributors are ideal for drawing liquids from canisters and for distributing these liquids to several vessels.

They consist of a screw cap for canister threads S 55 or S 60 and a movable body with three GL-threaded necks. The threaded necks allow the connection of tubing or tubes made of glass, metal, or plastic by means of BOLA Laboratory Screw Joints. The distributor can also be integrated into a pressure or vacuum system.

A possible unevenness of the canister thread is adjusted by an o-ring behind an elastic sealing lip, and the canister is closed tightly. The product is only exposed to the body of the distributor.

The special clou: the body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another canister without the risk of disarranging the tubing.

BOLA Distributors for Canisters

Material:	Temperature resistance	Chemical resistance:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**121°**

Product description:

Screw cap made of glass-fibre reinforced PTFE for canister thread S 55 or S 60, movable body with GL-threaded necks made of PTFE. Very good chemical resistance, for working temperatures up to max. +250°C. The product is only exposed to PTFE.

NEW

FDA conform

Canister thread S	Necks GL		Cat. No.:
55	2 x 14 / 1 x 18		**D 760-16**
60	3 x 18		**D 760-24**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into canisters.

BOLA Distributors for Canisters

Material:	Temperature resistance	Chemical resistance:	autoclave:
PP	**from -20°C to +110°C**	**++ very good**	**121°**

Product description:

Screw cap made of PP for canister thread S 55 or S 60, movable body with GL-threaded necks made of PP. Restricted chemical resistance, for working temperatures up to max. +110°C.

NEW

FDA conform

Canister thread S	Necks GL		Cat. No.:
55	2 x 14 / 1 x 18		**D 764-16**
60	3 x 18		**D 764-24**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into canisters.

BOLA Swivelling Screw Fittings

BOLA Swivelling Screw Fittings for GL threads or ground joints are ideal for fixing all kinds of probes, tubes or hard-walled tubing safely in a specific angle. It is possible to position supply tubes or probes independently from the angle of the neck.

Damages of supply tubes or probes due to collision with the stirrer shaft can be avoided.

BOLA Swivelling Screw Fittings with Ground Joint

BESTSELLER

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**PPS**	**from -50°C to +250°C**	**+++ universal**	**suitable**

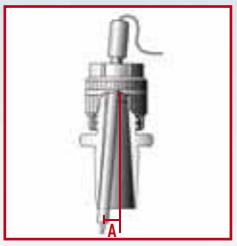
Product description:

Ground joint body made of PTFE, screw cap made of PPS. Probes, tubes or tubing are firstly inserted through the fitting, then the fitting is put into the ground joint and the inserted element can be fixed in the requested position.

NEW

FDA conform

Ground joint size NS	For probe/tube O.D. mm	Max. angle A mm	Thread of screw cap GL	Cat. No.:
19/26	6	4°	18	D 692-24
29/26	6	8°	25	D 692-34
29/32	8	7°	25	D 692-44
29/32	10	6°	25	D 692-54
29/32	12	5°	25	D 692-64



Applications:

Insertion of probes, tubes or tubing into vessels with ground joints for avoiding collision with the stirrer shaft.

BOLA Swivelling Screw Fittings

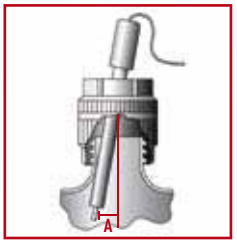
Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**PPS**	**from -50°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Screw cap made of PPS with inner parts made of PTFE. Probes, tubes or tubing are firstly inserted through the fitting, then the fitting is screwed on the GL neck and the inserted element can be fixed in the requested position.

FDA conform

For probe/tube O.D. mm	For thread GL	Max. angle A mm	Cat. No.:
2,0	18	10°	D 690-14
(1/8") 3,2	18	9°	D 690-18
6,0	18	5°	D 690-24
6,0	25	12°	D 690-34
8,0	25	10°	D 690-38
(3/8") 9,52	25	9°	D 690-42
10,0	25	8°	D 690-46
12,0	25	6°	D 690-50
19,0	32	3°	D 690-68



Applications:

Insertion of probes, tubes or tubing into vessels with GL necks for avoiding collision with the stirrer shaft.

BOLA Multiple Distributors for Barrels

These distributors are ideal for drawing liquids from barrels and for distributing these liquids to several vessels. They consist of a screw cap for barrels with female thread and a movable body with GL-threaded necks. The threaded necks allow the connection of tubing or tubes made of glass, metal, or plastic by means of BOLA Laboratory Screw Joints. Liquids can be drawn from the barrel without contamination of the ambient air by leaking vapours. In addition, the distributor can be integrated in a pressure or vacuum system.

The special clou: the body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another barrel without the risk of disarranging the tubing.

For easy determination of the suitable distributor, you can find the dimensions of the barrel threads on page 237.

BOLA Multiple Distributors for Barrels

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**1 bar**	**suitable**	**121°**

Product description:

Screw cap made of glass-fibre reinforced PTFE for barrels with female thread, body with GL-threaded necks made of PTFE. Very good chemical resistance, for working temperatures up to max. + 250°C. The product is only exposed to PTFE.

NEW

FDA conform

For female barrel thread	Necks GL	For tubing O.D. max. mm	Cat. No.:
R2"	4 x 18	10	**D 696-08**
R2"	2 x 18 / 1 x 25	2 x 10 / 1 x 14	**D 696-14**
Mauser 2"	4 x 18	10	**D 697-08**
Mauser 2"	2 x 18 / 1 x 25	2 x 10 / 1 x 14	**D 697-14**
Tri-Sure 2"	4 x 18	10	**D 698-08**
Tri-Sure 2"	2 x 18 / 1 x 25	2 x 10 / 1 x 14	**D 698-14**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into barrels.

BOLA Ring Wrench

Material:	Temperature resistance	Chemical resistance:
PP	**from -20°C to +110°C**	**+++ universal**

Product description:

Ring wrench made of PP.

I.D. mm	Total length mm		Cat. No.:
78	200		**D 701-24**

Applications:

For opening and closing BOLA Multiple Distributors for Barrels.

BOLA Barrel Aeration

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Consisting of a body made of PTFE for female thread R ¾" with a GL 32 thread, a PTFE/silicone gasket, an exchangeable filtering membrane (2µm) made of PTFE and a screw cap made of PPS. Very good chemical resistance, the product is only exposed to PTFE.

Pressure compensation at 0,1 bar differential pressure.
Max. flow rate:
» at 0,5 bar differential pressure: 80 l/h
» at 1,0 bar differential pressure: 320 l/h

FDA conform

For female barrel thread	O.D. of membrane mm	Thickness of membrane mm	Thread of screw cap GL	Cat. No.:
R3/4"	29	0,2	32	**N 1696-32**

Applications:

For pressure compensation during filling or drawing of liquids. Integrated membrane prevents contamination of the product. Membranes are available separately (see Cat. No. N 1699-32 on page 74).

BOLA Sets for Pressure Compensation

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Consisting of screw cap made of PPS for GL thread, PTFE/silicone gasket and exchangeable filtering membrane made of PTFE. High chemical resistance, the product is only exposed to PTFE. Pressure compensation already at 0,1 bar differential pressure.

FDA conform

For thread GL	Dia. of membrane mm	Flow rate at 0,5 bar /l/h	Flow rate at 1 bar /l/h	Cat. No.:
14	12	16	25	**N 1698-14**
18	16	25	85	**N 1698-18**
25	23	50	180	**N 1698-25**
32	29	80	320	**N 1698-32**
45	42	210	800	**N 1698-45**

Applications:

For pressure compensation during filling or drawing of liquids. Prevention of unintentional overpressure or vacuum in the vessel. Integrated membrane prevents contamination of the product. Membranes are available separately (see Cat. No. N 1699-32 on page 74).

BOLA Membranes for Pressure Compensation

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

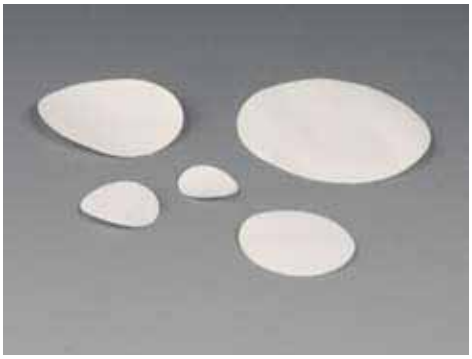
Filtering membrane (2µm) made of PTFE

FDA conform

For thread GL	Dia. of membrane mm	Flow rate at 0,5 bar /l/h	Flow rate at 1 bar /l/h	Cat. No.:
14	12	16	25	**N 1699-14**
18	16	25	85	**N 1699-18**
25	23	50	180	**N 1699-25**
32	29	80	320	**N 1699-32**
45	42	210	800	**N 1699-45**

Applications:

Replacement membrane for BOLA Set for Pressure Compensation (see Cat. No. N 1698-.. on page 74)



BOLA Barrel-GL-Adaptors

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Adaptors made of PTFE/PP, for transition from female barrel thread R2 Inch or Tri-Sure 2 Inch to a GL 45 thread.

NEW

FDA conform

» Made of PTFE, very good chemical resistance, working temperatures up to max. +250°C

A

Material	For barrel thread	Thread of head GL	Bore dia. max. mm	Dia. of grip ca. mm	Cat. No.:
PTFE	**R2"**	45	32	78	**D 736-12**
PTFE	**Tri-Sure 2"**	45	32	67	**D 736-24**

Material:	Temperature resistance	Chemical resistance:	Vacuum:	autoclave:
PP	**from -20°C to +250°C**	**++ very good**	**suitable**	**121°**

NEW

FDA conform

» Made of PP, restricted chemical resistance, working temperatures up to max. +110°C

B

Material	For barrel thread	Thread of head GL	Bore dia. max. mm	Dia. of grip ca. mm	Cat. No.:
PP	**R2"**	45	32	78	**D 737-12**
PP	**Tri-Sure 2"**	45	32	67	**D 737-24**

Applications:

For the connection of for example BOLA Multiple Distributors for Bottles with a GL 45 thread for inserting tubing, tubes or probes.

A

B

BOLA Screw Caps

BOLA Screw Caps are available as closed caps for closing bottles and vessels with GL thread or as caps with aperture which can for example hold tubes or – in connection with a gasket - be used as septum for sampling. All caps have a handy knurl for easy opening and closing.

They are available for bottle threads GL 14 to GL 45 and are either made of glass-fibre reinforced PTFE, PPS or PBTP. The closed caps are either supplied with an integrated PTFE/silicone gasket or with an integrated PTFE membrane.

The caps which are made of glass-fibre reinforced PTFE have a high chemical resistance and can be used with aggressive products.

PPS offers a high mechanical strength; even caps with small diameters can be closed safely. At the same time, these caps can be used at high temperatures due to a good chemical and thermal resistance.

PBTP caps are an ideal and cheap choice for all applications which do not need high chemical and thermal resistance.

BOLA Screw Caps with Aperture

Product description:

Screw cap with handy knurl, suitable for GL threads, with aperture, made of glass-fibre reinforced PTFE, PPS or PBTP

Material: **PTFE/Glass-fibre** Temperature resistance: **from -50°C to +250°C** Chemical resistance: **+++ universal**

FDA conform

For thread GL	Dia. of aperture mm		Cat. No.:
14	9,2		H 983-01
18	11,0		H 983-02
25	15,0		H 983-03
32	20,0		H 983-04
45	34,0		H 983-05

Material: **PPS** Temperature resistance: **from -50°C to +250°C** Chemical resistance: **+++ universal**

For thread GL	Dia. of aperture mm		Cat. No.:
14	9,2		H 995-14
18	11,0		H 995-18
25	15,0		H 995-25
32	20,0		H 995-32
45	34,0		H 995-45

Material: **PBTP** Temperature resistance: **from -45°C to +180°C** Chemical resistance: **+ good**

For thread GL	Dia. of aperture mm		Cat. No.:
14	9,2		H 984-01
18	11,0		H 984-02
25	15,0		H 984-03
32	20,0		H 984-04
45	34,0		H 984-05

Applications:

As joining piece between tubes with flange and tubes with GL thread, suitable gasket rings are available separately (Cat. No. H 975 / H 977 / on page 78). As septum by inserting a separately available gasket (Cat. No. H 973 on page 79)

BOLA Screw Caps

Product description:

Screw cap with handy knurl, with integrated PTFE/silicone gasket, suitable for GL threads, made of glass-fibre reinforced PTFE, PPS or PBTP. After assembly, the product is only exposed to PTFE.

Material: **PTFE** | Temperature resistance: **from -50°C to +250°C** | Chemical resistance: **+++ universal**

FDA conform

For thread GL			Cat. No.:
14			H 986-01
18			H 986-02
25			H 986-03
32			H 986-04
45			H 986-05

Material: **PPS** | Temperature resistance: **from -50°C to +250°C** | Chemical resistance: **+++ universal** | BESTSELLER

FDA conform

For thread GL			Cat. No.:
14			H 993-14
18			H 993-18
25			H 993-25
32			H 993-32
45			H 993-45

Material: **PBTP** | Temperature resistance: **from -45°C to +180°C** | Chemical resistance: **+ good**

FDA conform

For thread GL			Cat. No.:
14			H 987-01
18			H 987-02
25			H 987-03
32			H 987-04
45			H 987-05

Applications:

For closing bottles and vessels with GL threads.

BOLA Screw Caps HT (High Temp)

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PPS	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Screw cap with handy knurl made of PPS with elastic and highly chemical resistant integrated PTFE-membrane gasket. After assembly, the product is only exposed to PTFE. The cap provides a high mechanical and thermal resistance (up to max. +250°C).

FDA conform

For thread GL			Cat. No.:
14			**H 994-14**
18			**H 994-18**
25			**H 994-25**
32			**H 994-32**
45			**H 994-45**

Applications:

For all applications which need high chemical resistance and sealing. Usable under vacuum, e.g. cold traps. The gasket is physiologically safe according to VDI/VDE guideline 2480 and fulfils FDA 21 CFR 177-1550 requirements.

BOLA One-Sided Gaskets

BESTSELLER

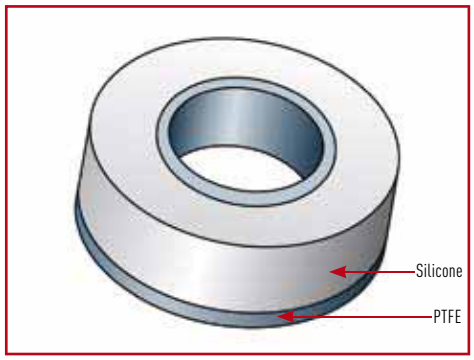
Material:	Temperature resistance	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Silicone ring with PTFE washer. After assembly, the product is only exposed to PTFE. Packing unit: 10 pieces, differing ordering quantities are rounded up to factor 10

FDA conform

For thread GL	O.D. x I.D. x Height mm	For tube dia. mm	Cat. No.:
14	12 x 6,0 x 3,5	5,5 x 6,5	**H 975-02**
18	16 x 6,0 x 4,5	5,5 x 6,5	**H 975-04**
18	16 x 8,0 x 4,5	7,5 x 9,0	**H 975-06**
18	16 x 10,0 x 4,5	9,0 x 11,0	**H 975-10**
25	22 x 8,0 x 6,5	7,5 x 9,0	**H 975-12**
25	22 x 10,0 x 6,5	9,0 x 11,0	**H 975-14**
25	22 x 12,0 x 6,5	11,0 x 13,0	**H 975-18**
32	29 x 10,0 x 9,0	9,0 x 11,0	**H 975-20**
32	29 x 12,0 x 9,0	11,0 x 13,0	**H 975-22**
32	29 x 14,0 x 9,0	13,0 x 15,0	**H 975-26**
32	29 x 16,0 x 9,0	15,0 x 17,0	**H 975-28**
32	29 x 18,0 x 9,0	17,0 x 19,0	**H 975-30**
45	42 x 26,0 x 9,0	25,0 x 27,0	**H 975-34**
45	42 x 32,0 x 9,0	31,0 x 33,0	**H 975-36**



Applications:

As gasket for BOLA Screw Caps with Aperture (Cat. No. H 983/ H 984/ H 995 on page 76). Also suitable for GL caps of company Duran Group (formerly Schott AG).

BOLA Double-Sided Gaskets

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

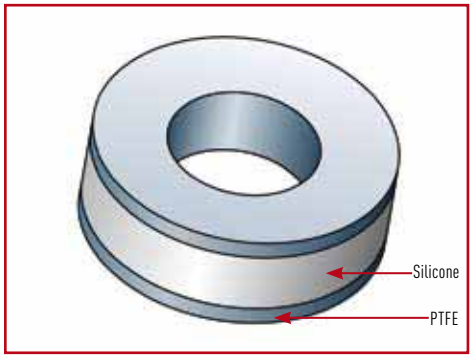
Silicone ring with double-sided PTFE washer. After assembly, the product is only exposed to PTFE.

FDA conform

For thread GL	O.D. x I.D. x Height mm	For tube dia. mm	Cat. No.:
14	12 x 6,0 x 3,6	5,5 x 6,5	**H 977-08**
18	16 x 6,0 x 4,6	5,5 x 6,5	**H 977-16**
18	16 x 8,0 x 4,6	7,5 x 9,0	**H 977-18**
18	16 x 10,0 x 4,6	9,0 x 11,0	**H 977-20**
25	22 x 8,0 x 6,6	7,5 x 9,0	**H 977-28**
25	22 x 10,0 x 6,6	9,0 x 11,0	**H 977-32**
25	22 x 12,0 x 6,6	11,0 x 13,0	**H 977-36**

Applications:

As gasket for BOLA Screw Caps with Aperture (Cat. No. H 983/ H 984/ H 995 on page 76). Also suitable for GL caps of company Duran Group (formerly Schott AG).



BOLA Gaskets for Screw Caps

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

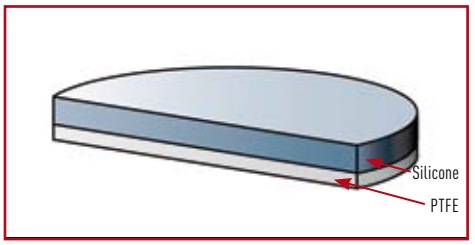
Upper side made of PTFE, lower side made of silicone-elastomer for balancing unevennesses on sealing surfaces. After assembly, the product is only exposed to PTFE

FDA conform

For thread GL	Dia. of gasket mm	Thickness of gasket mm	Cat. No.:
14	13,0	3,3	**H 973-14**
18	16,8	3,3	**H 973-18**
25	23,5	3,3	**H 973-25**
32	30,2	3,3	**H 973-32**
45	43,2	3,3	**H 973-45**

Applications:

As gasket for BOLA Screw Caps with Aperture (Cat. No. H 986/ H 987/ H 993 on page 77). As septum in combination with BOLA-Screw-Caps with Aperture (Cat. No. H 983 / H 984/ H 995 on page 76).



BOLA SVL Gaskets

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

NEW

FDA conform

Product description:

Silicone ring with double-sided washer made of PTFE. Suitable for Torion-/SVL threads. Universal chemical resistance, the product is only exposed to PTFE.

For SVL thread I.D. mm	O.D. of gasket mm	For tube dia. mm	Height mm	Cat. No.:
15	15	5,6 x 6,4	5	H 979-14
15	15	7,6 x 8,4	5	H 979-24
22	22	13,6 x 14,4	5	H 979-32

Applications:

As gasket for tubing, tubes or probes inserted through Torion threads.

BOLA Threaded Couplings

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

FDA conform

Product description:

Two screw caps made of PPS (up to +250°C) or PBTP (+180°C) with GL thread and a PTFE/FPM gasket. Connection piece made of PTFE. The product is only exposed to PTFE. For connecting two GL threads of the same size.

For thread GL	Length from sealing lip to sealing lip mm		A Cat. No.: PPS cap	B Cat. No.: PBTB cap
14	15		H 900-01	H 901-01
18	17		H 900-02	H 901-02
25	22		H 900-03	H 901-03
32	22		H 900-04	H 901-04
45	23		H 900-05	H 901-05

BOLA Reducing Screw Thread Adaptor Couplings

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

FDA conform

Product description:

Two screw caps made of PPS with GL thread and a PTFE/FPM gasket. Connection piece made of PTFE. The product is only exposed to PTFE. For connecting two GL threads of different sizes.

From thread GL	To thread GL	Length from sealing lip to sealing lip mm	Cat. No.:
18	14	20,0	H 904-02
25	14	27,5	H 904-03
25	18	28,3	H 904-04
32	18	32,5	H 904-05
32	25	28,0	H 904-06
45	25	38,0	H 904-07
45	32	33,0	H 904-08

BOLA GL Bellows

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Two screw caps made of PPS with GL thread and a PTFE/FPM gasket.
Bellow with sharp folds made of PTFE. Bellow can be bent up to an angle of 120°, flexible and strainless connection.

FDA conform

For thread GL	Min. length of bellow mm	Max. length of bellow mm	Cat. No.:
25	58	104	**H 902-05**
32	58	90	**H 902-10**
45	67	115	**H 902-15**

BOLA GL Reductions

Material:	Material:	Temperature resistance	Chemical resistance:
PTFE	**PPS**	**from -200°C to +250°C**	**+++ universal**

Product description:

Black screw cap made of PPS with GL 45 thread, movable reduction body made of PTFE for transition to GL 25. The body can be moved independently from the screw cap so that the completely assembled reduction can be removed and fixed on another vessel without the risk of disarranging the tubing or cable. The product is only exposed to PTFE.

FDA conform

For thread GL	Reducing thread GL	Max. tubing O.D. mm	Cat. No.:
45	25	0,8 - 10	**D 784-24**

Applications:

For connecting or inserting tubing, tubes or probes.

BOLA GL Dispenser

Material:	Temperature resistance	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Black screw cap made of PPS with GL 45 thread, movable dispenser with stopcock made of PTFE, integrated ventilation.
With PTFE cap for sealing the discharge tube.

FDA conform

Thread GL	Stopcock bore dia. mm	Dia. of discharge tube mm	Cat. No.:
45	4	4	**H 918-10**

Applications:

For controlled and safe pouring of liquids. A bottle with mounted dispenser can be headfirst fixed in a holder.

BOLA GL Funnels

Funnels with a capacity of approx. 100 ml made of borosilicate glass. Inlet tube made of PTFE, connection with GL screw caps made of PPS or with ground joint. The outlet tube has a length of approx. 64 mm on the lower side. The glass funnel can be fixed in each position.

Material:	Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**PPS**	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Insertion for reaction vessels with GL-threaded necks

NEW

FDA conform

A

Thread of funnel GL	Connecting thread on lower side GL	Inlet tube (I.D. x O.D.) mm	Cat. No.:
25	25	15 x 12	**D 738-12**
32	32	20 x 17	**D 738-22**
25	32	20 x 17	**D 738-42**
32	25	15 x 12	**D 738-52**

Product description:

Insertion for reaction vessels with ground joint sockets.

NEW

FDA conform

B

Thread of funnel GL	Ground joint NS	Inlet tube (I.D. x O.D.) mm	Cat. No.:
32	29/32	20 x 17	**D 739-22**

Applications:

Positionable insertion for reaction vessels. Adhering or agglutinating of powders is prevented. Liquids can be inserted directly without cooling or adhering at the wall of the vessel. Instead of the glass funnel, a condenser can be mounted at the upper screw cap and provide a direct return into the vessel.

BOLA Leading-in for Sensors

Material:	Material:	Temperature resistance	Chemical resistance:
PTFE	**PPS**	**from -200°C to +250°C**	**+++ universal**

Product description:

Black screw cap made of PPS with GL 45 thread, movable body made of PTFE with adjusting screw for fixing and sealing sensors. The product is only exposed to PTFE.

FDA conform

For thread GL	For sensor dia. mm		Cat. No.:
45	12 (+/-0,5)		**D 780-14**

Applications:

For contamination-free insertion of sensors into bottles with GL 45 thread.

BOLA Socket-GL Tube Fittings

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

FDA konform

Product description:

Fitting made of PTFE, with socket for tubes with ground joint and GL thread for connection of hard-walled tubing (e.g. PTFE, PFA, FEP) with BOLA Laboratory Screw Joints (see page 55). The product is only exposed to PTFE.

Socket size NS	Bore dia. mm	Thread GL	Cat. No.:
14/23	6,5	14	**D 571-08**
19/26	10,5	18	**D 571-16**
29/32	12,5	25	**D 571-32**
45/40	20,5	32	**D 571-40**

BOLA Ground Joint-GL Tube Fittings

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

Fitting made of PTFE, for transition from ground joints to GL threads. For connection of hard-walled tubing (e.g. PTFE, PFA, FEP) with BOLA Laboratory Screw Joints (see page 55). Ground joint body with turned rings and knurled grip for opening. The product is only exposed to PTFE.

Cone size NS	Bore dia. mm	Thread GL	Cat. No.:
14/23	6,5	14	**D 570-08**
19/26	10,5	18	**D 570-16**
29/32	12,5	25	**D 570-32**

Applications:

For connecting tubes or tubing to vessels with ground joint. For inserting and fixing probes, thermometers, dip tubes or cables.


for tubing


for probe

BOLA Spherical Ground Joint-GL Tube Fittings

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

NEW

FDA conform

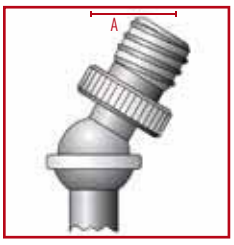
Product description:

Fitting made of PTFE, for transition from spherical ground joints to GL threads. For connection of hard-walled tubing (e.g. PTFE, PFA, FEP) with BOLA Laboratory Screw Joints (see page 55). The product is only exposed to PTFE.

Spherical ground joint size S	Thread GL	Bore dia. mm	Angle A max.	Cat. No.:
19	18	10,5	25°	**D 790-24**
29	25	14,5	20°	**D 790-36**
35	25	14,5	10°	**D 790-48**

Applications:

For connecting tubes or tubing to vessels with ground joint. For inserting and fixing probes, thermometers, dip tubes or cables.



BOLA GL Tube Fittings

A distribution system consists of tubes or tubing and connection pieces, so-called tube fittings. The BOLA-GL-Fitting-System is a modular system which consists of tube fittings, screw-in fittings, different stopcocks and valves.

All fittings have GL threads so that they can be connected to hard-walled tubing (PTFE, PFA, FEP) or tubes (e.g. glass, metal, plastic) by means of BOLA Laboratory Screw Joints.

Together with these BOLA Laboratory Screw Joints, the connection is absolutely tight and even suitable for vacuum; the screw joints for GL 14, GL 18 and GL 25 even resist pressures up to max. 10 bar at room temperature.

The system is completed by accessories like quick connectors, dirt traps and GL hose connectors.

BOLA GL Tube Fittings

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

FDA conform

Product description:

Straight tube fitting made of PTFE, two connections with GL thread. Universal chemical resistance, the product is only exposed to PTFE.

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size hexagon mm	Cat. No.:
14	6,5	50	15	**D 538-14**
18	10,5	50	19	**D 538-18**
25	14,5	56	27	**D 538-25**
32	21,0	75	32	**D 538-32**
45	32,5	75	46	**D 538-45**

Application:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA GL Tube Fittings T

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

FDA conform

Product description:

Tube fitting T-shaped made of PTFE, three connections with GL thread. Universal chemical resistance, the product is only exposed to PTFE.

Thread GL	Bore dia. mm	Length without screw joint mm	Height mm	Wrench size square mm	Cat. No.:
14	6,5	54	37	20	**D 540-14**
18	10,5	56	39	20	**D 540-18**
25	14,5	70	51	27	**D 540-25**
32	21,0	83	58	33	**D 540-32**
45	32,5	98	73	48	**D 540-45**

Application:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA GL Tube Fittings Elbow

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

Tube fitting elbow-shaped made of PTFE, two connections with GL thread. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size square mm	Cat. No.:
14	6,5	37	20	**D 539-14**
18	10,5	39	20	**D 539-18**
25	14,5	51	27	**D 539-25**
32	21,0	58	33	**D 539-32**
45	32,5	73	48	**D 539-45**

Application:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA GL Tube Fittings Cross

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

Tube fitting cross-shaped made of PTFE, four connections with GL thread. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size square mm	Cat. No.:
14	6,5	54	20	**D 541-14**
18	10,5	56	20	**D 541-18**
25	14,5	70	27	**D 541-25**
32	21,0	83	33	**D 541-32**
45	32,5	98	48	**D 541-45**

Application:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

SUITABLE: page **57**
Laboratory screw joints

BOLA GL-Screw-in Tube Fittings

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

Straight tube fitting made of PTFE, with one screw-in thread (either NPT or G thread). Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Screw-in thread NPT	Thread GL	Bore dia. mm	Wrench size hexagon mm	Cat. No.:
1/8"	14	4,0	15	D 516-08
1/4"	14	5,0	15	D 516-14
3/8"	14	6,5	19	D 516-20
1/8"	18	4,0	19	D 516-26
1/4"	18	6,5	19	D 516-32
3/8"	18	8,0	19	D 516-38
3/8"	25	8,0	27	D 516-44
1/2"	25	12,0	27	D 516-50

Screw-in thread G	Thread GL	Bore dia. mm	Wrench size hexagon mm	Cat. No.:
1/8"	14	4,0	15	D 517-08
1/4"	14	5,0	15	D 517-14
3/8"	14	6,5	19	D 517-20
1/8"	18	4,0	19	D 517-26
1/4"	18	6,5	19	D 517-32
3/8"	18	8,0	19	D 517-38
1/2"	25	12,0	27	D 517-50
1"	32	18,0	34	D 517-74

BOLA GL Quick Connectors

BESTSELLER

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PFA	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

Two-part quick connector completely made of PFA, with two GL threads for connecting tubing or tubes with BOLA Laboratory Screw Joints. Quick and easy disconnection of flow. When disconnected, the flow is interrupted by means of built-in non-return valves and only continues after a safe locking. Suitable for pressure up to max. 6 bar, for vacuum of 700 mm Hg and working temperatures up to max. +200°C. Universal chemical resistance, the product is only exposed to PFA.

FDA conform

Connecting thread GL	Length without screw joint	Flow at 4 bar (water) l/min.	Cat. No.:
14	75	3,2	D 625-20
18	75	4,0	D 625-40
25	79	10,5	D 625-60

Applications:

Ideal for conducting highly pure or aggressive products.

BOLA GL Ball Valves

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -20°C to +220°C**	**+++ universal**	**12 bar**	**suitable**

Product description:

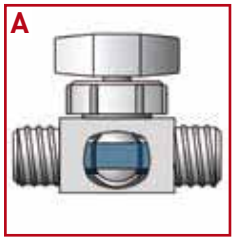
Two-way valve with straight bore and two connections with GL thread or three-way valve with L-shaped bore and three connections with GL thread. Ball-shaped stopcock plug for excellent tightness, free-moving stop valve. Suitable for pressure up to max. 12 bar, or for vacuum. Universal chemical resistance, the flowing product is only exposed to PTFE.

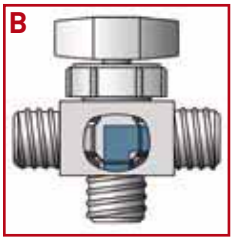
FDA conform

	Type	Bore shape	Connecting thread mm	Connecting thread GL	External dimensions L / D / H mm	Cat. No.:
A	2-Way	—	3	14	50 x 20 x 36	E 664-10
	2-Way	—	4	18	80 x 44 x 65	E 664-20
	2-Way	—	8	25	90 x 50 x 68	E 664-30
	2-Way	—	12	32	100 x 50 x 74	E 664-40
B	3-Way	L	3	14	50 x 20 x 52	E 667-10
	3-Way	L	4	18	80 x 40 x 90	E 667-20
	3-Way	L	8	25	90 x 50 x 98	E 667-30
	3-Way	L	12	32	100 x 50 x 106	E 667-40

Applications:

For distributing liquids or gases. Quick and easy disconnection of flow. Connection of tubing or tubes by means of BOLA Laboratory Screw Joints.





BESTSELLER

BOLA GL Stopcocks

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -30°C to +150°C**	**+++ universal**	**6 bar**	**suitable**

Product description:

Two-way stopcock with straight bore and two connections with GL thread or three-way stopcock with L-shaped or T-shaped bore and three connections with GL thread. Cylindrical stopcock plug for good tightness, stop valve with mark of flow direction. Suitable for pressure up to max. 6 bar, or for vacuum. Universal chemical resistance, the flowing product is only exposed to PTFE.

FDA conform

	Type	Bore shape	Connecting thread mm	Connecting thread GL	External dimensions L / D / H mm	Cat. No.:
A	2-Way	—	4	14	54 x 20 x 38	E 684-14
	2-Way	—	6	18	64 x 30 x 45	E 684-18
	2-Way	—	8	25	78 x 40 x 57	E 684-25
B	3-Way	L	4	14	64 x 47 x 43	E 686-14
	3-Way	L	6	18	74 x 57 c 57	E 686-18
	3-Way	L	6	25	78 x 59 x 57	E 686-25
C	3-Way	T	4	14	74 x 57 x 57	E 688-14
	3-Way	T	4	18	74 x 57 x 57	E 688-18
	3-Way	T	6	25	88 x 69 x 57	E 688-25

Applications:

For distributing liquids or gases. Quick and easy disconnection of flow. Connection of tubing or tubes by means of BOLA Laboratory Screw Joints.

BOLA Pressure-Relief Valves with Manual Ventilation

BESTSELLER

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -20°C to +150°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

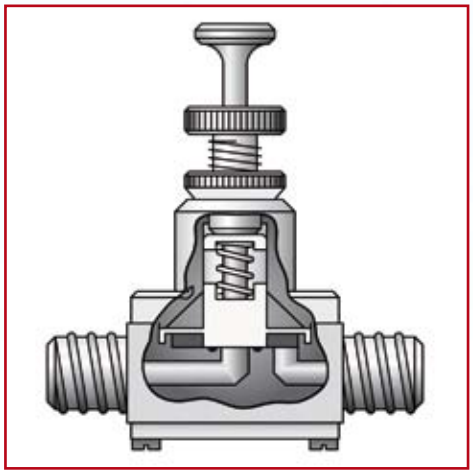
Body made of PTFE with two connections with GL 18 thread, valve made of PPS with toggle for manual ventilation by pulling and adjusting screw with counternut for adjusting and fixing of requested pressure in a range between 0,1 and 10 bar (factory setting 1,5 bar). Universal chemical resistance, the flowing product is only exposed to PTFE.

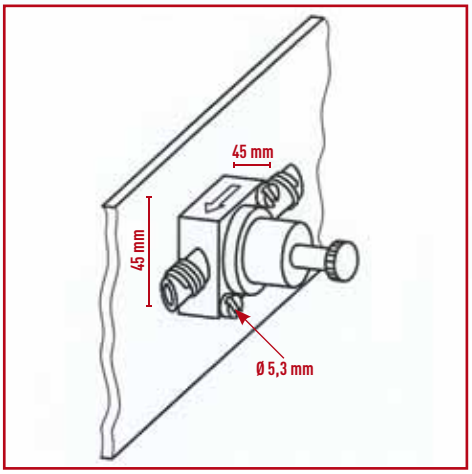
FDA conform

Connecting thread GL	Bore dia. mm	External dimensions L x D x H mm	Cat. No.:
18	6	88 x 54 x 116	**E 683-18**

Applications:

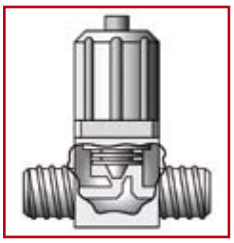
Pressure control valve with adjustable opening pressure. For preventing pressure drop during filling.





BOLA GL Control Valves

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**6 bar**	**suitable**


Product description:

Two-way valve with straight bore and two connections with GL thread completely made of PTFE. Motionless sealing without wearing parts due to integrated bellow. For best possible tightness even with considerable thermal fluctuations, the conical nipple of the bellow is prestressed by means of a spring. The valve can be opened and closed by turning the adjusting nut; a nipple on the top indicates the angle of opening. Suitable for pressure up to max. 6 bar, suitable for vacuum. Universal chemical resistance, the flowing product is only exposed to PTFE.

FDA conform

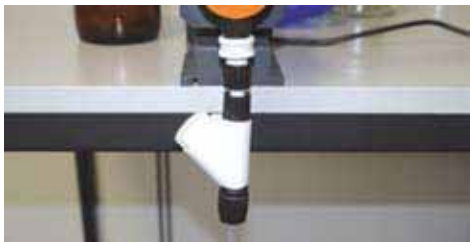
Connecting thread GL	Bore dia. mm	External dimensions L x D x H mm	Cat. No.:
14	4	62 x 30 x 73	**E 694-14**
18	6	80 x 44 x 83	**E 694-18**

Applications:

For distributing liquids or gases. Manual regulation for constant flow. Connection of tubing or tubes by means of BOLA Laboratory Screw Joints.

BOLA Dirt Traps

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**	**suitable**

Product description:

With two GL 18 threads for connecting hard-walled tubing (PTFE, PFA, FEP) or tubes with BOLA Laboratory Screw Joints. Lateral connection with plug for easy exchange of filtering membrane (thickness 0,2-3,0 mm) and for cleaning. The flow direction is marked with an arrow. Completely made of PTFE, the flowing product is only exposed to PTFE.

NEW

FDA conform

Connecting thread GL	Dia. of filtering membrane mm	Bore dia. mm	Total height mm	Cat. No.:
18	25	8	88	**N 1674-18**

Applications:

Protection of aggregates (pumps, valves, stopcocks, nozzles etc.) against particle contamination and damage. Metal-free, can be used under clean-room conditions. BOLA Filtering Membranes available separately (Cat. No. N 1690-28, page 204).

BOLA Adaptors for Prominent® Pumps

Material:	Temperature resistance	Chemical resistance:	Pressure:
PTFE	**from -200°C to +250°C**	**+++ universal**	**10 bar**


Product description:

Adaptor made of glass-fibre reinforced PTFE, transition from pump thread M20x1,5 to GL thread. Pressure resistant connection (max. 10 bar) of hard-walled tubing with Prominent® pumps by using BOLA Laboratory Screw Joints. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Connecting thread GL	Bore dia. mm		Cat. No.:
14	3,0		**D 730-12**
18	10,5		**D 730-24**

BOLA Vario Couplings

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:
PVDF	**from -40°C to +170°C**	**++ very good**	**3 bar**	**suitable**

Product description:

Two-part coupling made of PVDF for connecting elastic tubing (e.g. Viton®, Tygon®, silicone) to hard-walled tubing made of PTFE, glass or other plastics. Easy and ingenious functioning: the elastic tubing is pushed on a cone and fixed on the coupling by means of a connecting nut. On the other side, the hard-walled tubing is connected as follows:

Flanged PTFE tubing with miniature connectors (e.g. Cat. No. F 702 page 182) is connected to a female thread UNF ¼"28 G

Hard-walled tubing up to a maximum O.D. of 10 mm is connected to a GL thread by means of laboratory screw joints (see page 55). Restricted chemical resistance, working temperatures up to max. +170°C.

FDA conform

A

For tubing I.D. mm	For tubing wall thickness mm	Bore dia. mm	Connecting thread UNF	Cat. No.:
0,8	0,8 and 1,6	0,8	1/4" 28G	**F 778-08**
1,6	0,8 and 1,6	1,6	1/4" 28G	**F 778-16**

B

For tubing I.D. mm	For tubing wall thickness mm	Bore dia. mm	Connecting thread GL	Cat. No.:
0,8	0,8 and 1,6	0,8	14	**D 681-08**
1,6	0,8 and 1,6	1,6	14	**D 681-16**
3,2	1,6	3,2	14	**D 681-24**
4,0 and 4,8	1,6	4,0	14	**D 681-32**
6,4	1,6	6,4	18	**D 681-40**
8 und 9,5	1,6 and 2,4	8,0	18	**D 681-48**

Applications:

Peristaltic pumps

A

Example

B

Example

BOLA Hose Connectors (with Nut)

BESTSELLER

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PFA	from -200°C to +250°C	+++ universal	suitable

Product description:

GL 14 and GL 18 hose connectors made of PFA, GL 25 and GL 32 hose connectors made of PTFE. With elastic sealing lip, FPM o-ring and nut made of PPS. Available as straight or bent type. Universal chemical resistance, for working temperatures up to max. +250°C. The flowing product is only exposed to PFA or PTFE.

FDA conform


A


B

Straight type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length with nut mm	Cat. No.:
A	14	8,7	6,0	45	D 581-02
	18	10,4	7,0	51	D 581-04
	25	16,0	10,0	68	D 581-06
	32	21,0	16,0	80	D 581-08

Bent type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length with nut mm	Cat. No.:
B	14	8,7	6,0	49	D 582-02
	18	10,4	7,0	65	D 582-04

Applications:

For connecting elastic tubing to GL-threaded equipment.

BOLA Hose Connectors (without Nut)

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PFA	from -200°C to +250°C	+++ universal	suitable

Product description:

GL 14 and GL 18 hose connectors made of PFA, GL 25 and GL 32 hose connectors made of PTFE. With elastic sealing lip and FPM o-ring. Available as straight or bent type. Universal chemical resistance, for working temperatures up to max. +250°C. The flowing product is only exposed to PFA or PTFE.

FDA conform


A


B

Straight type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length without nut mm	Cat. No.:
A	14	8,7	6,0	34	D 568-14
	18	10,4	7,0	39	D 568-18
	25	16,0	10,0	55	D 568-25
	32	21,0	16,0	65	D 568-32

Bent type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length without nut mm	Cat. No.:
B	14	8,7	6,0	40	D 569-14
	18	10,4	7,0	54	D 569-18

BOLA Hose Connectors (with Nut)

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PP	**from -20°C to +110°C**	**++ very good**	**suitable**

Product description:

Hose connectors made of PP, with elastic sealing lip, FPM o-ring and nut made of PBTP. Available as straight or bent type. Restricted chemical resistance, for working temperatures up to max. +110°C. The flowing product is only exposed to PP.

FDA conform

Straight type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length with nut mm	Cat. No.:
A	14	8,8	6,0	46	D 585-14
	18	10,8	7,0	52	D 585-18
	25	16,0	10,0	68	D 585-25

Bent type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length with nut mm	Cat. No.:
B	14	8,8	6,0	51	D 586-14
	18	10,8	7,0	66	D 586-18

Applications:

For connecting elastic tubing to GL-threaded equipment.

A

B

BOLA Hose Connectors (without Nut)

Material:	Temperature resistance	Chemical resistance:	Vacuum:
PP	**from -20°C to +110°C**	**++ very good**	**suitable**

Product description:

Hose connectors made of PP, with elastic sealing lip and FPM o-ring. Available as straight or bent type. Restricted chemical resistance, for working temperatures up to max. +110°C. The flowing product is only exposed to PP.

FDA conform

Straight type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length without nut mm	Cat. No.:
A	14	8,8	6,0	36	D 583-14
	18	10,8	7,0	40	D 583-18
	25	16,0	10,0	55	D 583-25

Bent type

	Thread GL	O.D.of hose connector mm	I.D. of hose connector mm	Length without nut mm	Cat. No.:
B	14	8,8	6,0	41	D 584-14
	18	10,8	7,0	56	D 584-18

A

B

The BOLA GL Screw Joint System "EX" –
A safe protection against electrostatic charging

By adding conductive particles, these components become electroconductive and can be used for explosive applications.
The flowing products can for example be aggressive or combustible liquids or gases.

For function and assembly, please look at the GL Screw Joint System on page 52 which is constructed in the same way.

Electric conductivity
The surface resistance of these components is:
PTFE-EX: approx. 10^5 Ohm
PPS-EX: approx. 10^3 Ohm

Flammability
PTFE-EX and PPS-EX are inherently flame-retardant and self-extinguishing. The oxygen index (LOI-value) stands for the oxygen content in the ambient atmosphere in which a material continues burning after inflaming without additional energy source. The oxygen index of PTFE-EX is approx. 95%, the oxygen index of PPS-EX is approx. 50%. Both materials do not burn under normal conditions since the oxygen content of air is 21%.

UV protection
The materials are black and therefore UV-resistant. They can be used for products which react to UV rays.

Chemical resistance
Due to the addition of conductive pigments (e.g. electrographic carbon), the components may be attacked by strongly oxidizing products such as acids, caustic solutions or halogens.

Earthing
The complete system must be earthed professionally. It is advantageous to roughen the surface around the earthing clip to improve the contact.

Identification of EX Screw Joints
BOLA components with conductive particles can be identified by their black colour. The caps can be identified by the "EX" mark.
An attrition test on paper can also help. The component is rubbed slightly on a white piece of paper. A colouration indicates that the component has conductive particles.

BOLA Laboratory Screw Joints EX

Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	**PPS EX**	**from -200°C to +200°C**	**++ very good**	**10 bar**	**suitable**	**10^5 Ohm**

NEW

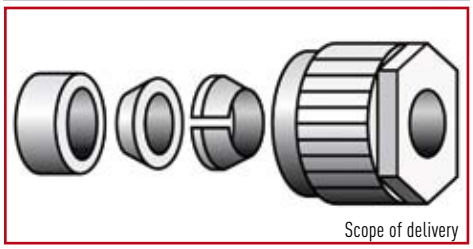
Product description:

Screw cap made of conductive black PPS-EX reinforced with glass fibres, inner parts made of conductive PTFE-EX

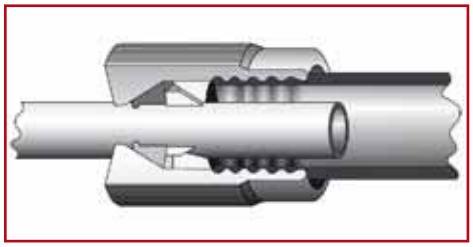
For tubing O.D. mm	Thread GL		Cat. No.:
4	14		D 840-66
6	14		D 840-74
4	18		D 841-46
6	18		D 841-54
8	18		D 841-62
10	18		D 841-74
8	25		D 842-62
10	25		D 842-74
12	25		D 842-80
14	25		D 842-90

Applications:

Connecting equipment and fittings with GL threads with hard-walled tubing or tubes made of glass, plastic or metal. Fixing probes, thermometers, dip tubes or cables in reaction vessels.



Scope of delivery



BOLA Replacement Inner Parts EX

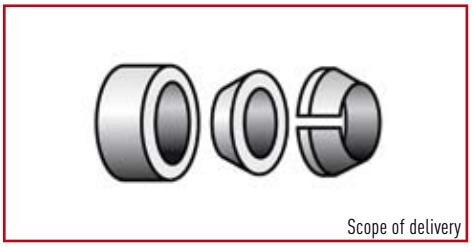
Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	PPS EX	from -200°C to +200°C	++ very good	10 bar	suitable	10^4 Ohm

Product description:

Made of conductive PTFE-EX.

NEW

For tubing O.D. mm	Thread GL		Cat. No.:
4	14		D 848-66
6	14		D 848-74
4	18		D 849-46
6	18		D 849-54
8	18		D 849-62
10	18		D 849-74
8	25		D 850-62
10	25		D 850-74
12	25		D 850-80
14	25		D 850-90



Scope of delivery

BOLA Replacement Caps EX

Material:	Temperature resistance	Chemical resistance:	Conductivity:
PPS EX	from -200°C to +200°C	++ very good	10^4 Ohm

Product description:

Black screw cap made of glass-fibre PPS-EX, with handy knurl and hexagon.

NEW

Thread GL	From tubing O.D. to tubing O.D. mm		Cat. No.:
14	0,8 - 6,0		D 846-10
18	0,8 - 10,0		D 846-20
25	0,8 - 10,0		D 846-30
25	10,1 - 14,0		D 846-34

BOLA BOLA GL Tube Fittings EX

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	from -200°C to +200°C	++ very good	10 bar	suitable	10^4 Ohm

Product description:

Straight tube fitting made of PTFE-EX, two connections with GL thread. Connection of tubing or tube with BOLA Laboratory Screw Joints EX.

NEW

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size hexagon mm	Cat. No.:
14	6,5	50	15	D 856-14
18	10,5	50	19	D 856-18
25	14,5	56	27	D 856-25

Applications:
For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA GL Tube Fittings T EX

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	**from -200°C to +200°C**	**++ very good**	**10 bar**	**suitable**	**10^4 Ohm**

NEW

Product description:

Tube fittingT-shaped made of PTFE-EX, three connections with GL thread. Connection of tubing or tube with BOLA Laboratory Screw Joints EX.

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size square mm	Cat. No.:
14	6,5	50	20	**D 857-14**
18	10,5	56	20	**D 857-18**
25	14,5	70	27	**D 857-25**

Applications:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA GL Tube Fittings Elbow EX

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	**from -200°C to +200°C**	**++ very good**	**10 bar**	**suitable**	**10^4 Ohm**

NEW

Product description:

Tube fitting elbow-shaped made of PTFE-EX, two connections with GL thread. Connection of tubing or tube with BOLA Laboratory Screw Joints EX.

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size square mm	Cat. No.:
14	6,5	37	20	**D 858-14**
18	10,5	39	20	**D 858-18**
25	14,5	51	27	**D 858-25**

Applications:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA GL Tube Fittings Cross EX

Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	**from -200°C to +200°C**	**++ very good**	**10 bar**	**suitable**	**10^4 Ohm**

NEW

Product description:

Tube fitting cross-shaped made of PTFE-EX, four connections with GL thread. Connection of tubing or tube with BOLA Laboratory Screw Joints EX.

Thread GL	Bore dia. mm	Length without screw joint mm	Wrench size square mm	Cat. No.:
14	6,5	54	20	**D 859-14**
18	10,5	56	20	**D 859-18**
25	14,5	70	27	**D 859-25**

Applications:

For distributing liquids or gases. As reduction for connecting different diameters of tubes or tubing.

BOLA Multiple Distributors for Bottles EX

Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	**PPS EX**	**from -200°C to +200°C**	**++ very good**	**10 bar**	**suitable**	**10^5 Ohm**

Product description:

Black screw cap made of conductive PPS-EX for bottle thread GL 45, body made of conductive PPS-EX. Insertion of tubing with a max. O.D. of 8 mm. Connection of tubing or tube with BOLA Laboratory Screw Joints EX.

Detailed information about distributors which are identical in construction can be found on page 60.

NEW

Necks GL			Cat. No.:
2 x 14			**D 864-08**
3 x 14			**D 865-08**

Applications:

Drawing or inserting aggressive or pure liquids. Inserting tubing, tubes and probes into vessels.

BOLA GL-Stopcocks EX

Material:	Material:	Temperature resistance	Chemical resistance:	Pressure:	Vacuum:	Conductivity:
PTFE EX	**PPS EX**	**from -200°C to +200°C**	**++ very good**	**6 bar**	**suitable**	**10^4 Ohm**

Product description:

Two-way stopcock made of conductive PTFE-EX with straight bore and two connections with GL thread or three-way stopcock with L-shaped or T-shaped bore and three connections with GL thread. Cylindrical stopcock plug made of conductive PTFE-EX for good tightness, stop valve with mark of flow direction. Grip made of red PP. Suitable for pressure up to max. 6 bar, suitable for vacuum. Connection of tubing or tube with BOLA Laboratory Screw Joints EX.

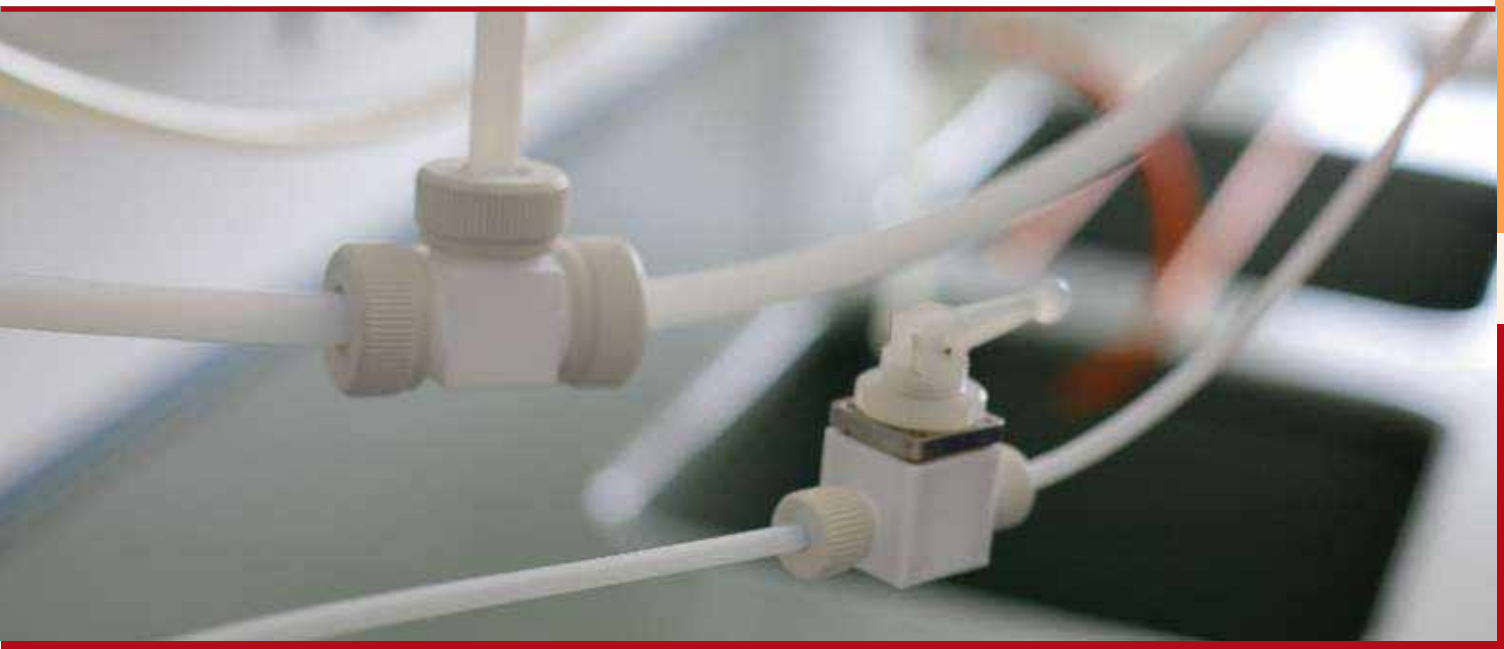
NEW

	Type	Bore shape	Bore dia. mm	Connecting thread GL	External dimensions L / D / H mm	Cat. No.:
A	2-Way	—	4	14	54 x 20 x 38	**E 712-14**
	2-Way	—	6	18	64 x 30 x 45	**E 712-18**
	2-Way	—	8	25	78 x 40 x 57	**E 712-25**
B	3-Way	L	4	14	64 x 47 x 43	**E 714-14**
	3-Way	L	6	18	74 x 57 c 57	**E 714-18**
	3-Way	L	6	25	78 x 59 x 57	**E 714-25**
C	3-Way	T	4	14	74 x 57 x 57	**E 716-14**
	3-Way	T	4	18	74 x 57 x 57	**E 716-18**
	3-Way	T	6	25	88 x 69 x 57	**E 716-25**

Applications:

For distributing liquids or gases. Quick and easy disconnection of flow.

Screw Joints for Pressures up to 5 bar



Joining things together: we have the ideal screw joints and connectors for almost all equipment and applications.

PRODUCT TIPS

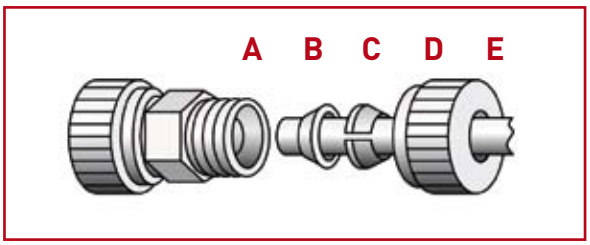
Page 98
Tube fittings

Page 102
Stopcocks

BOLA Screw Joints for Pressures up to 5 Bar

Components:

A Threaded neck of fitting
B Tapered ring
C V-ring
D Nut
E Tubing or tube



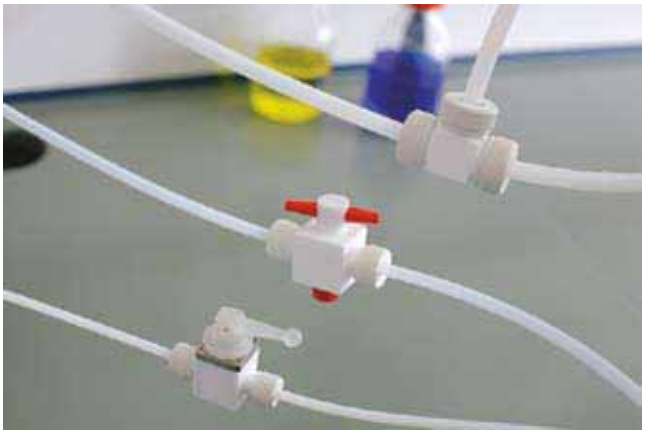
Assembly:

1. Push the nut on the tubing/tube
2. Push V-ring and then the tapered ring on the tubing/tube
3. Tighten the nut on the threaded neck – ready

What you should know about
the screw joint system up to 5 bar

This economic screw joint system was developed especially for tubing made of PTFE, PFA or FEP, but it can also be used with tubes made of glass or steel. Its function is based on compression rings which provide a pressure resistance of up to 5 bar at room temperature. All parts which are exposed to the medium are made of PTFE. Only the nut which is not in contact with the medium is made of glass-fibre reinforced PTFE for better stability. The fittings and nuts have metric threads.

All components of this system have a universal chemical resistance, since the product is only exposed to PTFE.



BOLA Tube Fittings

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Straight tube fitting made of PTFE with nuts made of glass-fibre reinforced PTFE. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Thread of fitting M	Bore dia. mm	Total length mm	For tubing O.D. mm	Cat. No.:
14 x 2	6	49	4	**D 503-02**
14 x 2	6	49	6	**D 503-04**
14 x 2	6	49	(1/4") 6,35	**D 503-06**
18 x 2	8	54	8	**D 503-08**
18 x 2	8	54	10	**D 503-12**
28 x 2	14	58	12	**D 503-14**
28 x 2	14	58	14	**D 503-16**
28 x 2	14	58	16	**D 503-18**

BOLA Tube Fittings T

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Tube fitting T-shaped made of PTFE, three connections with nuts made of glass-fibre reinforced PTFE. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Thread of fitting M	Bore dia. mm	Dimensions (L x H) mm	For tubing O.D. mm	Cat. No.:
14 x 2	4	56 x 39	4	D 505-02
14 x 2	4	56 x 39	6	D 505-04
14 x 2	4	56 x 39	(1/4") 6,35	D 505-06
18 x 2	8	60 x 43	8	D 505-08
18 x 2	8	60 x 43	10	D 505-12
28 x 2	14	71 x 54	12	D 505-14
28 x 2	14	71 x 54	14	D 505-16
28 x 2	14	71 x 54	16	D 505-18

SUITABLE: page **110**
Tubing for all fittings

BOLA Tube Fittings Elbow

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Tube fitting elbow-shaped made of PTFE, two connections with nuts made of glass-fibre reinforced PTFE. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Thread of fitting M	Bore dia. mm	Dimensions (L x H) mm	For tubing O.D. mm	Cat. No.:
14 x 2	4	39 x 39	4	D 504-02
14 x 2	4	39 x 39	6	D 504-04
18 x 2	8	43 x 43	8	D 504-08
18 x 2	8	43 x 43	10	D 504-12
28 x 2	14	54 x 54	12	D 504-14
28 x 2	14	54 x 54	14	D 504-16
28 x 2	14	54 x 54	16	D 504-18

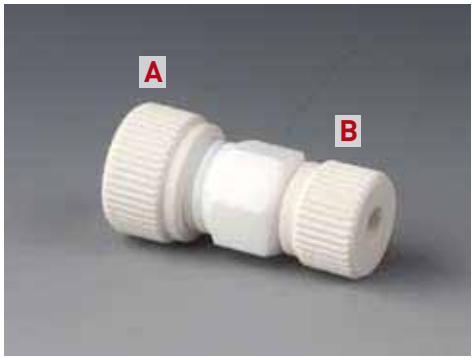
BOLA Reducing Unions

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Straight tube fitting made of PTFE with nuts made of glass-fibre reinforced PTFE. For connecting tubing or tube with different outer diameters. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform



A Thread of fitting M	For tubing O.D. mm	Bore dia. mm	B Thread of fitting M	For tubing O.D. mm	Cat. No.:
14 x 2	6	6	14 x 2	4	D 526-02
18 x 2	8	6	14 x 2	4	D 526-04
18 x 2	8	6	14 x 2	6	D 526-10
18 x 2	10	6	14 x 2	4	D 526-06
18 x 2	10	6	14 x 2	6	D 526-12
18 x 2	10	8	18 x 2	8	D 526-14
28 x 2	12	6	14 x 2	4	D 526-26
28 x 2	12	6	14 x 2	6	D 526-32
28 x 2	12	10	18 x 2	8	D 526-38
28 x 2	12	10	18 x 2	10	D 526-18
28 x 2	14	6	14 x 2	4	D 526-28
28 x 2	14	6	14 x 2	6	D 526-34
28 x 2	14	10	18 x 2	10	D 526-20
28 x 2	16	6	14 x 2	4	D 526-30
28 x 2	16	6	14 x 2	6	D 526-36
28 x 2	16	10	18 x 2	10	D 526-22

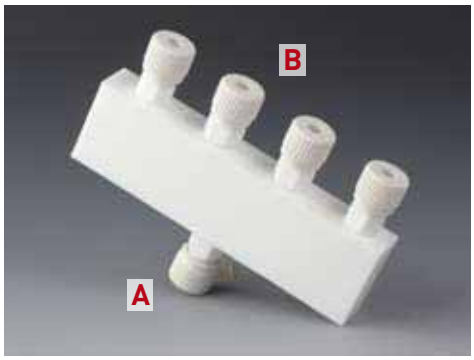
BOLA Distributors

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Body made of PTFE with nuts made of glass-fibre reinforced PTFE. One inlet and three or four outlets, bore diameter 6 mm. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform



Thread of fitting M	Inlets A	For tubing O.D. mm	Outlets B	For tubing O.D. mm	Dimensions L x W x H mm	Cat. No.:
14 x 2	1	4	3	4	100 x 22 x 96	D 512-01
14 x 2	1	6	3	6	100 x 22 x 96	D 512-02
14 x 2	1	4	4	4	140 x 22 x 96	D 512-08
14 x 2	1	6	4	6	140 x 22 x 96	D 512-09

BOLA Screw-in Tube Fittings

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Straight tube fitting made of PTFE with nuts made of glass-fibre reinforced PTFE and a screw-in thread (either NPT or G). Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

A Thread of fitting M	For tubing O.D mm	Bore dia. mm	B Screw- in thread	Total length mm	Cat. No.:
14 x 2	4	4	NPT 1/8"	38	D 518-02
14 x 2	4	4	G 1/8"	38	D 518-04
14 x 2	4	4	NPT 1/4"	40	D 518-06
14 x 2	4	4	G 1/4"	38	D 518-08
14 x 2	6	4	NPT 1/4"	40	D 518-12
14 x 2	6	4	G 1/4"	38	D 518-14
14 x 2	6	4	NPT 3/8"	46	D 518-16
14 x 2	6	4	G 3/8"	46	D 518-18
18 x 2	8	8	NPT 1/4"	46	D 518-24
18 x 2	8	8	G 1/4"	46	D 518-26
18 x 2	8	8	NPT 3/8"	46	D 518-28
18 x 2	8	8	G 3/8"	46	D 518-30
18 x 2	10	8	NPT 1/4"	46	D 518-36
18 x 2	10	8	G 1/4"	46	D 518-38
18 x 2	10	8	NPT 3/8"	46	D 518-40
18 x 2	10	8	G 3/8"	46	D 518-42
28 x 2	12	12	NPT 3/8"	56	D 518-48
28 x 2	12	12	G 3/8"	56	D 518-50
28 x 2	12	12	NPT 1/2"	56	D 518-52
28 x 2	12	12	G 1/2"	56	D 518-54
28 x 2	14	12	NPT 1/2"	56	D 518-60
28 x 2	14	12	G 1/2"	56	D 518-62
28 x 2	16	12	NPT 1/2"	56	D 518-68
28 x 2	16	12	G 1/2"	56	D 518-70

SUITABLE: page **110**
Tubing for all fittings

BOLA (2-Way/3-Way) Stopcocks

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -200°C to +250°C**	**+++ universal**	**2 bar**

Product description:

2-way stopcock with straight bore and two connections or 3-way stopcock with T-shaped bore and three connections, with nuts made of glass-fibre reinforced PTFE for connecting tubing or tube. Conical stopcock plug, tightness is increased by turning the nut on the lower side. 3-way stopcock plug with T-shaped mark of flow direction. Universal chemical resistance, the flowing product is only exposed to PTFE.

FDA conform

	Typ	Bore shape stopcock	Bore dia. mm	For tubing O. D. mm	Thread M	Outer dimensions L x D x H mm	Cat. No.:
A	2-Way	—	2	4	14 x 2	59 x 22 x 53	E 652-02
	2-Way	—	2	6	14 x 2	59 x 22 x 53	E 652-04
	2-Way	—	5	8	18 x 2	74 x 35 x 69	E 652-06
	2-Way	—	5	10	18 x 2	74 x 35 x 69	E 652-08
B	3-Way	T	1,5	4	14 x 2	59 x 41 x 53	E 654-02
	3-Way	T	1,5	6	14 x 2	59 x 41 x 53	E 654-04
	3-Way	T	3,5	8	18 x 2	74 x 54 x 69	E 654-06
	3-Way	T	3,5	10	18 x 2	74 x 54 x 69	E 654-08

Applications:

For distributing liquids or gases. Quick and easy disconnection of flow.

A

B

BOLA Control Valves

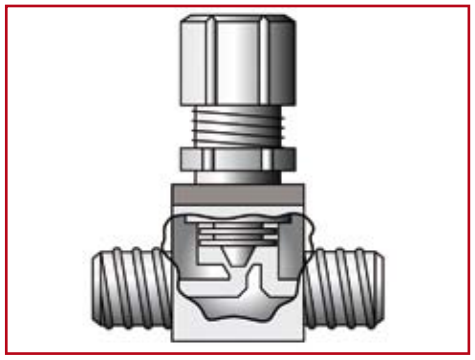
Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -30°C to +150°C**	**+++ universal**	**6 bar**	**suitable**

Product description:

Body made of PTFE with 2 connections and nuts made of glass-fibre reinforced PTFE for connecting tubing or tube. Bore dia. 6 mm. Motionless sealing by means of a gastight bellow made of PTFE with flat cone point. No leakages.

FDA conform

- volume flow can be regulated manually (without regulation scale).
- suitable for panel mounting
- easy disassembly for cleaning
- universal chemical resistance, the flowing product is only exposed to PTFE



Thread of fitting M	For tubing O. D. mm	Outer dimensions L x D x H mm	Cat. No.:
18 x 2	8	85 x 44 x 84	E 672-54
18 x 2	10	85 x 44 x 84	E 672-56

BOLA Snap Valves

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -30°C to +150°C**	**+++ universal**	**6 bar**	**suitable**

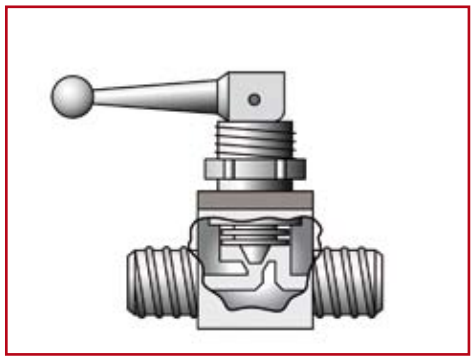
Product description:

Body made of PTFE with 2 connections and nuts made of glass-fibre reinforced PTFE for connecting tubing or tube. Bore dia. 6 mm. Motionless sealing by means of a gastight bellow made of PTFE with flat cone point. No leakages.
Lever locks when valve is open, switch setting is easily visible at position of the lever.

FDA conform

- » suitable for panel mounting
- » easy disassembly for cleaning
- » universal chemical resistance, the flowing product is only exposed to PTFE

Thread of fitting M	For tubing O.D. mm	Outer dimensions L x D x H mm	Cat. No.:
18 x 2	8	85 x 44 x 90	**E 674-54**
18 x 2	10	85 x 44 x 90	**E 674-56**



BOLA Non-Return Valves

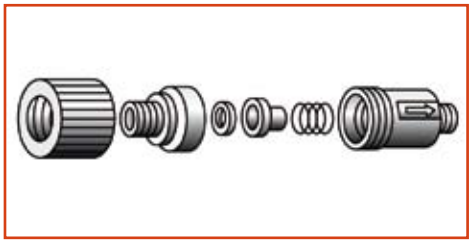
Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Made of PTFE, with nuts made of glass-fibre reinforced PTFE for connecting tubing or tube. Opening pressure adjustable between 0,1 bar and 2 bar (factory setting 0,1 bar). The built-in lock function only allows flow in one direction, the flow direction is marked by an arrow, any fitting position is possible. All parts are easy to disassemble by hand for cleaning. Universal chemical resistance, the flowing product is only exposed to PTFE or PFA.

FDA conform

Thread of fitting M	For tubing O.D. mm	Total length mm	O.D. mm	Cat. No.:
14 x 2	4	110	38	**E 680-21**
14 x 2	6	110	38	**E 680-23**
18 x 2	8	110	38	**E 680-27**
18 x 2	10	110	38	**E 680-31**
28 x 2	12	140	54	**E 680-33**



SUITABLE: page **110**
Tubing for all fittings

BOLA Ground Joint Tube Fittings

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**
Vacuum: **suitable**

FDA conform

Product description:

Fitting made of PTFE for transition from ground joints to metric threads for connecting hard-walled tubing (e.g. PTFE, PFA or FEP). With nuts made of glass-fibre reinforced PTFE, body with rings and knurled grip for opening. The product is only exposed to PTFE.

Ground joint NS	For tubing O.D. mm	Thread of fitting M	Bore dia. mm	Cat. No.:
14/23	6	14 x 2	5,0	H 1001-04
19/26	6	14 x 2	5,0	H 1001-06
29/32	6	14 x 2	5,0	H 1001-10
29/32	8	18 x 2	8,5	H 1001-12
29/32	10	18 x 2	8,5	H 1001-14

Applications:

For connecting tubes or tubing to vessels with ground joint. For inserting and fixing probes, thermometers, dip tubes or cables.

BOLA Replacement Nuts

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**

FDA conform

Product description:

Made of glass-fibre reinforced PTFE. For fittings, valves and stopcocks.

Thread of fitting M	For tubing O.D. mm		Cat. No.:
14 x 2	4 - 6,35		D 501-01
18 x 2	8 - 10,0		D 501-04
28 x 2	12 - 16,0		D 501-07

BOLA Replacement Compression Rings

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**

FDA conform

Product description:

Made of PTFE, two-part set with one tapered ring and one v-ring

Thread of fitting M	For tubing O.D. mm		Cat. No.:
14 x 2	4		D 502-01
14 x 2	6		D 502-02
14 x 2	(1/4") 6,35		D 502-03
18 x 2	8		D 502-04
18 x 2	(3/8") 9,52		D 502-05
18 x 2	10		D 502-06
28 x 2	12		D 502-07
28 x 2	(1/2") 12,7		D 502-51
28 x 2	14		D 502-08
28 x 2	16		D 502-09

BOLA BOLA Plugs

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Made of PTFE, for closing unused fitting connections (together with a suitable glass-fibre reinforced PTFE nut).

FDA conform

Connection for O.D. mm			Cat. No.:
4 / 6 / (1/4") 6,35			D 648-02
8 / (3/8") 9,52 / 10			D 648-08
12 / (1/2") 12,7 / 14 /16			D 648-14

BOLA Stopcocks with Hose Connectors

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -200°C to +250°C**	**+++ universal**	**2 bar**

Product description:

2-way stopcock with straight bore and two hose connectors or 3-way stopcock with T-shaped bore and three hose connectors for connecting elastic tubing (e.g. Viton®, Tygon®, silicone). Conical stopcock plug, tightness is increased by turning the nut on the lower side. 3-way stopcock plug with T-shaped mark of flow direction. Universal chemical resistance, the flowing product is only exposed to PTFE.

FDA conform

	Type	Bore shape stopcock	Bore dia. mm	For tubing I. D. mm	O.D. of hose connectors mm	Outer dimensions L x D x H mm	Cat. No.:
A	2-Way	—	1,5	4	4,5	60 x 22 x 53	E 650-03
	2-Way	—	3,0	6	6,8	60 x 22 x 53	E 650-06
	2-Way	—	4,0	8	9,0	60 x 22 x 53	E 650-09
	2-Way	—	6,0	10	11,0	85 x 35 x 69	E 650-12
B	3-Way	T	1,0	4	4,5	60 x 41 x 53	E 650-50
	3-Way	T	2,0	6	6,8	60 x 41 x 53	E 650-53
	3-Way	T	3,0	8	9,0	60 x 41 x 53	E 650-56
	3-Way	T	4,0	10	11,0	85 x 60 x 69	E 650-59

Applications:

For distributing liquids or gases. Quick and easy disconnection of flow.

A

B

BOLA Tubing Connectors

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

Straight fitting made of PTFE with two connectors for elastic tubing (e.g. Viton®, Tygon®, silicone). Universal chemical resistance, the product is only exposed to PTFE.

Total length mm	Bore dia. mm	O.D. of connectors mm	Cat. No.:
45	2	4,5	**D 575-02**
53	3	6,8	**D 575-04**
61	5	9,0	**D 575-06**
69	6	11,0	**D 575-08**

BOLA Tubing Connectors T

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

T-shaped fitting made of PTFE with three connectors for elastic tubing (e.g. Viton®, Tygon®, silicone). Universal chemical resistance, the product is only exposed to PTFE.

Total length mm	Bore dia. mm	O.D. of connectors mm	Cat. No.:
19,5	2	4,5	**D 577-02**
22,5	3	6,8	**D 577-04**
25,5	5	9,0	**D 577-06**
28,5	6	11,0	**D 577-08**

BOLA Tubing Connectors Elbow

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

Elbow-shaped fitting made of PTFE with two connectors for elastic tubing (e.g. Viton®, Tygon®, silicone). Universal chemical resistance, the product is only exposed to PTFE.

Total length mm	Bore dia. mm	O.D. of connectors mm	Cat. No.:
19,5	2	4,5	**D 574-02**
22,5	3	6,8	**D 574-04**
25,5	5	9,0	**D 574-06**
28,5	6	11,0	**D 574-08**

BOLA Tubing Connectors Cross

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Cross-shaped fitting made of PTFE with four connectors for elastic tubing (e.g. Viton®, Tygon®, silicone). Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Total length mm	Bore dia. mm	O.D. of connectors mm	Cat. No.:
28,5	6	11,0	**D 573-08**

BOLA Tubing Connectors Y

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Y-shaped fitting made of PTFE with three connectors for elastic tubing (e.g. Viton®, Tygon®, silicone). Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Total length mm	Bore dia. mm	O.D. of connectors mm	Cat. No.:
40	2	4,5	**D 576-02**
47	3	6,8	**D 576-04**
53	5	9,0	**D 576-06**
60	6	11,0	**D 576-08**

BOLA Reducing Tubing Connectors

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Straight fitting made of PTFE with two connectors for elastic tubing (e.g. Viton®, Tygon®, silicone) with different inner diameters. Universal chemical resistance, the product is only exposed to PTFE.

FDA conform

Total length mm	Bore dia. mm	From O.D. of connector mm	To O.D. of connector mm	Cat. No.:
45	2	6,8	4,5	**D 572-02**
55	3	9,0	6,8	**D 572-04**
75	5	11,0	9,0	**D 572-06**

BOLA Screw-In Tubing Connectors

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Straight fitting made of PTFE with one connector for elastic tubing (e.g. Viton®, Tygon®, silicone) and one screw-in thread (either NPT or G). Universal chemical resistance, the product is only exposed to PTFE.

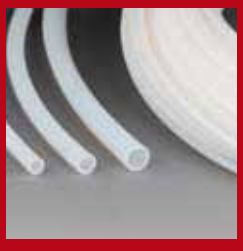
FDA conform

Total length mm	Bore dia. mm	O.D. of connector mm	Thread NPT	Thread G	Wrench size mm	Cat. No.:
20	2,5	4,5	1/8"		14	**D 579-02**
22	5,0	6,8	1/4"		15	**D 579-04**
22	5,8	9,0	1/4"		15	**D 579-06**
22	4,0	6,8		1/4"	15	**D 579-22**
22	5,0	9,0		1/4"	15	**D 579-24**
25	8,0	11,0		3/8"	18	**D 579-26**

Tubing » Films » Tiles

Totally practice-oriented: BOLA Tubing, Films and Tiles meet the highest demands and are used in more and more laboratories.

PRODUCT TIPS



Page 118
PTFE Tubing

Page 114
Flexible Tubing

Page 115
Conductive Tubing

BOLA Tubing

BOLA Tubing offers many advantages:

» **Short minimum lengths**
Depending on the tubing dimensions – for details please look at our price-list. Minimum lengths are unfortunately necessary for granting a low price per metre.

» **No specification of fixed rolls – available per metre**
Free choice of requested length between minimum length and maximum production length

» **Longer lengths in one piece possible**
For tubing up to O.D. 10 mm, quantities of up to 100 metres in one length are possible without extra charge; quantities of more than 100 metres in one length are only available in particular cases – please ask us.

» **Whenever possible, your ordered quantity is supplied in one length**
If our inventory or the ordered quantity does not allow another possibility, the tubing is supplied in partial lengths without consultation. Example: 90 m, 57 m, 23 m

» **Good to handle**
Tubing up to an O.D. of 3 mm and with a minimum length of 30 m is supplied on reels. This prevents bends and twists and makes storage and rolling up easier.

» **Tailored rolls/reels are available**
Several rolls with the same lengths are available at low extra charges, e.g. 5 rolls of 40 metres or 11 rolls of 22 metres.

» **Excellent quality at fair prices**
Stricter tolerances than the general industrial standard GKV – perfect interaction with our BOLA Fittings and BOLA Stopcocks

Tolerances of BOLA Tubing – You can count on them.

BOLA Tubing is perfectly suitable for the use with all BOLA Screw Joint Systems. You can be sure that all fittings and screw joints fit together with the tubing. The production of tubing always involves certain tolerances in outer diameter and wall thickness.

We always check our tubing repeatedly on the basis of strict BOLA-internal standards. These standards are stricter than the standards which are currently in the market.

Nominal O.D.
from 0,4 mm to 3,2 mm
» tolerance of O.D. +/- 0,05 mm

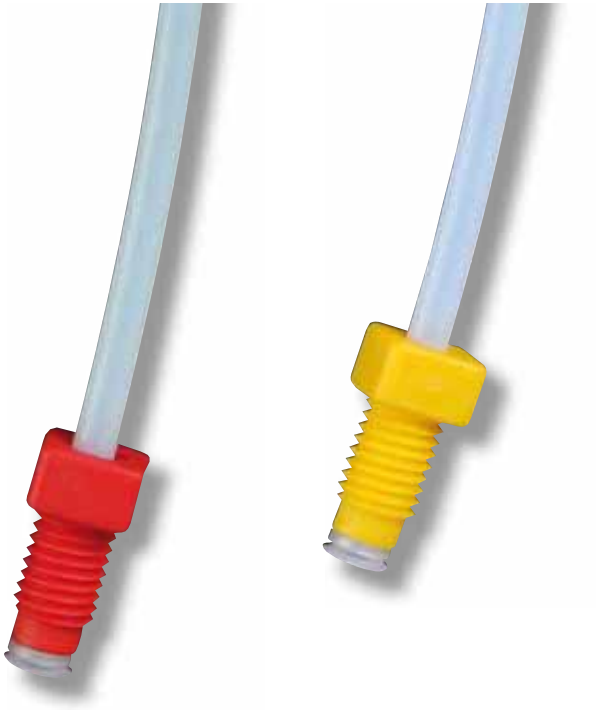
over 3,3 mm to 10,0 mm
» tolerance of O.D. +/- 0,10 mm

over 10,1 mm to 16,0 mm
» tolerance of O.D. +/- 0,15 mm

over 16,1 mm to 22,0 mm
» tolerance of O.D. +/- 0,20 mm

over 22,1 mm
» tolerance of O.D. +/- 0,25 mm

HELPFUL: page **228**
Detailed information about tubing tolerances



What you should know about the choice of tubing

Incorrectly chosen tubing can endanger the user. Here you can find the most important features in tabular form. The number of "+"-signs stands for the degree of performance of the feature.

Tubing material	PTFE	PFA	FEP
Maximum temperature (at moderate charge)	+260°C	+260°C	+205°C
Minimum temperature (at moderate charge)	-200°C	-270°C	-270°C
Chemical resistance	+++	+++	++(+)
Transparency	+	++(+)	+++
Surface quality	++	+++	+++
Gas proofness (in limit range)	++	+++	+++
Recovery	+	++	++
Costs	+	+++	++

Our tip: PTFE tubing is ideal for the "normal" work in laboratories.

If you need tubing which is absolutely gastight even in limit range of pressure and temperature, you should choose PFA or FEP. PFA only has advantages at temperatures of more than +205°C, but is more expensive than FEP tubing.

We shape and bend ... according to your needs.

FEP and PFA tubing is most suitable for shaping or bending. A special thermal procedure is applied to shape the tubing to the requested form. Please contact us for a free and non-binding quotation.

We connect and assemble ... according to your needs.

We can offer you our "know how" for cutting tubing, assembling fittings (either from our standard range or suitable for your specific system) from single pieces to complete series manufacturing. Please contact us for a free quotation.

Typical range of applications for tubing made of fluoroplastics (PTFE, PFA,FEP)

- For transport of aggressive products such as acids, lyes, gases and solvents
- For analysis- or measuring devices of chromatography and laboratory
- As product lines in miniplant systems
- As dosing lines for reaction vessels
- In liquid chromatography; high-purity tubing without additives (e.g. softeners) which could destroy analysis
- As covering of mechanically operated parts, e.g. bowden wires (due to the low coefficient of friction)
- As covering of sensors in chemical plants
- For transport of lacquers, oils, resins and food products
- As covering of heating elements in galvanic stations and microelectronics
- Antistatic tubing in explosive applications

BOLA Tubing

Frequently asked questions about customized tubing

» **Which tubing dimensions are available?**
We can supply tubing with outer diameters between 0,4 mm and 40 mm and wall thicknesses between 0,1 mm and 4 mm.

» **What if I only need a small quantity of customized tubing?**
Small quantities can be supplied but only at higher cost as a minimum order quantity has to be purchased. Unfortunately it is not possible to indicate exact minimum lengths. In general: the smaller the outer diameter, the bigger the minimum quantity and the smaller the price per metre. Please send us your actual requirement. We will then provide you with the corresponding minimum quantity and price.

» **Which tubing materials do you offer?**
We offer tubing made of fluoroplastics such as PTFE, PTFE-EX, FEP and PFA. Additionally, we supply tubing made of PEEK.

» **What shall I do if I am not sure if the requested tubing is producible?**
Normally we know this and can inform you quickly.

» **Do you have screw joint systems for every diameter of tubing?**
We offer a wide range of screw joints. A screw joint system to your requirements might already exist. If not, custom screw joints can be offered and supplied. Please contact us.

» **How do close tolerances affect the price of tubing?**
In general, close tolerances increase the price for production because expenses for checking the tubing are higher and there can be more waste of tubing which does not fulfil these close tolerances. It can even occur that a production is not possible if the tolerances are too close – in this case we will contact you to find a solution.

» **What is the lead time for tubing?**
The lead time depends on many factors such as dimension, quantity, material, tolerances and running length. The typical lead time for customized tubing is between 3 and 6 weeks.

» **How do I get a quotation?**
Send us your enquiry by fax or e-mail stating all relevant dimensions such as diameter, length, etc. We will do our utmost to get our offer to you as soon as possible. Please do not forget to indicate the required quantity. It is also important to include in your enquiry whether the requested tubing is a one-time or a repeating need.

Cleaning and reuse of tubing

In general, cleaned fluoroplastic tubing should only be reused if the transported product is known and rated with "+" in the chemical resistance chart.

It is not recommended to reuse the tubing with unknown products and mixtures of chemicals. For all water-soluble substances (e.g. salts, acids, bases etc) you can use water as cleaning agent.

Volatile solvents such as alcohols, esters, ketones, low-boiling hydrocarbons, chlorinated hydrocarbons are given off reversibly by storing under aeration (only if they have not been absorbed by the interior surface of the tubing).

If you are using substances which can only be eliminated by organic solvents or if you are using toxic and dangerous products, the tubing should be disposed appropriately after use. A visual inspection or, in case of unclarity an inspection according to EN 12115, has to be made before reusing cleaned tubing.

You haven't found anything suitable? – No problem

We would be glad to send you a quotation. For quick processing, we need some information:

- Outer diameter in mm (e.g. 16 mm)
- Inner diameter in mm (e.g. 12 mm)
- Which quantity in one length do you need?
- Which total quantity do you need?
- Which material shall be used?

Further information – not obligatory, but often making sense.

- Do you need special tolerances for outer or inner diameter (e.g. Ø 10 mm +/- 0,1 mm; this means tubing can vary between 9,9 mm and 10,1 mm)?
- Shall the tubing be deformable, for example for making flanges?
- Up to which temperature will the tubing be used?
- Which pressure shall the tubing resist?
- Shall the tubing be electroconductive?
- Shall the tubing be transparent?
- Shall the tubing have a special surface quality?
- Do you need certificates? (e.g. test certificates, certificates of compliance or FDA certificates)
- To which pressure or vacuum at which temperatures is the tubing exposed?
- Do you need special packaging?
- Shall the tubing be dyed with a colour? Which colour do you request?
- Do you need an exceptionally tight bending radius?
- Does the tubing have to be absolutely gastight?

BOLA Flexible Tubing

BESTSELLER

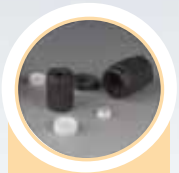
Material:	Temperature resistance:	Chemical resistance:	Transparency:	Vacuum:
PFA	**from -270°C to +260°C**	**+++ universal**	**transparent**	**suitable**

Product description:

Corrugated tubing with circular corrugations around the longitudinal axis and cylindrical tubing ends with a length of 40 mm which can for example be connected directly to fittings, stopcocks or hose connectors. Together with BOLA Laboratory Screw Joints, the connection is absolutely tight and suitable for vacuum.

FDA conform

Tubing size NW	Tubing end I.D.	Tubing end O.D.	Bending radius[1] mm	Pressure load max. bar	Length 0,25 m Cat. No.:	Length 0,5 m Cat. No.:	Length 1,0 m Cat. No.:	Length 2,5 m Cat. No.:
4,5	2	4	5	1,7		S 1822-01	S 1822-19	S 1822-52
8	6	8	15	2	S 1822-92	S 1822-02	S 1822-20	S 1822-56
10	8	10	18	2	S 1822-93	S 1822-04	S 1822-22	S 1822-60
13	10	12	23	2	S 1822-94	S 1822-06	S 1822-24	S 1822-64
14	12	14	25	2		S 1822-08	S 1822-26	S 1822-68
16	14	16	28	2		S 1822-10	S 1822-28	S 1822-72
19	16	18	32	2	S 1822-98	S 1822-14	S 1822-32	S 1822-76
21	17,5	20	35	2		S 1822-16	S 1822-34	S 1822-80
23	20,9	(1") 25,4	40	1,2		S 1822-18	S 1822-36	S 1822-84



SUITABLE: page **57**
Laboratory screw joints

Product advantages:

» flexible to highly flexible
» tight bending radius only causes little cross-section reduction
» non-porous
» translucent

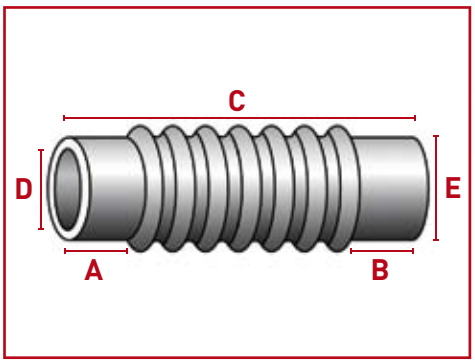
Applications:

» ideal for connections under vibrations
» usable with a small bending radius
» for compensation of thermal expansions
» for easy handling of liquids

BOLA Customized Flexible Tubing

Flexible tubing made of PFA can be manufactured individually according to your specifications. We would be glad to send you a quotation.
Please complete the list below and send us a copy by fax to +49 (0)9346-928651. Thank you.

Quantity	
Tubing size NW	
A Tubing end length	
B Tubing end length	
C Total length	
D Tubing end I. D.	
E Tubing end O.D.	



[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

BOLA Flexible Tubing Ex

Material:	Temperature resistance:	Chemical resistance:	Conductivity:
PFA-EX	**from -270°C to +260°C**	**+++ universal**	**10^5 Ohm**

Product description:

Conductive corrugated tubing with nominal width 10 and with circular corrugations around the longitudinal axis. Cylindrical tubing ends with a length of 40 mm can for example be connected directly to fittings, stopcocks or hose connectors. Together with BOLA Laboratory Screw Joints EX, the connection is conductive, absolutely tight and suitable for vacuum.

NEW

Tubing end I.D.	Tubing end O.D.	Bending radius[1] mm	Burst pressure[2] bar	Length 0,5 m Cat. No.:	Length 1,0 m Cat. No.:	Length 2,5 m Cat. No.:
4	6	18	13	S 1824-24	S 1824-54	S 1824-74
6	8	18	13	S 1824-27	S 1824-57	S 1824-77
8	10	18	13	S 1824-30	S 1824-60	S 1824-80
10	12	18	13	S 1824-33	S 1824-63	S 1824-83

Product advantages:

» conductive with surface resistance of 10^5 Ohm
» flexible to highly flexible
» tight bending radius only causes little cross-section reduction
» non-porous

Applications:

» antistatic applications
» in explosive ambiance (explosion protection)
» for easy handling of liquids and gases
» for transport of solvents or alcohols
» ideal for connections under vibrations
» usable with a small bending radius
» for compensation of thermal expansions

SUITABLE: page **94**
Conductive fittings and stopcocks made of PTFE -Ex

[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

[2] Burst pressure: computed value in bar at a room temperature of 23°C. It is recommended to restrict the maximum working pressure to 25% of the burst pressure. For higher temperatures, this value has to be multiplied by the reduction factor shown on page 226. It is the user's responsibility to check if the used tubing fulfils the respective requirements.

BOLA Antistatic Explosion-Proof Tubing

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Conductivity:
PTFE-EX	**from -270°C to +260°C**	**+++ universal**	**10^6 Ohm**

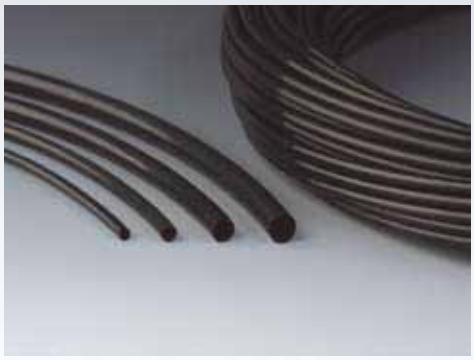
Product description:

Very good electric conductivity due to a special "antistatic compound" made of pure PTFE and finest, highly pure carbon dust (less than 2,5%).
Colour: black

NEW

FDA conform

I.D. mm	O.D. mm	Wall thickness mm	Bending radius[1] mm	Burst pressure[2] bar	Cat. No.:
(1/32") 0,8	(1/16") 1,6	0,4	7	140	S 1827-10
(1/16") 1,6	(1/8") 3,2	0,8	13	140	S 1827-26
2,0	3,0	0,5	18	70	S 1827-30
4,0	6,0	1,0	36	70	S 1827-40
6,0	8,0	1,0	64	46	S 1827-50
8,0	10,0	1,0	100	35	S 1827-60
10,0	12,0	1,0	144	28	S 1827-64
12,0	14,0	1,0	196	23	S 1827-68



Product advantages:

» extensive chemical resistance due to PTFE parts
» resistance of less than 10^6 Ohm according to EN 12115 directive
» ideal for light-sensitive substances

Applications:

» antistatic applications
» in explosive ambiance (explosion protection)
» for transport of solvents or alcohols

[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

[2] Burst pressure: computed value in bar at a room temperature of 23°C. It is recommended to restrict the maximum working pressure to 25% of the burst pressure. For higher temperatures, this value has to be multiplied by the reduction factor shown on page 226. It is the user's responsibility to check if the used tubing fulfils the respective requirements.

BOLA Zebra Explosion-Proof Tubing

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Conductivity:
PFA-EX	**from -270°C to +250°C**	**+++ universal**	**10^6 Ohm**

Product description:

Transparent PFA tubing with black longitudinal conductive stripes on the outer surface. The tubing is absolutely round and can be connected to all common fittings.

NEW

FDA conform

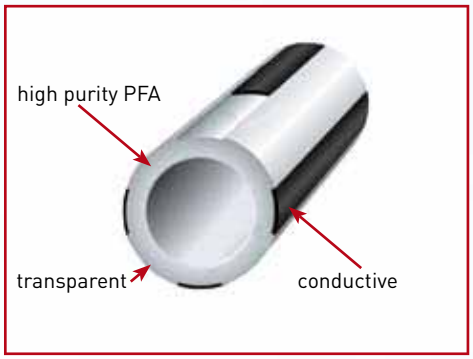
I.D. mm	O.D. mm	Wall thickness mm	Bending radius[1] mm	Burst pressure[2] bar	Cat. No.:
2,0	3,0	0,5	15	57	S 1855-30
4,0	6,0	1,0	25	57	S 1855-40
6,0	8,0	1,0	50	41	S 1855-50
8,0	10,0	1,0	80	32	S 1855-60
10,0	12,0	1,0	130	27	S 1855-64

Product advantages:

» the flowing product is only exposed to PFA
» no chemical restrictions due to the outer conducting stripes
» resistance less than 10^6 Ohm
» smooth, non-porous interior surface
» clear visibility of the flowing product
» no corrosion unlike metal lines or metal meshes
» almost universal chemical resistance

Applications:

» antistatic applications
» in explosive ambiance (explosion protection)
» for transport of highly flammable solvents or alcohols
» for transport of highly pure chemicals and gases



[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

[2] Burst pressure: computed value in bar at a room temperature of 23°C. It is recommended to restrict the maximum working pressure to 25% of the burst pressure. For higher temperatures, this value has to be multiplied by the reduction factor shown on page 226. It is the user's responsibility to check if the used tubing fulfils the respective requirements.

BOLA PTFE Tubing

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +260°C**	**+++ universal**

FDA conform

Product description:

Translucent to milky-white appearance

Product advantages:

» almost universal chemical resistance
» free from extractable agents
» physiologically safe
» non-adhesive surface
» very good sliding characteristics
» very good dielectric characteristics
» biocompatibility certified according to USP class VI
» flame retardant according to UL94V0
» oxygen value more than 95
» resistant to irradiation and weather
» can be sterilized in ETO and in autoclaves

SUITABLE: page **84**
Fittings, screw joints, stopcocks, valves

I.D. mm	O.D. mm	Wall thickness mm	Bending radius[1] mm	Burst pressure[2] bar	Cat. No.:
0,2	(1/16") 1,6	0,70	6	960	**S 1810-01**
0,2	0,4	0,10	2	960	**S 1810-02**
0,3	0,6	0,15	3	140	**S 1810-04**
0,3	(1/16") 1,6	0,65	4	606	**S 1810-05**
0,4	0,9	0,25	3	175	**S 1810-06**
0,5	1,0	0,25	4	140	**S 1810-08**
0,5	(1/16") 1,6	0,55	5	308	**S 1810-09**
(1/32") 0,8	(1/16") 1,6	0,40	7	140	**S 1810-10**
1,0	(1/16") 1,6	0,30	8	84	**S 1810-12**
1,0	2,0	0,50	8	140	**S 1810-14**
1,0	3,0	1,00	9	280	**S 1810-16**
1,2	1,8	0,30	8	70	**S 1810-18**
1,4	2,2	0,40	12	80	**S 1810-19**
1,5	2,1	0,30	14	56	**S 1810-20**
1,5	2,5	0,50	13	93	**S 1810-22**
1,5	3,0	0,75	12	140	**S 1810-23**
1,5	3,5	1,00	12	186	**S 1810-21**
(1/16") 1,6	(1/8") 3,2	0,80	13	140	**S 1810-26**
(1/16") 1,6	2,4	0,40	14	70	**S 1810-24**
1,9	2,5	0,30	20	44	**S 1810-28**
2,0	3,0	0,50	18	70	**S 1810-30**
2,0	4,0	1,00	16	140	**S 1810-32**
2,4	(1/8") 3,2	0,40	25	46	**S 1810-33**
3,0	4,0	0,50	32	46	**S 1810-34**
3,0	5,0	1,00	25	93	**S 1810-36**
3,0	6,0	1,50	24	140	**S 1810-37**

You will find further tubing diameters in the adjoining chart

I.D. mm	O.D. mm	Wall thickness mm	Bending radius[1] mm	Burst pressure[2] bar	Cat. No.:
Continuation of tubing diameters					
4,0	5,0	0,50	50	35	**S 1810-38**
4,0	6,0	1,00	36	70	**S 1810-40**
(11/64") 4,35	(1/4") 6,35	1,00	40	64	**S 1810-42**
5,0	6,0	0,50	72	28	**S 1810-44**
5,0	7,0	1,00	49	56	**S 1810-46**
6,0	7,0	0,50	98	23	**S 1810-48**
6,0	8,0	1,00	64	46	**S 1810-50**
7,0	8,0	0,50	128	20	**S 1810-52**
7,0	9,0	1,00	81	40	**S 1810-54**
7,5	10,0	1,25	80	46	**S 1810-56**
8,0	(3/8") 9,52	0,75	120	26	**S 1810-58**
8,0	10,0	1,00	100	35	**S 1810-60**
8,0	11,0	1,50	80	52	**S 1810-61**
8,0	12,0	2,00	72	70	**S 1810-62**
9,0	11,0	1,00	121	31	**S 1810-63**
10,0	12,0	1,00	144	28	**S 1810-64**
10,0	14,0	2,00	98	56	**S 1810-66**
12,0	14,0	1,00	196	23	**S 1810-68**
12,0	16,0	2,00	128	46	**S 1810-70**
13,0	16,0	1,50	170	32	**S 1810-72**
14,0	16,0	1,00	256	20	**S 1810-74**
16,0	18,0	1,00	324	17	**S 1810-78**
18,0	20,0	1,00	400	16	**S 1810-84**
20,0	22,0	1,00	490	14	**S 1810-88**

Applications:

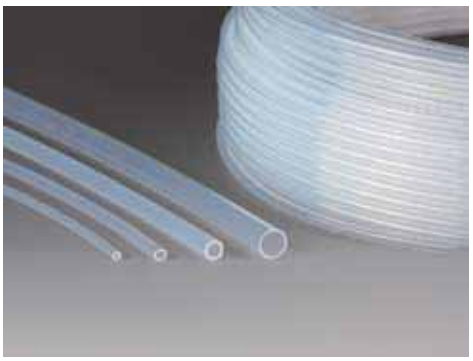
» Perfect tubing for aggressive and pure liquids or gases

[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

[2] Burst pressure: computed value in bar at a room temperature of 23°C. It is recommended to restrict the maximum working pressure to 25% of the burst pressure. For higher temperatures, this value has to be multiplied by the reduction factor shown on page 226. It is the user's responsibility to check if the used tubing fulfils the respective requirements.

BOLA FEP Tubing

Material:	Temperature resistance:	Chemical resistance:	Transparency:
FEP	**from -270°C to +205°C**	**+++ universal**	**transparent**



FDA conform

Product description:

Transparent, gastight tubing

Product advantages:

» non-porous
» almost universal chemical resistance
» free from extractable agents
» physiologically safe
» non-adhesive surface
» very good sliding characteristics
» very good dielectric characteristics
» biocompatibility certified according to USP class VI
» flame retardant according to UL94V0
» oxygen value more than 95
» resistant to irradiation and weather
» can be sterilized in Gamma, ETO, E-Beam and in autoclaves

I.D. mm	O.D. mm	Wall thickness mm	Bending radius[1]	Burst pressure[2] bar	Cat. No.:
(1/32") 0,8	(1/16") 1,6	0,40	7	112	**S 1815-04**
(1/16") 1,6	(1/8") 3,2	0,80	13	112	**S 1815-08**
2,0	3,0	0,50	18	56	**S 1815-07**
2,0	4,0	1,00	16	112	**S 1815-12**
3,6	6,0	1,20	30	75	**S 1815-16**
(5/32") 3,96	(1/4") 6,35	1,20	34	67	**S 1815-24**
4,0	6,0	1,00	36	56	**S 1815-20**
(11/64") 4,35	(1/4") 6,35	1,00	52	51	**S 1815-28**
5,6	8,0	1,20	53	48	**S 1815-32**
6,0	8,0	1,00	64	37	**S 1815-36**
(1/4") 6,35	(3/8") 9,52	1,59	58	56	**S 1815-40**
6,8	10,0	1,60	63	53	**S 1815-44**
8,0	10,0	1,00	100	28	**S 1815-48**
(3/8") 9,52	(1/2") 12,7	1,59	101	37	**S 1815-56**
10,0	12,0	1,00	144	22	**S 1815-60**
12,0	14,0	1,00	196	19	**S 1815-68**

Applications:

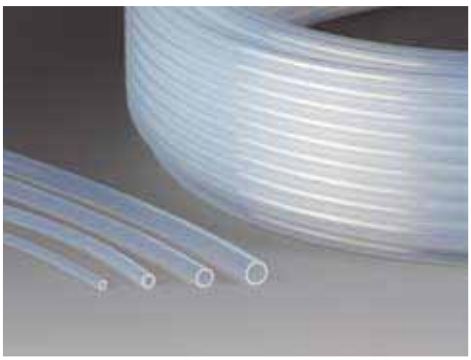
» Perfect tubing for aggressive and pure liquids or gases

[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

[2] Burst pressure: computed value in bar at a room temperature of 23°C. It is recommended to restrict the maximum working pressure to 25% of the burst pressure. For higher temperatures, this value has to be multiplied by the reduction factor shown on page 226. It is the user's responsibility to check if the used tubing fulfils the respective requirements.

BOLA PFA Tubing

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -200°C to +260°C**	**+++ universal**	**transparent**



Product description:

Transparent, gastight tubing

FDA conform

I.D. mm	O.D. mm	Wall thickness mm	Bending radius[1]	Burst pressure[2] bar	Cat. No.:
(1/32") 0,8	(1/6") 1,6	0,40	7	140	**S 1811-02**
(1/6") 1,6	(1/8") 3,2	0,80	13	140	**S 1811-04**
2,0	3,0	0,50	18	70	**S 1811-05**
2,0	4,0	1,00	16	140	**S 1811-06**
3,6	6,0	1,20	30	96	**S 1811-08**
(5/32") 3,96	(1/4") 6,35	1,20	34	84	**S 1811-12**
4,0	6,0	1,00	36	70	**S 1811-10**
(11/64") 4,35	(3/8") 6,35	1,00	52	64	**S 1811-14**
5,6	8,0	1,20	53	60	**S 1811-16**
6,0	8,0	1,00	64	46	**S 1811-18**
6,35	9,52	1,59	58	70	**S 1811-20**
6,8	10,0	1,60	63	66	**S 1811-22**
8,0	10,0	1,00	100	35	**S 1811-24**
8,8	12,0	1,60	90	51	**S 1811-26**
(3/8") 9,52	(1/2") 12,7	1,59	101	47	**S 1811-28**
10,0	12,0	1,00	144	28	**S 1811-30**
12,0	14,0	1,00	196	23	**S 1811-40**
14,0	16,0	1,00	256	20	**S 1811-50**

Product advantages:

» non-porous
» almost universal chemical resistance
» free from extractable agents
» physiologically safe
» non-adhesive surface
» very good sliding characteristics
» very good dielectric characteristics
» biocompatibility certified according to USP class VI
» flame retardant according to UL94V0
» oxygen value more than 95
» resistant to irradiation and weather
» can be sterilized in Gamma, ETO, E-Beam and in autoclaves
» mechanical strength even at high temperatures

Applications:

» Perfect tubing for aggressive and pure liquids or gases

SUITABLE: page **60**
Multiple distributor for bottles for different threads and tubing O.D.s

[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

[2] Burst pressure: computed value in bar at a room temperature of 23°C. It is recommended to restrict the maximum working pressure to 25% of the burst pressure. For higher temperatures, this value has to be multiplied by the reduction factor shown on page 226. It is the user's responsibility to check if the used tubing fulfils the respective requirements.

BOLA PFA Corrugated Tubing

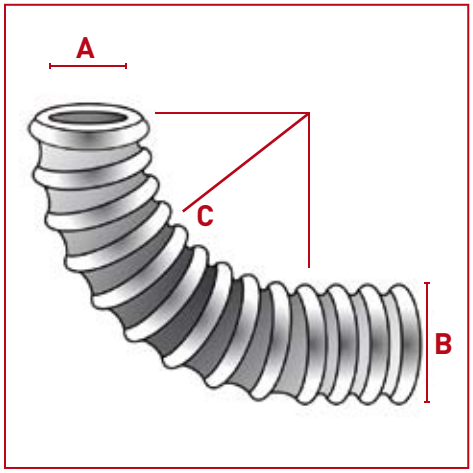
Material:	Temperature resistance:	Chemical resistance:	Transparency:	Vacuum:
PFA	**from -270°C to +260°C**	**+++ universal**	**transparent**	**suitable**

Product description:

Circular corrugations around the longitudinal axis. Can be shortened easily by means of a tubing cutter.

FDA conform

Nominal width NW	I.D. A mm	O.D. B mm	Bending radius[1] C mm	Pressure load max. bar	Cat. No.:
4,5	4,3	6,8	5	1,7	S 1820-01
8	7,7	10,7	15	3,4	S 1820-02
10	9,7	13,0	18	2,8	S 1820-04
13	12,4	16,1	23	2,6	S 1820-06
14	13,7	17,8	25	2,3	S 1820-08
16	15,4	19,7	28	2,3	S 1820-10
19	18,4	23,2	32	2,2	S 1820-14
21	19,8	24,8	35	2,1	S 1820-16
23	23,8	28,8	40	1,2	S 1820-23



Product advantages:

» flexible to highly flexible
» tight bending radius only causes little cross-section reduction
» non-porous
» translucent
» resistant to irradiation and weather
» almost universal chemical resistance

Applications:

» Perfect tubing for aggressive and pure liquids or gases

BOLA Colour Tubing

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +260°C**	**+++ universal**

Product description:

This completely imbued tubing is lightfast, different colours assure high safety against confusions. The colour pigments can possibly affect the chemical resistance.

I.D. mm	O.D. mm	Bending radius[1] mm	Colour	Cat. No.:
4	6	36	red	S 1861-40
6	8	64	red	S 1861-50
4	6	36	blue	S 1862-40
6	8	64	blue	S 1862-50
4	6	36	green	S 1863-40
6	8	64	green	S 1863-50
4	6	36	yellow	S 1864-40
6	8	64	yellow	S 1864-50

[1] Bending radius: minimum bending radius in mm at a room temperature of 23°C

BOLA Heat Shrinkable Tubing

Material:	Temperature resistance:	Chemical resistance:	Transparency:	Shrink rate:
PTFE	**from -270°C to +260°C**	**+++ universal**	**transparent**	**4:1**

Product description:

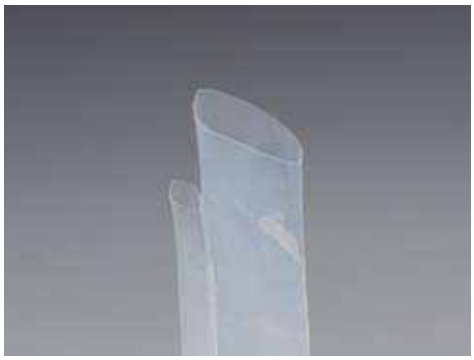
For protection of probes, cables, electric components etc. against chemical disturbance. The shrink rate of 4:1 means that the inner diameter of the tubing shrinks to approx. ¼ of the original inner diameter and that the length shrinks to approx. 15%. Good heat transmission due to low wall thickness.

FDA conform

Expanded I.D. mm	Min. shrunk O.D. mm	Wall thickness after shrinkage mm	Cat. No.:
(5/64") 2,0	0,7	0,22	S 1828-08
(1/8") 3,2	1,0	0,25	S 1828-16
(3/16") 4,7	1,3	0,30	S 1828-24
(1/4") 6,3	(1/16") 1,6	0,30	S 1828-32
(8/8") 9,5	2,5	0,30	S 1828-40
(1/2") 12,7	3,7	0,38	S 1828-48
(3/4") 19,0	5,7	0,38	S 1828-56
(1") 25,4	7,0	0,38	S 1828-64

Product advantages:

» transparent
» incombustible (ASTM D876)
» insulation resistance 10^{18} Ω/cm (ASTM D 876)
» good electric strength
» flame retardant



BOLA Spiral Tubing

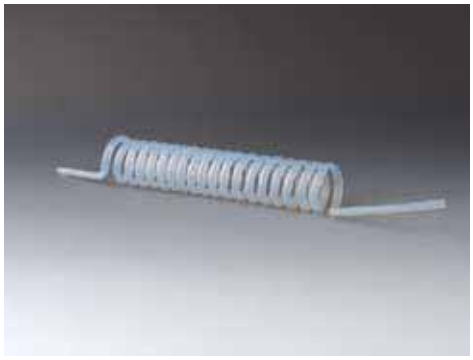
Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -270°C to +260°C**	**+++ universal**	**transparent**

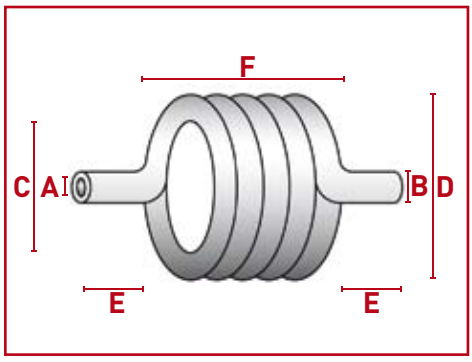
Product description:

Spiral tubing made of PFA is manufactured individually according to your specifications. Please take the possible tubing dimensions from the list on page 120. We would be glad to send you a quotation.
Please complete the list below and send us a copy by fax to +49 (0)9346-928651. Thank you.

FDA conform

	Quantity	
A	Tubing I.D.	
B	Tubing O.D.	
C	Spiral I.D.	
D	Spiral O.D.	
E	Length of tubing ends	
F	Length of spiral	





BOLA Tubing Cutter

Product description:

Ideal for cutting plastic and rubber tubing with and without textile reinforcement up to a diameter of 28 mm. The blade is exchangeable. Not suitable for steel reinforced tubing.

Up to tubing O.D. max. mm			Cat. No.:
28			S 1852-28

BOLA Replacement Blades

Product description:

For tubing cutter S 1852-28.

Up to tubing O.D. max. mm			Cat. No.:
28			S 1853-28

BOLA PEEK Capillary Tubing

Material:	Temperature resistance:	Chemical resistance:
PEEK	from -50°C to +250°C	+++ universal

FDA conform

Product description:

Flexible, brown high-pressure tubing for almost all organic or inorganic liquids.

I.D. mm	O.D. mm	Bending radius mm	Pressure resistant up to bar	Cat. No.:
0,25	(1/16") 1,6	4	350	S 1817-08
0,50	(1/16") 1,6	4	350	S 1817-12
(1/32") 0,80	(1/16") 1,6	4	280	S 1817-16
(1/16") 1,60	(1/8") 3,2	7	280	S 1817-20

Product advantages:

» metal-free
» corrosion-proof
» high pressure resistance
» biocompatible
» high temperature resistance (melting point +334°C)
» alternative for capillary tubing made of titan or stainless steel

BOLA Assortment of Remainder Tubing

Material:	Material:	Material:	Temperature resistance:	Chemical resistance:
PTFE	PFA	FEP	from -200°C to +250°C	+++ universal

FDA conform

Product description:

No rejections. Approx. 10 rolls of unsorted tubing made of PTFE, FEP and PFA with different diameters. Length of up to 2 metres per roll. No selection possible.

			Cat. No.:
			S 1899-10

BOLA Tiles

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Standard sizes with different thicknesses

Length x width x height mm			Cat. No.:
300 x 300 x 2			S 1805-02
300 x 300 x 3			S 1805-04
300 x 300 x 4			S 1805-06
300 x 300 x 5			S 1805-08
300 x 300 x 6			S 1805-10
300 x 300 x 8			S 1805-12
300 x 300 x 10			S 1805-14
300 x 300 x 15			S 1805-16

Applications:

Ideal for using as table pad. Also suitable for using as slideway or for insulation.

BESTSELLER

BOLA Sheets

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Delivered in rolls with a length of 1000 mm. Colour: white

Thickness mm		Cat. No.: width 300 mm	Cat. No.: width 600 mm
0,05		S 1803-02	S 1803-21
0,12		S 1803-04	S 1803-23
0,25		S 1803-06	S 1803-25
0,50		S 1803-08	S 1803-27
0,75		S 1803-10	S 1803-29
1,00		S 1803-12	S 1803-31
1,50		S 1803-14	S 1803-33

Applications:

Ideal for using as table pad or for lining drawers. Also suitable for using as slideway or for insulation.

BOLA Self-Adhesive PTFE Sheets

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PTFE	**from -50°C to +230°C**	**+++ universal**	**transparent**

Product description:

Roll of 1000 mm length with special glue on silicone basis on one side which is protected by a transparent sheet. On the white PTFE-side almost universal chemical resistance. Temperature resistance up to approx. +230°C

FDA conform

Thickness mm	Width mm	Length mm	Cat. No.:
0,25	600	1000	S 1850-16
0,75	600	1000	S 1850-24

Applications:

Ideal for using as table pad or for lining as protection against chemical damages. Also suitable for using as slideway or for insulation. The sheet with thickness 0,75 mm should be used whenever there is a mechanical load or an extremely aggressive ambiance.

BOLA FEP Sheets

Material:	Temperature resistance:	Chemical resistance:
FEP	**from -200°C to +250°C**	**+++ universal**

Product description:

Transparent, gastight and non-porous rolls with a length of 1000 mm.

FDA conform

Thickness mm	Width mm	Length mm	Cat. No.:
0,025	150	1000	S 1833-04
0,05	150	1000	S 1833-08
0,12	150	1000	S 1833-12
0,25	150	1000	S 1833-16
0,025	300	1000	S 1833-34
0,05	300	1000	S 1833-38
0,12	300	1000	S 1833-42
0,25	300	1000	S 1833-46

Applications:

Ideal for using as table pad or for lining drawers. Also suitable for using as slideway or for insulation.

BOLA Rods

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Virginal rods for further treatment and processing in lengths of up to 2 m. Diameter and length are nominal dimensions and can contain a machining allowance.

FDA conform

O.D. mm			Cat. No.:
6			S 1800-06
8			S 1800-08
10			S 1800-10
12			S 1800-12
15			S 1800-15
16			S 1800-16
20			S 1800-20
25			S 1800-25
30			S 1800-30
35			S 1800-35
40			S 1800-40
50			S 1800-50
65			S 1800-65

BOLA Sealing Tape

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

For sealing threads, checked according to DIN / DVGW and KTW.

FDA conform

Width mm	Thickness mm	Length mtr.	Cat. No.:
12	0,1	12	H 960-01

Product advantages:

» does not embrittle, swell and agglutinate

» does not contain oil or grease

» prevents rusting and sticking

» easy removal even after years

BOLA Flat Sealing Tapes

Material: **PTFE**
Temperature resistance: **from -200°C to +270°C**
Chemical resistance: **+++ universal**

NEW

FDA conform

Product description:

Deformable, virginal PTFE flat tape with expanded fibre structure.

Thickness mm	Width mm	Length mtr.	Cat. No.:
5	2	20	H 959-16
10	3	10	H 959-22
14	4	10	H 959-28
22	7	5	H 959-34
30	5	5	H 959-40
50	5	5	H 959-50

Product advantages:

» tasteless
» odourless up to +270°C
» self-adhesive
» physiologically safe
» not ageing
» good sealing also on uneven surfaces
» almost universal chemical resistance
» quick and easy assembly

Applications:

For making customized gaskets "on-site".

BOLA Fluoroplastic Spray

Material: **PTFE**

FDA conform

Product description:

Release and anti-blocking agent as well as lubricant for laboratory,

Capacity ml			Cat. No.:
400			H 958-04

Product advantages:

» dry and greaseless
» CFC-free
» silicone-free
» heat resistant up to +260°C
» non-adhesive and dirt-repellent
» physiologically safe
» excellent gliding and separating effects

BOLA Fluorslidepaste

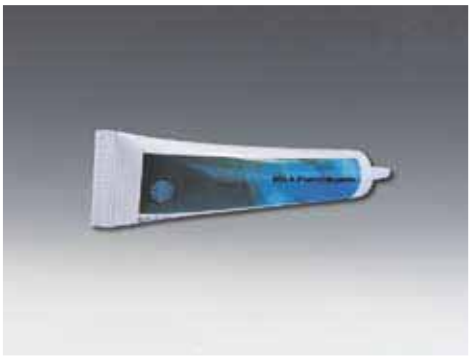
Material: **PTFE**
Temperature resistance: **from -36°C to +260°C**
Chemical resistance: **+++ universal**

FDA conform

Product description:

Extremely stable, synthetic high-temperature paste in resealable tube.

Capacity g			Cat. No.:
56			S 1870-16



Product advantages:

» exceptionally low friction / coefficient
» extremely long-lasting
» for temperatures between -36°C and over +260°C
» resists high mechanical loads
» not soluble in most solvents
» non-flammable
» oxygen-resistant
» compatible with all common elastomers and plastics
» chemical resistance against aggressive chemicals or solvents

BOLA Screws with Countersunk

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

NEW

FDA conform

Product description:

Similar to DIN 963/DIN EN ISO 2009

Thread M	Pitch mm	Usable length mm	Dia. of head mm	Cat. No.:
4	0,7	30	8,4	H 1124-14
5	0,8	30	9,3	H 1124-18
6	1,0	30	11,3	H 1124-22
8	1,25	40	15,8	H 1124-26
10	1,50	40	18,3	H 1124-30

BOLA Screws with Cylindrical Head

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

NEW

FDA conform

Product description:

Similar to DIN 84/DIN EN ISO 1207

Thread M	Pitch mm	Usable length mm	Dia. of head x Height of head mm	Cat. No.:
4	0,7	30	7,0 x 4,0	H 1128-14
5	0,8	30	8,5 x 4,5	H 1128-18
6	1,0	30	10,0 x 5,0	H 1128-22
8	1,25	40	13,0 x 6,0	H 1128-26
10	1,50	40	16,0 x 7,0	H 1128-30

BOLA Hexagon Nuts

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

NEW

FDA conform

Product description:

Similar to DIN 934 / DIN EN ISO 4032

Thread M	Pitch mm	Hexagon mm	Height mm	Cat. No.:
4	0,7	7	5,0	H 1132-14
5	0,8	8	6,0	H 1132-18
6	1,0	10	7,5	H 1132-22
8	1,25	13	9,0	H 1132-26
10	1,50	16	11,0	H 1132-30

BOLA Washers

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

NEW

FDA conform

Product description:

Similar to DIN 125-1, packing unit: 10 pieces

Thread M	O.D. mm	I.D. mm	Height mm	Cat. No.:
4	9,0	4,3	0,9	H 1126-14
5	10,0	5,3	1,1	H 1126-18
6	12,0	6,4	1,8	H 1126-22
8	16,0	8,4	1,8	H 1126-26
10	20,0	10,5	2,2	H 1126-30

BOLA Balls

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

FDA conform

Product description:

Made of solid PTFE, with smooth surface. Different packing units.

Dia. of ball mm	Packing unit		Cat. No.:
3	pack of 100 pieces		H 964-03
6	pack of 100 pieces		H 964-06
9	pack of 100 pieces		H 964-09
12	pack of 100 pieces		H 964-12
15	pack of 50 pieces		H 964-15
20	pack of 50 pieces		H 964-18
25	pack of 25 pieces		H 964-21
30	pack of 25 pieces		H 964-24

Applications:

For extension of surfaces of e. g. distillation apparatus;
as splash guard

BOLA Boiling Stones

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Prevent splashes and production of bubbles during boiling.
Packed in resealable bag.

Grain size mm	Packing unit g		Cat. No.:
4	500		**H 972-02**
6	500		**H 972-04**

Product advantages:

» durable

» almost universal chemical resistance

Ground Joint Components

No matter if you use sleeves with gripping ring, with ribs or sleeves for spherical ground joints – you always make the right choice since they all feature the unique properties of PTFE.

PRODUCT TIPS

Page 134
Bellows

Page 132
Sleeves

Page 133
Sleeves for spherical ground joints

BOLA Sleeves

BOLA Sleeves
– helpful accessories for many applications

All BOLA sleeves are sealing without any grease and the product will not be contaminated by any greasy residues. They are made for creating gastight, liquid-tight and vacuum tight ground joint connections.

Sealing rings on the outside of the sleeves and a low friction coefficient prevent sticking of the ground joints. This reduces the danger of breaking and injury.

The sleeves have an excellent chemical resistance and can be used at working temperatures between -200°C and + 250°C.

Their solid construction (partly with gripping ring) makes them suitable for continued use.

All common joint clamps can still be used.

The sleeves are available for European and American ground joint sizes.

BOLA Sleeves – with sealing rings.

Punctiform sealing on the rings improves both sealing and releasing.

BESTSELLER

BOLA Sleeves with Gripping Ring

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Feature:
PTFE	**from -200 °C to +250°C**	**+++ universal**	**suitable**	**reusable**

Product description:

Made of PTFE, with gripping ring and sealing rings on the outside, high-vacuum tight sealing; low leak rate: <1x10^{-4} mbar x l x s^{-1}; solid construction for continued use; sealing rings are easy accessible and therefore easy to clean.

FDA conform

European standard Size NS	ES Cat. No.:	US standard Size	US Cat. No.:
10/19	H 933-01	14/20	H 935-01
12/21	H 933-02	19/22	H 935-03
14/23	H 933-03	19/38	H 935-04
19/26	H 933-04	24/40	H 935-05
24/29	H 933-05	29/42	H 935-06
29/32	H 933-06	34/45	H 935-07
34/35	H 933-07	45/50	H 935-09
45/40	H 933-09		
50/42	H 933-10		
55/44	H 933-11		
60/46	H 933-12		
71/51	H 933-13		
85/55	H 933-14		
100/60	H 933-15		

BOLA Sleeves with Ribs

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Feature:
PTFE	from -200 °C to +250°C	+++ universal	suitable	reusable

Product description:

Made of PTFE, with sealing rings ("ribs") on the outside. Without gripping ring and therefore usable with joint clamps. For vacuum up to 0,1 mbar; solid construction for continued use; sealing rings are easily accessible and therefore easy to clean.

FDA conform

European standard Size NS	ES Cat. No.:	US standard Size	US Cat. No.:
7/16	H 930-01	14/20	H 932-03
10/19	H 930-02	19/38	H 932-05
12/21	H 930-03	24/40	H 932-06
14/23	H 930-04	29/42	H 932-07
19/26	H 930-05	45/50	H 932-10
24/29	H 930-06		
29/32	H 930-07		
34/35	H 930-08		
40/38	H 930-09		
45/40	H 930-10		
50/42	H 930-11		
60/46	H 930-13		
71/51	H 930-14		
85/55	H 930-15		

Applications:

For example for rotary evaporators.



BOLA Spherical Ground Joint Sleeves

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Feature:
PTFE	from -200 °C to +250°C	+++ universal	suitable	reusable

Product description:

Made of PTFE, with gripping ring and sealing rings on the outside, high-vacuum tight sealing; low leak rate: $<1x10^{-2}$ mbar x l x s^{-1}; solid construction for continued use.

FDA conform

European standard Size S	ES Cat. No.:	US standard Size KS	US Cat. No.:
13	H 934-02	18	H 931-04
19	H 934-04	28	H 931-06
29	H 934-06	35	H 931-10
35	H 934-08	55	H 931-16
40	H 934-12		
51	H 934-16		
64	H 934-18		

BOLA Joint Clamps

Material:	Temperature resistance:	Chemical resistance:	Feature:
PTFE	**from -50 °C to +250°C**	**+++ universal**	**reusable**

Product description:

PTFE-encapsulated steel spring core. Universal chemical resistance since the product is only exposed to PTFE.

FDA conform

Size NS				Cat. No.:
14/23				**H 942-14**
19/26				**H 942-19**
29/32				**H 942-32**
45/40				**H 942-45**

Applications:

For connecting ground joint parts, especially if highly aggressive liquids are involved; high recovery even at high temperatures.

BOLA Bellows

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200 °C to +250°C**	**+++ universal**	**suitable**

Product description:

Made of PTFE, with round folds and sealing rings on the outside; maximum deflection: 40°

FDA conform

Socket NS	Cone NS	Total minimum length, mm	Total maximum length, mm	Cat. No.:
14/23	14/23	86	90	**H 907-03**
29/32	29/32	106	114	**H 907-10**
45/40	45/40	128	144	**H 907-15**

Applications:

Strainless connection of ground joint equipment; for compensating vibrations from vacuum pumps; for length compensation of heated columns; angular misalignment.

BOLA Bellows

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	from -200 °C to +250°C	+++ universal	suitable

Product description:

Made of PTFE, with sharp folds and sealing rings on the outside; maximum deflection: 120°.

FDA conform

A Socket NS European standard	Cone NS	Total minimum length, mm	Total maximum length, mm	ES Cat. No.:
14/23	14/23	82	90	H 906-02
19/26	19/26	93	105	H 906-04
24/29	24/29	110	124	H 906-06
29/32	29/32	100	120	H 906-12
45/40	45/40	130	170	H 906-14
B Socket US standard	**Cone**	**Total minimum length, mm**	**Total maximum length, mm**	**US Cat. No.:**
14/35	14/35	82	90	H 905-02
19/22	19/22	95	97	H 905-07
24/40	24/40	120	137	H 905-15
29/42	29/42	124	142	H 905-17
45/50	45/50	150	165	H 905-21

Applications:

Strainless connection of ground joint equipment; for compensating vibrations from vacuum pumps; for length compensation of heated columns; angular misalignment.

A

B

BOLA Stoppers

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	from -200 °C to +250°C	+++ universal

Product description:

Made of PTFE, with ground joint and sealing rings on the outside; knurled or hexagonal grip. Compared with glass stoppers, they are easily removable and can be used without grease. The stoppers can expand under heat which might lead to a breaking of the ground joint sockets.

FDA conform

A Size NS		Knurled grip Cat. No.:	B Size NS	Wrench size (SW) mm	Hexagonal grip Cat. No.:
10/19		H 936-02			
12/21		H 936-03			
14/23		H 936-04	14/23	19	H 937-04
19/26		H 936-05	19/26	26	H 937-05
24/29		H 936-06			
29/32		H 936-07	29/32	35	H 937-07
34/35		H 936-08			
45/40		H 936-10	45/40	52	H 937-10

Applications:

For closing ground joint parts.

A

B

BOLA Ground Joint Adaptors

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200 °C to +250°C**	**+++ universal**

FDA conform

Product description:

Made of PTFE, socket in cone, with sealing rings on the outside and knurled grip.

Socket NS	Cone NS	Knurled grip dia. mm	Cat. No.:
14/23	19/26	30	**H 980-03**
14/23	29/32	40	**H 980-06**
19/26	29/32	40	**H 980-09**
29/32	45/40	55	**H 980-12**

Applications:

For connecting different ground joint sizes.

BESTSELLER

BOLA Ground Joint Reducing Set

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200 °C to +250°C**	**+++ universal**	**suitable**

NEW

FDA conform

Product description:

Made of PTFE, consisting of reducing rings graduated as follows: NS 14 – NS 19 – NS 24 – NS 29 – NS 34 - NS 45 and NS 60.

Dimensions NS	Height/length of ground joint mm		Cat. No.:
14 - 60	20		**H 981-14**

Applications:

For bridging different cone and socket sizes e. g. a NS 14 cone can functionally be placed into a NS 45 socket.

BOLA Stoppers

Material:	Material:	Temperature resistance:	Chemical resistance:	Transparency:
PTFE	Glass	from -10°C to +100°C	++ very good	transparent

Product description:

Made of borosilicate glass, with hexagonal grip, type SAFE LAB: Patented system consisting of additional threads and a screw nut made of PTFE with glass fibre.

FDA conform

Total height mm	Size NS		Cat. No.:
50	14/23		K 1200-02
75	24/29		K 1200-04
90	29/32		K 1200-05

Applications:

For closing ground joint parts. By turning the screw nut clockwise, a stuck stopper can be removed easily.

BOLA Glass Flange Metal Adaptors

Material:	Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	Silicone	from -50°C to +250°C	+++ universal	low	suitable

Product description:

Made of PTFE and silicone, circular PTFE collar facilitates assembly and assures exact placement of the gasket. The elasticity for expansions and contractions is given by a special kind of silicone which is placed behind PTFE sealing lips. Universal chemical resistance since the product is only exposed to PTFE.

NEW

FDA conform

Nominal width	O.D. mm	Bore dia. mm	Sealing height mm	Cat. No.:
10	25	14	3	D 720-10
15	32	16	3	D 720-15
25	47	27	3	D 720-25

Applications:

For HWS® "Adaptor, metal, for flexible metallic hose" for a reliable sealing between glass flange and metal adaptor. Ideal for sealing temper connections, e.g. on double walled vessels.

BOLA O-Rings

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200 °C to +250°C**	**+++ universal**

FDA conform

Product description:

Made of PTFE. Due to the nearly inexhaustible possibilities of dimensions we only manufacture PTFE-O-Rings to your specifications.

Applications:

As sealing.

BOLA O-Rings for Laboratory Flat Flanges

Material:	Temperature resistance:	Chemical resistance:
FEP	**from -60°C to +205°C**	**++ very good**

FDA conform

Product description:

Silicone core with seamless FEP coating; manufactured according to DIN 12214;1996-12; flexible, almost universal chemical resistance.

For flat flange NW	Dimensions mm		Cat. No.:
60	75 x 4		**H 969-18**
100	110 x 4		**H 969-25**
120	132 x 4		**H 969-45**
150	155 x 5		**H 969-55**
200	214 x 5		**H 969-75**

Applications:

As sealing.

Temperature Measurement

Precise and reliable measurements even in aggressive liquids – all probes are encapsulated with PTFE for maximum chemical resistance.

PRODUCT TIPS

Page 143
PT100 Temperature Probes

Page 142
Double PT100 Temperature Probes

BOLA Temperature Probes and Immersion Probes

Structure and function of BOLA Temperature Probes

All BOLA Temperature Probes are sensors based on platinum resistance changes under temperature influence with a deposited table of values.

The thermocouple itself is located at the end of a PTFE-encapsulated stainless steel tube (material code 1.4571).

The stainless steel tube provides certain rigidity, but can be bent to the requested form by hand, so that the probe can be used at the optimum measuring point.

A connection can either be made by using LEMO® couplings or by connecting the strands of the cable directly to your measuring device. The cable is also encapsulated with PTFE/PFA and connected tightly to the temperature probe.

Advantages of BOLA Temperature Probes

Reduction of response time
The probes have tapered tips which reduces the response time considerably.

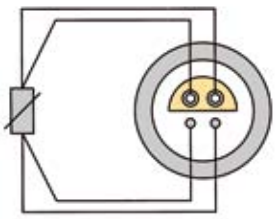
Chemical resistance and no metal
The PTFE encapsulation provides an almost universal chemical resistance. All parts which are exposed to the medium do not contain any metal.

High measuring accuracy
Due to the four-wire system, the influence of output and transfer resistance is almost eliminated (aberration approx. 0.002-0.004 %/Ohm). A comparison is normally not needed. The length of the cable can be quite long.

Safe to handle
Due to a collar ring at its end, the probe cannot fall into the medium.

Performance data of BOLA Temperature Probes

Pin configuration of the LEMO® coupling



Denomination:	Temperature probe / PT 100
Temperature range:	-50°C to +250°C
Specification:	DIN EN 60751
Type:	Platinum temperature sensor
Class:	A
Tolerance:	0,15 + (0,002 x (t))
Typical aberrations:	at 0°C: +/-0,15°C at 100°C: +/- 0,35°C

We produce temperature probes according to your indications

Do you need a different temperature probe?
No problem – we can quote for your special requirements.

Coating custom temperature probes and thermometers

We can coat your temperature probes or thermometers with a PTFE heat shrinkable tubing so that they have the chemical resistance of PTFE. Even if the probes or thermometers break, there is no risk of contamination due to the PTFE coating.

Because of the thin coating, the probe or thermometer has slower response behaviour.

For coating, your probe/thermometer has to resist a short-time temperature of minimum +250°C.

Please contact us!

HELPFUL: page **224**
Determination of response times of temperature probes

Response times of BOLA Temperature Probes

Due to the properties of PTFE, the response times of PTFE-encapsulated temperature probes are longer than the response times of glass or metal probes. We have indicated all corresponding T 50 and T 90 values of our temperature probes.

Plugs and sockets

Our temperature probes are normally supplied with sockets type LEMO® size 1. Should you need a different LEMO® size or a plug instead of a socket, we can offer corresponding adaptors.

We can also supply temperature probes with your specific plug or socket. You can find below the most important dimensions for determination of LEMO® plugs and sockets.

Easy identification of plug and socket size!

You can find out your plug or socket size as follows:

Plug Lemo Size 0
O.D. 7 mm

Plug Lemo Size 1
O.D. 9 mm

Socket Lemo size 0
O.D. 9 mm

Socket Lemo size 1
O.D.12 mm

BESTSELLER

BOLA Double Temperature Probes Lemo® Compact

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Two independent thermocouples in one PTFE-encapsulated stainless steel tube (1.4571). Temperature probe Ø 8 mm, tip Ø 6 mm, collar ring Ø 12 mm. Connection by two couplings (type Lemo®, socket size 1, 4-pole) fixed directly at the end of the probe.

NEW

FDA conform

Typical response times:

» T 50: 20 - 24 s
» T 90: 30 s

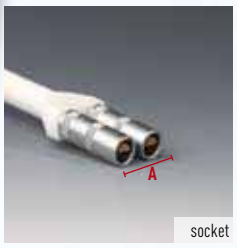
See page 224 for detailed explanation.

Usable length mm	Total length mm	Number of thermocouples	Width of coupling A mm	Cat. No.:
300	400	2 x PT 100	27	**P 1740-20**
400	500	2 x PT 100	27	**P 1740-23**
500	600	2 x PT 100	27	**P 1740-30**

Applications:

» parallel temperature measurement in aggressive liquids
» double safety due to redundant systems
» control function due to two independent thermocouples
» simultaneous temperature measurement and safety switching in only one port
» ideal for built-in measurement cables

probe tip



socket

BOLA Temperature Probes Lemo® Compact

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

One thermocouple in a PTFE-encapsulated stainless steel tube (1.4571). Temperature probe Ø 8 mm, tip Ø 6 mm, collar ring Ø 12 mm. Connection by a coupling (type Lemo®, socket size 1, 4-pole) fixed directly at the end of the probe.

FDA conform

Typical response times:

» T 50: 7 - 12 s
» T 90: 14 - 16 s
See page 224 for detailed explanation.

Usable length mm	Total length mm		Cat. No.:
100	170		**P 1730-10**
300	370		**P 1730-20**
400	470		**P 1730-23**
500	570		**P 1730-25**

Applications:

» temperature measurement in aggressive liquids
» ideal for built-in measurement cables

probe tip

socket

SUITABLE: page **71**
Swivelling screw fittings

BOLA Temperature Probes Lemo®

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**


probe tip


socket

FDA conform

Product description:

One thermocouple in a PTFE-encapsulated stainless steel tube (1.471). Temperature probe Ø 8mm, tip Ø 6mm, collar ring Ø 12mm. With white PTFE-coated cable (length: 1,5m) and coupling (type Lemo® socket size 1, 4-pole).

Typical response times:

» T 50: 7 - 12 s
» T 90: 14 - 16 s
See page 224 for detailed explanation.

Usable length mm	Total length		Cat. No.:
100	160		**P 1760-10**
200	260		**P 1760-15**
300	360		**P 1760-20**
500	560		**P 1760-25**
600	660		**P 1760-30**

Applications:

» temperature measurement in aggressive liquids
» cable provides flexible connection from measuring device to medium

BOLA Temperature Probes

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**


probe tip


connecting cable

FDA conform

Product description:

One thermocouple in a PTFE-encapsulated stainless steel tube (1.471). Temperature probe Ø 8mm, tip Ø 6mm, collar ring Ø 12mm. With white PTFE-coated cable (length: 1,5m, 4 strands).

Typical response times:

» T 50: 7 - 12 s
» T 90: 14 - 16 s
See page 224 for detailed explanation.

Usable length mm	Total length		Cat. No.:
100	160		**P 1750-10**
200	260		**P 1750-15**
300	360		**P 1750-20**
500	560		**P 1750-25**
600	660		**P 1750-30**

Applications:

» temperature measurement in aggressive liquids
» cable provides flexible connection from measuring device to medium

BOLA Total Immersion Probes Lemo®

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Total immersion probe (class A, PRT 100), with white PTFE-coated cable, coupling (type Lemo®, socket size 1, 4- pole) and collar ring Ø 5 mm.

Typical response times:

» T 50: 4 - 6 s
» T 90: 6- 8 s

See page 224 for detailed explanation.

Usable length mm	Probe dia. mm	Cable length m	Cat. No.:
50	4	4	**P 1790-20**

Applications:

» e.g. for measuring temperatures in autoclaves
» can be immersed totally into the liquid


probe tip


socket

BOLA Total Immersion Probes

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Total immersion probe (class A, PRT 100), with white PFA-coated cable (4 strands) and collar ring Ø 5 mm.

Typical response times:

» T 50: 4 - 6 s
» T 90: 6 - 8 s

See page 224 for detailed explanation.

Usable length mm	Probe dia. mm	Cable length m	Cat. No.:
50	4	4	**P 1780-20**

Applications:

» e.g. for measuring temperatures in autoclaves
» can be immersed totally into the liquid


probe tip


connecting cable



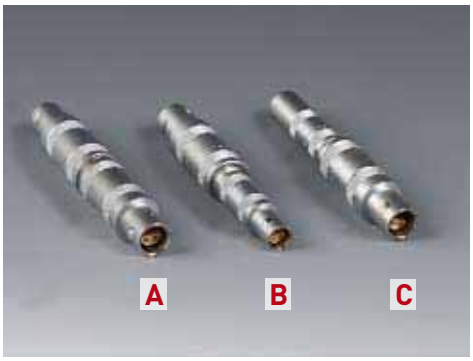
BOLA Adaptors for Temperature Probes

NEW

Product description:

4-pole adaptors. All BOLA temperature probes are equipped with a socket size 1.

	Size first side	Size second side	Length mm	Transition from size	Cat. No.:
A	Plug 1	Plug 1	72	Socket size 1 to Socket size 1	P 1720-16
B	Plug 1	Plug 0	65	Socket size 1 to Socket size 0	P 1720-32
C	Plug 1	Socket 0	65	Socket size 1 to Plug size 0	P 1720-24



Applications:

- for the connection of different sizes of plugs and couplings
- for the connection of existing ports to temperature probes
- for the connection of existing measurement cables with plugs or sockets of company Lemo®

Vessels and Distillation Equipment

A suitable solution for practically every application in well-known BOLA-quality and optimally adapted to your needs.

PRODUCT TIPS

Page 148
Scrubber Bottles

Page 163
Digestion Vessels

Page 166
Distillation Apparatus

BOLA Scrubber Columns

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
FEP	**from -200°C to +205°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

Tall, slim scrubber column made of FEP. Inlet and outlet tube as well as riser tube are made of FEP (5,6 x 8 mm), bottom and top are made of pure PTFE. The standard PTFE frit has a pore size of approx. 3 µm and is screwed on the riser tube with an M8x1 thread. It can be exchanged with the PTFE gas distributor with fine bores (Cat. No. N 1501-16 – page 198) which needs a lower primary pressure.

FDA conform

Capacity ml	Total height mm	Connection for tubing O.D. mm	O.D. of column mm	Cat. No.:
500	400	2 x 8	54	**A 117-04**
1.000	700	2 x 8	54	**A 117-08**

Product advantages:

» transparent
» unbreakable
» intense mixing of gas due to tall riser tube
» frit easily exchangeable

SUTABLE: page **197**
Scrubber Adaptor for Bottles with GL 45 and GLS 80

BOLA Scrubber Bottles

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

Bottle made of PFA. PTFE top with two threaded connections. The standard PTFE frit has a pore size of approx. 3 µm and is screwed on the riser tube with an M8x1 thread. It can be exchanged with the PTFE gas distributor with fine bores (Cat. No. N 1501-16 – page 198) which needs a lower primary pressure.

FDA conform

Capacity ml	Total height mm	Connection for tubing O.D. mm	O.D. of bottle mm	Cat. No.:
250	175	2 x 6	60	**A 118-01**
500	200	2 x 6	75	**A 118-02**
1.000	240	2 x 8	95	**A 118-03**

Product advantages:

» transparent
» unbreakable
» frit easily exchangeable

BOLA Micro Scrubber Bottles

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

For use with volumes up to 50 ml. The gas inlet tube (not included, please choose a hard-walled tubing) is inserted through the fitting on the top and can be fixed safely. The side fitting is used as gas outlet.

FDA conform

Capacity ml	Total height mm	Connection for tubing O.D. mm	O.D. of bottle mm	Cat. No.:
50	180	6	31	**A 119-24**

Product advantages:

» transparent

» unbreakable

» non-porous

Applications:

Can also be used as cold trap.

BOLA Wide-Mouth Bottles

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -200°C to +250°C**	**+++ universal**	**no pressure**

Product description:

Thick-walled, smooth interior surface, screw cap.

FDA conform

Capacity ml	Total height mm	I.D. mm	O.D. mm	Thread of screw cap	Cat. No.:
1	22	9	12	M 12 x 1,0	**A 100-01**
5	35	15	20	M 20 x 1,5	**A 100-03**
10	44	18	28	GL 25 x 3,5	**A 100-04**
25	53	25	34	GL 32 x 4,0	**A 100-05**
50	72	31	45	GL 40 x 4,0	**A 100-06**
100	87	34	50	GL 45 x 4,0	**A 100-07**
250	122	34	63	GL 45 x 4,0	**A 100-08**
500	157	46	75	GL 56 x 4,0	**A 100-09**
1.000	194	58	100	GL 70 x 5,0	**A 100-10**

BOLA Wide-Mouth Bottles with Conical Neck

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

Transparent, non-porous, conical neck, screw cap.

FDA conform

Capacity ml	Total height mm	I.D. mm	O.D. mm	Buttress thread S	Cat. No.:
50	94	20	38	28	**A 103-03**
100	117	20	45	28	**A 103-06**
250	153	32	61	40	**A 103-09**
500	181	32	76	40	**A 103-12**
1.000	221	32	94	40	**A 103-15**

SUITABLE: page **60**
Distributors for different threads and tubing diameters

SUITABLE: page **65**
Threaded adaptors for connecting different kinds of bottle threads

BOLA Wide-Mouth Bottles with Conical Neck

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -200°C to +250°C**	**+++ universal**	**no pressure**

Product description:

Thick-walled, smooth interior surface, ergonomic grips on bottle and screw cap.

FDA conform

Capacity ml	Total height mm	I.D. of neck mm	O.D. mm	Thread M	Cat. No.:
25	62	19	33	25 x 2,0	**A 111-16**
50	77	25	43	30 x 2,0	**A 111-24**
100	87	33	52	42 x 2,5	**A 111-32**
250	112	42	67	48 x 2,5	**A 111-40**

BOLA Narrow-Mouth Bottles with Conical Neck

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
FEP	**from -200°C to +205°C**	**++ very good**	**no pressure**	**transparent**

Product description:

Transparent, non-porous, conical neck, tall shape, screw cap.

FDA conform

Capacity ml	Total height mm	I.D. of neck mm	O.D. mm	Thread GL	Cat. No.:
50	93	10	38	18	**A 105-03**
100	122	10	45	18	**A 105-06**
250	163	17	61	25	**A 105-09**
1.000	235	22	96	32	**A 105-15**

BOLA Wash Bottles

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**transparent**

Product description:

Transparent, non-porous, graduated, screw cap.

FDA conform

Capacity ml	Total height mm	O.D. mm	Cat. No.:
250	200	60	**A 114-02**
500	280	72	**A 114-03**
1.000	320	92	**A 114-04**

BOLA Round Bottom Flasks

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**suitable**	**transparent**

Product description:

Transparent, non-porous, with ground joint neck size 29, conditionally suitable for vacuum, e.g. at 30 mbar and 50°C.

FDA conform

Capacity ml	Total height mm	O.D. of ball mm	Cat. No.:
100	117	67	**A 158-06**
250	149	88	**A 158-08**
500	177	107	**A 158-09**

Applications:

For example for rotary evaporators

SUITABLE: page **135**
Different types of stoppers

BOLA Round Bottom Flasks with Two or Three Ground Joint Necks

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**suitable**	**transparent**

Product description:

Transparent, non-porous, central ground joint neck size 29 and lateral ground joint necks. Conditionally suitable for vacuum, e.g. at 30 mbar and 50°C.

FDA conform

A	Capacity ml	Total height mm	O.D. of ball mm	Lateral necks NS	Cat. No.:
	100	117	67	1 x 14/23	**A 155-12**
	250	149	88	1 x 29/32	**A 155-20**
	500	177	107	1 x 29/32	**A 155-36**
B	**Capacity ml**	**Total height mm**	**O.D. of ball mm**	**Lateral necks NS**	**Cat. No.:**
	100	117	67	2 x 14/23	**A 156-12**
	250	149	88	2 x 29/32	**A 156-20**
	500	177	107	2 x 29/32	**A 156-36**

BOLA Round Bottom Flasks with Threaded GL Necks

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**suitable**	**transparent**

Product description:

Transparent, non-porous, central ground joint neck size 29 and 2 lateral GL 18 threaded necks (suitable laboratory screw joints with Cat. No. D 629-.. can be found on page 57). Conditionally suitable for vacuum, e.g. at 30 mbar and 50°C.

FDA conform

Capacity ml	Total height mm	O.D. of ball mm	Cat. No.:
100	117	67	**A 149-12**
250	149	88	**A 149-20**
500	177	107	**A 149-36**

BOLA Jars

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

Translucent, non-porous, sturdy design, screw cap.

FDA conform

Capacity ml	Total height mm	O.D. mm	I.D. mm	Thread S	Depth mm	Cat. No.:
7	37	22	18,5	24	32	**A 130-01**
15	40	31	25,5	32	34	**A 130-02**
22	50	31	25,5	32	50	**A 130-03**
30	70	31	25,5	32	63	**A 130-04**
60	47	50	45,5	52	40	**A 130-05**
90	67	50	45,5	52	58	**A 130-06**
120	53	66	60,0	69	45	**A 130-07**
240	95	66	60,0	69	86	**A 130-09**
360	88	85	80,0	88	78	**A 130-10**
500	120	85	80,0	88	109	**A 130-11**
1.000	151	107	100,0	110	139	**A 130-12**

BOLA Jars

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

Translucent, non-porous, sturdy design, screw cap with 2 connections for tubing O.D. 6,35 mm (1/4"). Suitable PTFE, PFA and FEP tubing can be found on page 118.

FDA conform

Capacity ml	Total height mm	O.D. mm	I.D. mm	Cat. No.:
120	74	66	60	**A 131-12**
240	116	66	60	**A 131-14**
360	109	85	80	**A 131-15**

BOLA Micro Reaction Vessels

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**low pressure**	**suitable**	**transparent**

Product description:

Vessel made of translucent, non-porous PFA, screw cap made of PTFE with threaded necks for connection of e. g. thermometers, probes or sensors.

FDA conform

Capacity ml	Total height mm	O.D. mm	I.D. mm	for Tube O.D. max. mm	Threaded necks	Cat. No.:
90	96	50	45,5	2 x 8,5 / 1 x 10	2 x GL14 / 1 x GL18	**B 318-40**
240	130	66	60,0	2 x 10,0 / 1 x 16	2 x GL18 / 1 x GL25	**B 318-64**
500	158	85	80,0	3 x 16	3 x GL25	**B 318-80**

SUITABLE: page **57**
Laboratory screw joints

BOLA Vials

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

Product description:

Translucent, non-porous, with round or conical bottom, screw cap.

FDA conform

	Capacity ml	Total height mm	O.D. mm	Bottom shape	Thread S	Cat. No.:
A	5	36	22	conical	25	**A 194-04**
	30	76	30	conical	32	**A 194-08**
B	7	36	22	round	25	**A 195-04**
	15	40	30	round	32	**A 195-08**

Applications:

For centrifugal or evaporation work.

BOLA Jars with Ground Joint

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Transparency:
PFA	**from -50°C to +250°C**	**+++ universal**	**suitable**	**transparent**

NEW

FDA conform

Product description:

Jar made of translucent, non-porous PFA, screw cap made of PFA with integrated ground joint neck size 29 made of PTFE.

Capacity ml	Total height mm	O.D. mm	I.D. mm	Cat. No.:
1.000	193	107	100	**A 159-24**
2.000	310	107	100	**A 159-36**

Applications:

Evaporation vessel for rotary evaporators, reaction vessel

BESTSELLER

BOLA Beakers

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Thick-walled, smooth interior surface, reinforced upper rim, with spout. Optionall PTFE lid with centering shoulder is available.

Capacity ml	Height mm	O.D. mm	I.D. mm	Cat. No.:
3	22	17	15	**A 136-02**
5	24	21	19	**A 136-03**
10	36	26	23	**A 136-04**
25	47	31	28	**A 136-05**
50	57	41	35	**A 136-06**
100	78	51	44	**A 136-07**
150	92	56	48	**A 136-08**
250	97	65	58	**A 136-09**
500	119	81	76	**A 136-11**
1.000	152	105	97	**A 136-13**
2.000	198	142	136	**A 136-14**
3.000	232	156	148	**A 136-15**

BOLA Lids

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Lid with centering shoulder.

O.D. mm	Suitable for Cat. No.:	Cat. No.:	O.D. mm	Suitable for Cat. No.:	Cat. No.:
27	A 136-03	**H 927-03**	82	A 136-09	**H 927-09**
35	A 136-04	**H 927-04**	94	A 136-11	**H 927-11**
40	A 136-05	**H 927-05**	125	A 136-13	**H 927-13**
50	A 136-06	**H 927-06**	166	A 136-14	**H 927-14**
60	A 136-07	**H 927-07**	185	A 136-15	**H 927-15**
66	A 136-08	**H 927-08**			

BOLA Beakers

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**transparent**

FDA conform

Product description:

Translucent, non-porous, graduated, with spout.

Capacity ml	Height mm	O.D. bottom mm	Cat. No.:
25	50	23	**A 137-01**
50	58	39	**A 137-02**
100	71	50	**A 137-03**
250	95	67	**A 137-05**
500	119	82	**A 137-07**
1.000	141	104	**A 137-09**

BOLA Erlenmeyer Flasks

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

FDA conform

Product description:

Thick-walled, with ground joint.

Capacity ml	Height mm	O.D. bottom mm	Ground Joint NS	Cat. No.:
50	86	54	19/26	**A 151-01**
100	128	63	19/26	**A 151-02**
250	144	85	29/32	**A 151-03**
500	190	107	29/32	**A 151-04**

BOLA Evaporating Dishes

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Cylindrical shape, without spout.

Capacity ml	Height mm	O.D. mm	I.D. mm	Cat. No.:
25	27	43	40	**A 170-01**
50	25	66	62	**A 170-02**
100	29	80	75	**A 170-03**
250	56	100	94	**A 170-04**

BOLA Evaporating Dishes, Conical Shape

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:
Conical shape, with spout.

FDA conform

Capacity ml	Height mm	O.D. top mm	O.D. bottom mm	Cat. No.:
25	37	38	34	A 169-01
50	41	49	46	A 169-02
100	54	64	60	A 169-03
250	62	97	90	A 169-04

BOLA Evaporating Dishes

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:
Cylindrical shape, with spout.

FDA conform

Capacity ml	Height mm	O.D. mm	I.D. mm	Cat. No.:
100	18	105	100	A 176-02
250	36	130	125	A 176-03

SUITABLE: page **49**
Spatula and tweezers

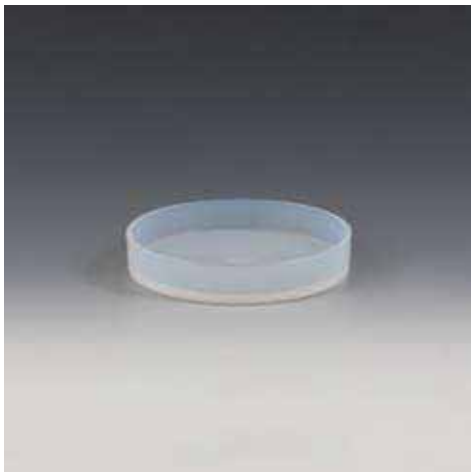
BOLA Evaporating Dishes

Material: **PFA**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:
Cylindrical shape, without spout, transparent, non-porous, stackable.

FDA conform

Capacity ml	Height mm	O.D. mm	I.D. mm	Cat. No.:
15	14,0	56	50	A 177-01
100	19,5	105	100	A 177-03



BOLA Evaporating Dishes

Material:	Temperature resistance:	Chemical resistance:
PFA	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Conical shape, with spout, transparent, non-porous.

Capacity ml	Height mm	O.D. top mm	O.D. bottom mm	Cat. No.:
100	30	90	60	**A 171-01**

BOLA Crucibles

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Conical, bellied shape, without spout.

Capacity ml	Height mm	O.D. top mm	O.D. bottom mm	Cat. No.:
25	26	49	33	**A 197-03**
50	35	62	33	**A 197-04**
100	48	78	45	**A 197-05**

BOLA Watch Dishes

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Convex shape

O.D. mm	Height mm		Cat. No.:
50	8		**A 200-01**
75	8		**A 200-02**
100	11		**A 200-03**
125	12		**A 200-04**

Applications:

For blends or for covering vessels

BOLA Test Tubes

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Round bottom, wall thickness 1 mm.

FDA conform

Capacity ml	Height mm	O.D. mm	Cat. No.:
1,5	70	8	**A 181-01**
4,8	100	10	**A 181-02**
7,0	100	12	**A 181-03**
20,0	160	16	**A 181-04**
34,0	180	18	**A 181-05**

BOLA Test Tubes

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**transparent**

Product description:

Round bottom, transparent, non-porous, wall thickness 1 mm, with PTFE screw cap.

FDA conform

Capacity ml	Height mm	O.D. mm	Cat. No.:
10	140	12	**A 185-01**
15	110	16	**A 185-02**
20	160	16	**A 185-03**
50	220	22	**A 185-05**

BOLA Test Tubes

Material:	Temperature resistance:	Chemical resistance:	Transparency:	autoclave:
PFA	**from -200°C to +250°C**	**+++ universal**	**transparent**	**121°**

Product description:

Round bottom, transparent, non-porous, wall thickness 1 mm.

FDA conform

Capacity ml	Height mm	O.D. mm	Cat. No.:
10	140	12	**A 183-01**
15	110	16	**A 183-02**
20	160	16	**A 183-03**
25	150	19	**A 183-04**

BOLA Centrifuge Tubes

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Round bottom

Capacity ml	Height mm	O.D. mm	Wall thickness mm	Cat. No.:
12	100	16	1	**A 193-02**
28	107	24	2	**A 193-03**
50	100	34	2,5	**A 193-04**

BOLA Sampling Bags

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PVF	**from -200°C to +250°C**	**+ good**	**transparent**

Product description:

Transparent, non-porous, without plasticisers, with 2 exchangeable ports made of PTFE.

Capacity l	Length mm	Width mm	Cat. No.:
1,0	150	250	**A 223-58**
2,0	200	250	**A 223-62**
5,0	250	350	**A 223-70**
10,0	350	500	**A 223-74**

Applications:

For the storage of gases or liquids.

BOLA Connectors for Sampling Bags

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Connectors to be screwed in the ports of sampling bags.

	Type	O.D. mm	Bore dia. mm	Cat. No.:
A	Connector with tube	6	3	**A 226-06**
B	Stopcock with tube	6	3	**A 226-12**

BOLA Funnels

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	from -200°C to +250°C	+++ universal

Product description:

Conical opening with long outlet.

FDA conform

I.D. inlet mm	O.D. inlet mm	I.D. outlet mm	O.D. outlet mm	Total height mm	Cat. No.:
30	33	4	7	50	H 920-02
50	52	6	10	84	H 920-04
74	78	6	11	116	H 920-06
99	104	10	15	150	H 920-08
152	158	11	18	200	H 920-10

BOLA Dipper Vessels

Material:	Temperature resistance:	Chemical resistance:	autoclave:
PTFE	from -200°C to +250°C	+++ universal	121°

Product description:

With handle and holes in wall and botton.

FDA conform

I.D. of vessel mm	O.D. of vessel mm	Depth of vessel mm	Dia. of bores mm	Total height mm	Cat. No.:
35	38	60	6	100	H 1138-08
57	60	100	8	175	H 1138-16
95	100	140	12	230	H 1138-24

Applications:

For washing, rinsing or dipping solids in aggressive or pure substances.

BOLA Dipper Baskets

Material: **PFA**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

Non-porous basket with a mesh size of approx. 0,6 x 0,6 mm in the bottom, with fixed stem.

FDA conform

I.D. of vessel mm	O.D. of vessel mm	Depth of vessel mm	Total height mm	Cat. No.:
62	75	19	176	H 997-03

Applications:

For washing, rinsing or dipping solids in aggressive or pure substances.

BOLA Sample Cups

Material: **PP**
Temperature resistance: **from -20°C to +110°C**
Chemical resistance: **++ very good**

Product description:

Different colours, smooth interior surface, non-slip outer surface, dishwasher safe, conical shape, height 85 mm, wall thickness 2 mm.

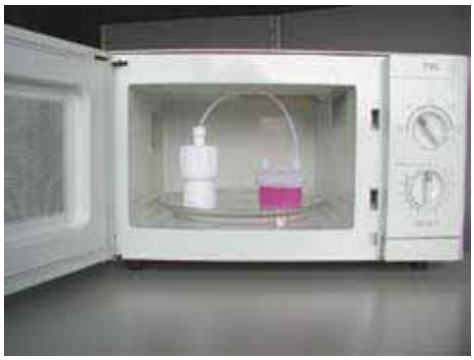
FDA conform

Colour			Cat. No.:
clear			H 1050-08
red			H 1051-08
blue			H 1052-08
green			H 1053-08
yellow			H 1054-08
white			H 1055-08

Applications:

Storage of samples, also usable as drinking cups.

BOLA Hydrolyzing and Digestion Vessels for Microwave Ovens



Microwave ovens are often used for making quick and easy digestions. The energy of a microwave oven penetrates the material of the vessel almost without any loss. It only heats the liquid within a few seconds over the boiling point.

BOLA Digestion Vessels are made of TFM, a modified PTFE with thermoplastic parts for a homogenous, non-porous surface which avoids contaminations and memory effects.

They are available in 2 versions:

» Cat. No. A 240-..: consisting of basic vessel, screw cover and mounted sealing and rupture membrane.

» Cat. No. A 250-..: consisting of basic vessel, screw cover, mounted sealing and rupture membrane and exchangeable liner which allows a more precise weighted sample and different digestions with only one basic vessel.

As soon as the pressure exceeds the maximum limit, the rupture membrane bursts and the released liquid will be drained through an optional tubing (O.D. 6,35 mm / 1/4") into a separately available collecting vessel (see Cat. No. A 131-..).

Material:	Material:	Chemical resistance:
PTFE	**TFM**	**+++ universal**

BOLA Digestion Vessels

Product description:

Dimensionally stable basic vessel and screw cover made of TFM, homogenous, non-porous surface. 1 piece of sealing and rupture membranes already mounted, 10 pieces of replacement membranes included in delivery. For samples of up to max. 0,5 g.

FDA conform

Capacity ml	Internal dimensions Ø x Height mm	O.D. of body mm	O.D. of cover mm	Pressure max. bar	Temperature max. C°	Cat. No.:
5	15 x 32	30	40	25	160	**A 240-02**
10	16 x 52	50	60	25	160	**A 240-04**
20	22 x 60	50	60	20	150	**A 240-06**
50	33 x 62	69	95	20	150	**A 240-08**
100	35 x 110	70	95	15	140	**A 240-10**

BOLA Digestion Vessels with Liners

Product description:

Dimensionally stable basic vessel with exchangeable liner and screw cover made of TFM, homogenous, non-porous surface. The liner allows a more precise weighted sample and different digestions with only one basic vessel. 1 piece of sealing and rupture membranes already mounted, 10 pieces of replacement membranes included in delivery. For samples of up to max. 0,5 g.

FDA conform

Capacity ml	Internal dimensions Ø x Height mm	O.D. of body mm	O.D. of cover mm	Pressure max. bar	Temperature max. C°	Cat. No.:
10	24 x 63	50	60	25	160	**A 250-04**
20	30 x 63	50	60	20	150	**A 250-06**
50	43 x 77	69	95	20	150	**A 250-08**

BOLA Liners

Product description:

Liners for digestion vessels (Cat. No. A 250-..) made of TFM, homogenous, non-porous surface

FDA conform

For capacity ml	Weight g	Suitable for Cat. No.:	Cat. No.:
10	48	A 250-04	**A 252-04**
20	55	A 250-06	**A 252-06**
50	112	A 250-08	**A 252-08**

BOLA Hydrolyzing and Digestion Vessels for Microwave Ovens

BOLA Sealing and Rupture Membranes

Product description:

1 set consisting of 10 sealing membranes made of PFA and 10 rupture membranes made of PTFE, for digestion vessels (Cat. No. A 240-.. and A 250-..)

FDA conform

For capacity ml			Cat. No.:
5			A 244-02
10 and 20			A 244-04
50 and 100			A 244-06

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**no pressure**	**transparent**

BOLA Jars with Tubing Connections

Product description:

Collecting vessel for liquids which are released after the burst of sealing and rupture membranes in the digestion vessels. Translucent, non-porous, sturdy design, screw cap with 2 connections for tubing O.D. 6,35 mm (1/4"). Suitable tubing made of PTFE, FEP or PFA can be found on page 118.

FDA conform

Capacity ml	Total height mm	O.D. mm	I.D. mm	Cat. No.:
120	74	66	60	A 131-12
240	116	66	60	A 131-14
360	109	85	80	A 131-15

BOLA Flat Flange Distillation Apparatus

Product description:

Suitable for the distillation of strong alkaline or acid products as well as very aggressive solvents when the resistance of other materials, e.g. glass, is not sufficient. All parts exposed to the medium are either made completely of PTFE/PFA or, like the thermometers, jacketed with PTFE. The distillate in the Liebig Condenser is conducted to the collecting vessel through a PFA pipe.

For heating, we recommend to either use a thermostat or an electric heating mantle. A temperature of +200°C should not be exceeded.

As alternative to the reaction vessel made of PTFE with round bottom, you can also use the reaction vessel made of PFA with flat bottom. It is translucent, non-porous and can be used with a hotplate magnetic stirrer and a PTFE-encapsulated magnetic stirring bar for stirring.

The Safe-Lab principle:

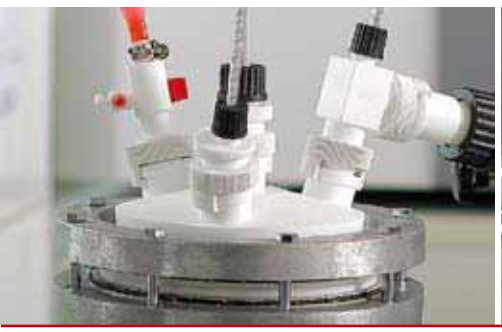
For security reasons, our distillation apparatus are equipped with the patented Safe-Lab system. This system allows a tight and safe connection as well as an easy disconnection of cone and socket. A special nut which is held on an external thread above the cone holds and locks the socket. For disconnection, this special nut has to be turned clockwise. The power is enforced by the thread pitch and is transferred axially to the socket. The ground joint is released.

BOLA Flat Flange Distillation Apparatus

Material:	Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	PFA	from -200°C to +250°C	+++ universal	suitable

FDA conform

Capacity Cat.No.:	500 ml B 280-03	1.000 ml B 280-06	2.000 ml B 280-09	4.000 ml B 280-12	6.000 ml B 280-15
Total dimensions H x L mm	450 x 600	550 x 700	700 x 750	750 x 980	790 x 1000
Flat Flange Reaction Vessels	NW 100 B 281-03	NW 100 B 281-06	NW 100 B 281-09	NW 150 B 281-12	NW 150 B 281-15
Flat Flange Gaskets	NW 100 B 282-02	NW 100 B 282-02	NW 100 B 282-02	NW 150 B 282-04	NW 150 B 282-04
Flat Flange Lids	NW 100 B 283-02	NW 100 B 283-02	NW 100 B 283-02	NW 150 B 283-04	NW 150 B 283-04
Flat Flange Joining Pieces	NW 100 B 284-02	NW 100 B 284-02	NW 100 B 284-02	NW 150 B 284-04	NW 150 B 284-04
Dropping Funnels with Cone NS 29/32	125 ml B 285-01	125 ml B 285-01	250 ml B 285-02	500 ml B 285-03	500 ml B 285-03
Liebig Condensers	300 mm B 291-02	450 mm B 291-04	450 mm B 291-04	600 mm B 291-06	600 mm B 291-06
Distillation Thermometers 0/+250:1C°	B 290-03	B 290-03	B 290-03	B 290-03	B 290-03
Moon-Shaped Stirrer Shafts	Ø 10 x 350 mm C 376-12	Ø 10 x 450 mm C 376-14	Ø 10 x 510 mm C 376-16	Ø 10 x 600 mm C 376-18	Ø 10 x 600 mm C 376-18
Thermometers for Flask 0/+250:1C°	Ø 7 x 450 mm B 287-03	Ø 7 x 450 mm B 287-03	Ø 7 x 530 mm B 287-06	Ø 7 x 600 mm B 287-09	Ø 7 x 600 mm B 287-09
Thermometer Holders NS 29/32	B 286-03	B 286-03	B 286-03	B 286-03	B 286-03
Stirrer Bearings NS 29/32	B 288-02	B 288-02	B 288-02	B 288-02	B 288-02
Distillation Heads 2x NS 29/32	B 289-02	B 289-02	B 289-02	B 289-02	B 289-02
Receiver Adaptors	B 292-02	B 292-02	B 292-02	B 292-02	B 292-02
Vacuum Stopcocks	B 293-02	B 293-02	B 293-02	B 293-02	B 293-02
Round Bottom Flasks with Ground Joint or Distillate Bottles	100 ml A 158-06	250 ml A 158-08	500 ml A 158-09	1.000 ml B 305-04	1.000 ml B 305-04



BOLA Flat Flange Reaction Vessels

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Round bottom, thick wall, smooth interior surface. Can be heated by a thermostat or an electric heating mantle.

FDA conform

Capacity ml	Flange NW	O.D. of vessel mm	Total height mm	Cat. No.:
500	100	110	120	**B 281-03**
1.000	100	110	205	**B 281-06**
2.000	100	140	270	**B 281-09**
4.000	150	200	290	**B 281-12**
6.000	150	215	320	**B 281-15**

BOLA Flat Flange Reaction Vessels

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**transparent**

Product description:

Flat bottom, translucent, non-porous, big opening. Can be heated by thermostats or an electric heating mantle or can be used with a heatable magnetic stirrer and a PTFE-encapsulated magnetic stirring bar for stirring.

FDA conform

Capacity ml	Flange NW	O.D. of vessel mm	Total height	Cat. No.:
2.400	170/146	150	150	**B 320-01**

BOLA Flat Flange Gaskets

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

Gasket with silicone inlet (thickness 0,5 mm). Universal chemical resistance, since the product is only exposed to PTFE.

FDA conform

For flange NW			Cat. No.:
100			**B 282-02**
150			**B 282-04**
170/146			**B 321-01**

BOLA Flat Flange Joining Pieces

Material:
Silumin

Product description:

Joining piece made of silumin, connection between reaction vessel and lid. Locked by zinc-plated steel screws.

For flange NW	Number of screws		Cat. No.:
100	6		**B 284-02**
150	8		**B 284-04**
170/146	8		**B 323-01**

BOLA Flat Flange Lids

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

One-piece, 3 declined lateral ground joint necks size 29 angled 15°.

For flange NW	Center neck NS		Cat. No.:
100	29/32		**B 283-02**
150	29/32		**B 283-04**
150	45/40		**B 283-06**
170/146	29/32		**B 322-01**

BOLA Dropping Funnels

Material:	Material:	Temperature resistance:	Chemical resistance:	Transparency:
PTFE	**FEP**	**from -200°C to +250°C**	**+++ universal**	**transparent**

FDA conform

Product description:

Dropping funnel made of transparent FEP, fine adjustment stopcock with cone size 29 made of PTFE. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

Capacity ml			Cat. No.:
125			**B 285-01**
250			**B 285-02**
500			**B 285-03**

BOLA Liebig Condensers "Transparent"

Material:	Material:	Temperature resistance:	Chemical resistance:	Transparency:
PTFE	**PFA**	**from -200°C to +250°C**	**+++ universal**	**transparent**

FDA conform

Product description:

Thin-walled cooling tube made of translucent and gastight PFA, cooling jacket made of borosilicate glass with hose connectors made of PP and nuts for connection of cooling water, ground joint cone and socket size 29 made of PTFE. The distillate is only exposed to PFA/PTFE. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

Length mm			Cat. No.:
300			**B 291-02**
450			**B 291-04**
600			**B 291-06**

BOLA Liebig Condensers "Vacuum"

Material:	Temperature resistance:	Chemical resistance:	Vacuum:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**

Product description:

One-piece cooling tube with ground joint socket and cone size 29 made of PTFE, cooling jacket made of borosilicate glass with hose connectors made of PP and nuts for connection of cooling water. The distillate is only exposed to PFA/PTFE. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Length mm			Cat. No.:
300			**B 295-02**
450			**B 295-04**
600			**B 295-06**

BOLA Liebig Condensers "Vertical"

Material:	Temperature resistance:	Chemical resistance:	Transparency:
PFA	**from -200°C to +250°C**	**+++ universal**	**transparent**

Product description:

Thin-walled cooling tube made of translucent and gastight PFA, cooling jacket made of borosilicate glass with hose connectors made of PP and nuts for connection of cooling water, ground joint cone and socket size 29 made of PTFE. The distillate is only exposed to PFA/PTFE. Suitable for vertical assembly. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Length mm			Cat. No.:
300			**B 301-02**
450			**B 301-04**

BOLA Distillation Thermometers

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -0°C to +250°C**	**+++ universal**

Product description:

PTFE-jacketed glass thermometer, justified to an immersion depth of 50 mm. Length 300 mm, O.D. 7,5 mm, measuring range 0/+250:1°C.

FDA conform

For reaction vessel ml				Cat. No.:
500-6.000				**B 290-03**

BOLA Thermometers for Flasks

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -0°C to +250°C**	**+++ universal**

Product description:

PTFE-jacketed glass thermometer, O.D. 7 mm, measuring range 0/+250:1°C

FDA conform

For reaction vessel ml	Measuring range C°	O.D. mm	Length mm	Cat. No.:
500	0 / +250:1	7	450	**B 287-03**
1.000	0 / +250:1	7	530	**B 287-06**
2.000-6.000	0 / +250:1	7	600	**B 287-09**

HELPFUL: page **140**
Suitable PT100 temperature probes

BOLA Thermometer Holders

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

A flexible gasket made of PTFE/silicone holds all thermometers with an O.D. of 7-8 mm. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint. The product is only exposed to PTFE.

FDA conform

Ground joint NS	For diameter mm	Angle	Cat. No.:
29/32	7 - 8	7 °	**B 286-03**

BOLA Stirrer Bearings

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

Guiding the stirrer shaft. With adjustable special gasket. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Cone NS	For stirrer shaft dia. mm		Cat. No.:
29/32	10		B 288-02

BOLA Moon-Shaped Stirrer Shafts

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

PTFE-jacketed stainless steel shaft, stirrer blade and access for the stirrer shaft completely made of PTFE. Stirrer blade tilts and fits through a ground joint. Further stirrer shafts can be found on page 14.

FDA conform

For reaction vessel ml	For ground joint NS	Dia. of stirrer shaft mm	Length mm	Cat. No.:
500	29/32	10	350	C 376-12
1.000	29/32	10	450	C 376-14
2.000	29/32	10	510	C 376-16
4.000-6.000	29/32	10	600	C 376-18
4.000/6.000	45/40	16	600	C 376-20

BOLA Distillation Heads

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

2 ground joint cones size 29 and 1 vertical connection for thermometers of an O.D. of 7-8 mm. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Cone NS	For dia. mm	Angle of vertical cone	Cat. No.:
29/32	7 - 8	90°	B 289-02

BOLA Receiver Adaptors

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Ground joint cone and socket size 29, as well as socket size 19 for example for vacuum stopcock (see Cat. No. B 293-02 page on 173). Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Cone NS	Socket NS	Lateral socket NS	Lateral angle	Cat. No.:
29/32	19/26	29/32	15°	**B 292-02**

BOLA Vacuum Stopcocks

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Ground joint cone size 19, bore diameter 2 mm, connections for tubing O.D. 8 mm. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Cone NS	Bore dia. of stopcock mm		Cat. No.:
19/26	2		**B 293-02**

BOLA Links

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

For vertical positioning of the Liebig condenser (e.g. in a lid of a reaction vessel). Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Cone NS	Socket NS	Angle	Cat. No.:
29/32	29/32	15°	**B 303-02**

BOLA Ground Joint Tube Fittings

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +205°C**	**+++ universal**

Product description:

For connecting tubes, hard-walled tubing, thermometers. The sealing rings on the outside of the cone prevent sticking of the ground joints and improve the sealing. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Cone NS	For tubing I.D. x O.D. mm	Bore dia. mm	Cat. No.:
19/26	4,0 x 6,0	5	**B 304-10**
29/32	1,6 x 3,2	2	**B 304-16**
29/32	4,0 x 6,0	8	**B 304-20**
29/32	6,0 x 8,0	8	**B 304-22**
29/32	8,0 x 10,0	8	**B 304-24**

BOLA Ground Joint Distributors

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +205°C**	**+++ universal**

Product description:

With ground joint cone and socket size 29. All ground joints are connected with a bore dia. of 10 mm. The bore dia. of the cone is 16 mm. Integrated special nut (Safe-Lab) for easy locking and unlocking of the ground joint.

FDA conform

Socket NS	Cone NS	Length x Width x Total height mm	Cat. No.:
2 x 29/32	29/32	113 x 40 x 105	**B 302-02**
3 x 29/32	29/32	160 x 40 x 105	**B 302-04**

BOLA "Safe-Lab" Nuts

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +205°C**	**+++ universal**

Product description:

Allows a tight and safe connection as well as an easy disconnection of cone and socket. The special nut which is held on an external thread above the cone holds and locks the socket. For disconnection, this special nut has to be turned clockwise. The power is enforced by the thread pitch and is transferred axially to the socket. The ground joint is released.

FDA conform

Suitable for ground joint NS			Cat. No.:
19/26			**K 1349-06**
29/32			**K 1349-10**
45/40			**K 1349-16**


mount special nut


insert and seize ground joint cone


stuck


loosen by turning clockwise


removed

BOLA Distillate Bottles

Material:	Material:	Temperature resistance:	Chemical resistance:	Transparency:
PTFE	FEP	from -200°C to +205°C	++ very good	transparent

FDA conform

Product description:

Collecting vessel for distillate. Transparent bottle made of FEP, ground joint adaptor size 29 made of PTFE, bottle is not suitable for vacuum

Capacity ml	Dia. of bottle mm	Total height mm	Cat. No.:
250	59	160	B 305-02
500	72	190	B 305-03
1.000	92	235	B 305-04

BOLA Cold Traps

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	Transparency:
PFA	from -200°C to +250°C	+++ universal	suitable	transparent

FDA conform

Product description:

Transparent, connecting nut made of PTFE glam fibres reinforced, head made of PTFE with two threaded necks GL 14 for connection of hard-walled tubing by means of separately available laboratory screw joints (page 55). For soft, flexible tubing we recommend to use GL hose connectors (see page 91).

Collecting capacity ml	O.D.of column mm	Total height mm	Cat. No.:
320	60	400	B 317-60

BOLA Threaded Adaptors

Material:	Temperature resistance:	Chemical resistance:
PTFE	from -200°C to +250°C	+++ universal

NEW

FDA conform

Product description:

Allow the use of BOLA Multiple Distributors for Bottles with female thread GL 45 also on bottles with GL 32, GL 40 and S 40 threads.

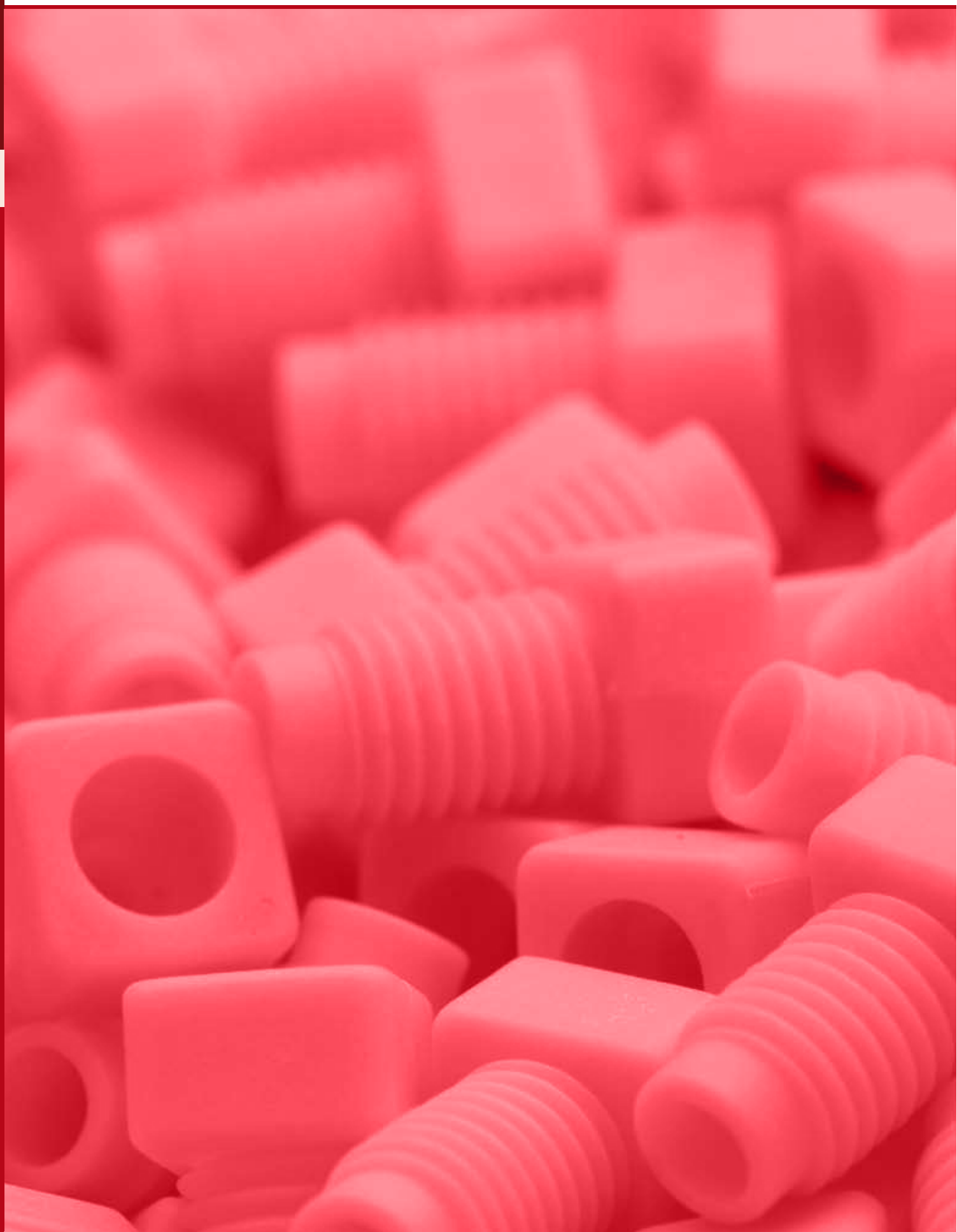
Example 1 for Cat. No. H 978-30:

Transition from GL40/S40 to GL 45
Suitable for Merck® bottles with GL 40 thread or for all PFA-, PTFE bottles and jars with thread GL 40 and S 40

Example 2 for Cat. No. H 978-40:

Transition from GL 32 to GL 45
Suitable for bottles with GL 32 thread, e.g. from company Duran Group (formerly Schott AG)

	Bottle thread GL / S	Top thread GL		Cat. No.:
A	GL 32	45		H 978-30
B	GL/S 40	45		H 978-40



Screw Joints for HPLC

Easy handling, sturdy design and pressure resistance up to 30 bar: also in HPLC applications BOLA Screw Joints are your first choice.

PRODUCT TIPS

Page 178
Distributors for Bottles

Page 182
Tubing with mini fittings

Page 181
Distributors with UNF Threads

BOLA HPLC Distributors for Bottles

They consist of a screw cap made of glass-fibre reinforced PP with GL 45 thread and a movable body with connection ports. All necessary screw joints and gaskets for connecting hard-walled tubing (e.g. PTFE, FEP or PFA) up to a maximum diameter of 6 mm are included in delivery and make the HPLC distributors usable immediately.

Tubing up to a diameter of 4 mm can be passed and fixed absolutely tightly at the requested immersion depth.

The distributors with stopcocks allow closing unused ports; the FEP stopcock plug provides a universal chemical resistance.

Because of the stopcocks, it is not possible to pass the tubing. A connection to the bottom of the bottle can still be made by pushing tubing with O.D. of 5 mm or
I.D. of 6 mm in or on the port on the lower side of the distributor.

A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the distributor.

The special feature: the body of the distributor can be turned independently from the screw cap. This means, that the completely assembled distributor can be removed and fixed on another bottle without the risk of disarranging the tubing.

BOLA HPLC Distributors for Bottles

BESTSELLER

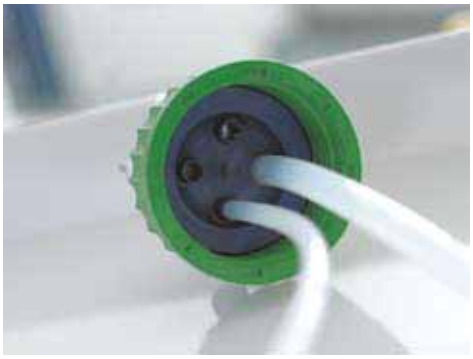
Material:	Temperature resistance:	Chemical resistance:	autoclave:
PP	**from -20°C to + 140°C**	**++ very good**	**121°**

Product description:

Green screw cap made of glass-fibre reinforced PP for bottle thread GL 45 and body made of PP. Available either with four ports with screw joints suitable for tubing O.D. 1,6 to 2,0 mm and 2,1 to 4,0 mm or with four ports with screw joints suitable for tubing O.D. 6,0 mm. Plugs for closing unused ports are included in delivery.

FDA conform

Suitable for thread GL	Four ports for tubing O.D. mm		Cat. No.:
45	1,6 - 4,0		**D 606-08**
45	6,0		**D 608-08**



BOLA HPLC Distributors for Bottles with Stopcocks

Material:	Temperature resistance:	Chemical resistance:	autoclave:
PP	**from -20°C to + 140°C**	**++ very good**	**121°**

Product description:

Green screw cap made of glass-fibre reinforced PP for bottle thread GL 45 and body made of PP. With four ports with screw joints suitable for tubing O.D. 1,6 to 2,0 mm and 2,1 to 4,0 mm and four stopcocks with stopcock plugs made of FEP.

FDA conform

Suitable for thread GL	Four ports for tubing O.D. mm	Bore dia. of stopcock mm	Cat. No.:
45	1,6 - 4,0	2,4	D 607-08

BOLA Replacement Parts for HPLC Distributors for Bottles

BOLA Replacement Nuts

Product description:

Nuts made of PP.

FDA conform

	For tubing O.D. mm			Cat. No.:
A	1,6 - 4,0			D 610-02
	6,0			D 610-04

BOLA Replacement Sealing Rings

Product description:

Sealing rings made of silicone. Packing unit: 10 pieces

	For tubing O.D. mm			Cat. No.:
B	1,6 - 2,0			D 610-08
	2,1 - 4,0			D 610-12

Replacement O-Rings

Product description:

O-rings made of FPM. Packing unit: 10 pieces

	For tubing O.D. mm			Cat. No.:
C	6,0			D 610-16

BOLA Replacement Plugs

Product description:

Plugs made of silicone. Packing unit: 10 pieces

				Cat. No.:
D				D 610-30

BOLA Extender with Adaptor for Syringe Filters

Product description:

Made of PTFE, with female Luer cone for fixing syringe filters.

FDA conform

A Connection	B O.D. mm		Cat. No.:
Luer cone	3,5		D 610-50

Applications:

For sterile aeration by means of syringe filters.

BOLA Screw Joints for HPLC

What you should know about the BOLA HPLC Screw Joint System

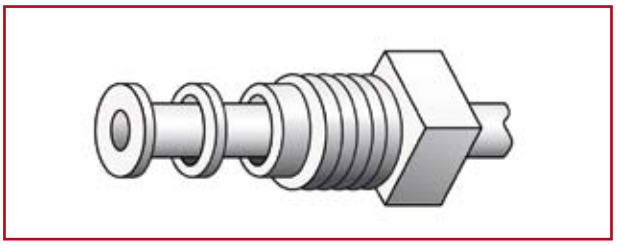
This system is based on flanged tubing and UNF ¼" 28 G threads. These threads have their origin in the United States and are mainly used in chromatography/HPLC." ¼"" stands for the outer diameter of 6,35 mm. "28 G" stands for 28 thread pitches at the length of one inch (25,4 mm).

Following tubing sizes are mainly used in HPLC:

» 1/8" (O.D. approx. 3,2 mm x I.D. approx. 1,6 mm)

» 1/16" (O.D. approx. 1,6 mm x I.D. approx. 0,8 mm)

The screw joint itself consists of a screw (BOLA Tube End Fitting) with washer and flanged tubing. It resists pressures up to 30 bar.



The metal-free washer provides ideal contact pressure of the flanged tubing and prevents small folds during the last phase of tightening the tube end fitting.

The flowing product is only exposed to PTFE – the screw joint has a universal chemical resistance and is absolutely clean.

The PTFE tubing to be flanged must be made of a special type of PTFE. Our tubing fulfils this requirement (see page 198). Besides PTFE tubing, there can also be used FEP and PFA tubing (both gastight and transparent).

The different colours of the tube end fittings can be used for distinction.

How to flange PTFE tubing

» cut tubing square
» clamp tubing by means of tubing holder – overhang approx. 3-5 mm
» press tubing on flanging tip and preform it
» press preformed tubing end on cooling plate
» push fitting and washer on the tubing and tighten the fitting
» ready

Of course we also have flanged tubing with assembled tube end fittings in different lengths in our standard range (see page 182).

We can also manufacture tubing according to your requirements.

Don't confuse UNF ¼" 28 and M6 threads!

Besides the common UNF threads, there are also M6 threads circulating. These threads are very similar to the UNF thread, but please only use UNF tube end fittings to avoid damage or leakage of your fittings. You can find universal couplings for a transition from UNF ¼" 28G to M6 on page 186.

BOLA Distributors for Bottles

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	from -50°C to +200°C	+++ universal

Product description:

Black screw cap made of PPS for bottle thread GL 45. Without stopcocks: body made of PTFE with 2 or 4 ports with female thread UNF ¼" 28 G on upper and lower sides. With stopcocks: body made of PTFE with 2 or 3 ports with female thread UNF ¼" 28 G on upper and lower sides and stopcock made of FEP for each port. A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the distributor. The body of the distributor can be turned independently from the screw cap. This means, that the assembled distributor can be removed completely and fixed on another bottle without the risk of disarranging the tubing. Very good chemical resistance, for working temperatures up to +200°C.

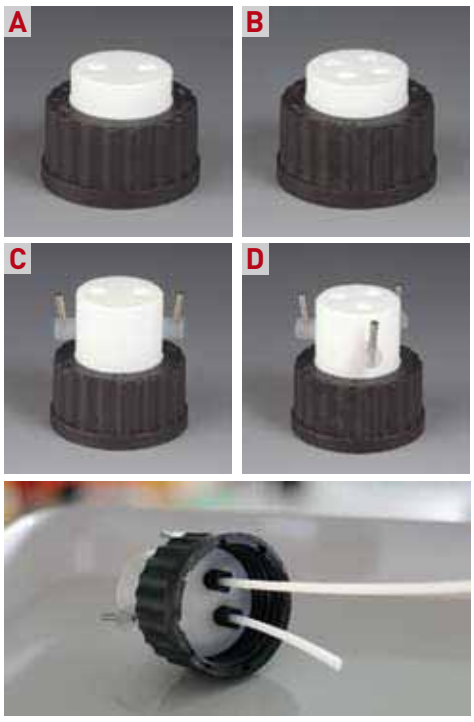
FDA conform

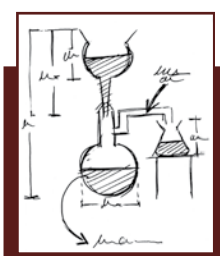
	For tubing I.D. x O.D. mm		Bore dia. mm	Connections	Cat. No.:
A	0,8 x 1,6		0,8	2 x UNF 1/4" 28G	F 745-02
B	0,8 x 1,6		0,8	4 x UNF 1/4" 28G	F 745-10

	For tubing I.D. x O.D. mm		Bore dia. mm	Connections	Cat. No.:
A	1,6 x 3,2		1,6	2 x UNF 1/4" 28G	F 745-04
B	1,6 x 3,2		1,6	4 x UNF 1/4" 28G	F 745-12

	For tubing I.D. x O.D. mm	Number of stopcocks	Bore dia. mm	Connections	Cat. No.:
C	0,8 x 1,6	2	0,8	2 x UNF 1/4" 28G	F 746-02
D	0,8 x 1,6	3	0,8	3 x UNF 1/4" 28G	F 746-10

	For tubing I.D. x O.D. mm	Number of stopcocks	Bore dia. mm	Connections	Cat. No.:
C	1,6 x 3,2	2	1,6	2 x UNF 1/4" 28G	F 746-04
D	1,6 x 3,2	3	1,6	3 x UNF 1/4" 28G	F 746-12





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BOLA Chromatography Adaptors

Material:	Temperature resistance:	Chemical resistance:
PTFE	from -50°C to +200°C	+++ universal

Product description:

Black screw cap made of PPS with GL thread. Body made of PTFE with one port with female thread UNF ¼" 28 G for connection of mini fittings (see tube end fittings page 182). A possible unevenness of the bottle neck is adjusted by an o-ring behind an elastic sealing lip, and the bottle is closed tightly. The product is only exposed to the body of the adaptor. Very good chemical resistance, for working temperatures up to max. +200°C.

FDA conform

Thread of screw cap GL	For tubing I.D. x O.D. mm		Cat. No.:
14	(1/32" x 1/16") 0,8 x 1,6		F 755-03
18	(1/32" x 1/16") 0,8 x 1,6		F 755-06
25	(1/32" x 1/16") 0,8 x 1,6		F 755-09
32	(1/32" x 1/16") 0,8 x 1,6		F 755-12
45	(1/32" x 1/16") 0,8 x 1,6		F 755-15

Thread of screw cap GL	For tubing I.D. x O.D. mm		Cat. No.:
14	(1/16" x 1/8") 1,6 x 3,2		F 757-03
18	(1/16" x 1/8") 1,6 x 3,2		F 757-06
25	(1/16" x 1/8") 1,6 x 3,2		F 757-09
32	(1/16" x 1/8") 1,6 x 3,2		F 757-12
45	(1/16" x 1/8") 1,6 x 3,2		F 757-15

BESTSELLER

BOLA Flanged Tubing

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	from -50°C to +120°C	+++ universal	30 bar

Product description:

Flanged PTFE tubing with black tube end fittings UNF ¼" 28 G made of PP and washers made of PA. The tubing is ready for use.

FDA conform

Tubing I.D. x O.D. mm	Total length mm		Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	100		F 740-02
(1/32" x 1/16") 0,8 x 1,6	250		F 740-04
(1/32" x 1/16") 0,8 x 1,6	500		F 740-06
(1/32" x 1/16") 0,8 x 1,6	750		F 740-08
(1/32" x 1/16") 0,8 x 1,6	1.000		F 740-10

Tubing I.D. x O.D. mm	Total length mm		Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	100		F 740-20
(1/16" x 1/8") 1,6 x 3,2	250		F 740-22
(1/16" x 1/8") 1,6 x 3,2	500		F 740-24
(1/16" x 1/8") 1,6 x 3,2	750		F 740-26
(1/16" x 1/8") 1,6 x 3,2	1.000		F 740-28

Applications:

Connection to BOLA Distributors for Bottles or BOLA Chromatography Adaptors.

BOLA Miniature Couplings

Material:	Material:	Temperature resistance:	Chemical resistance:
PTFE	POM	from -200°C to +200°C	+++ universal

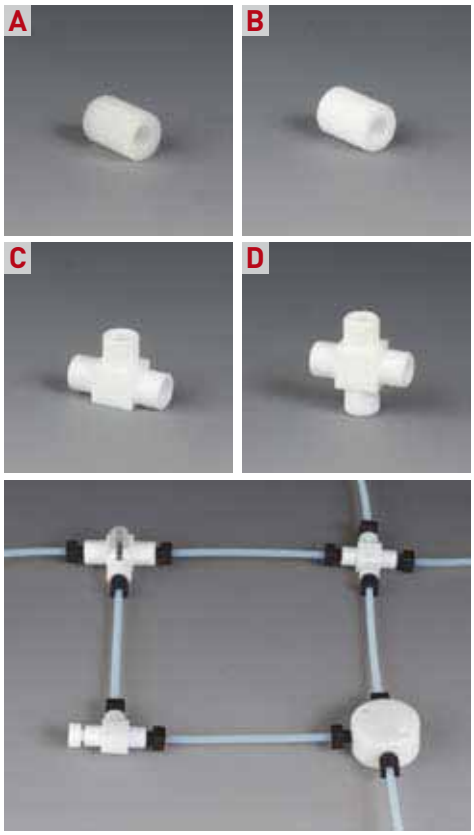
Product description:

Three types of couplings available: straight type made of PTFE or POM with higher mechanical strength, "T" type with three connections or "cross" type with four connections, all made of PTFE. The tubing is connected by means of tube end fittings (see page 182) to a female thread UNF ¼" 28 G.

FDA conform

	Type	Material	For tubing I.D x O.D. mm	Connections	Total length mm	Cat. No.:
A	straight	POM	(1/32" x 1/16") 0,8 x 1,6	2	17	F 707-02
B	straight	PTFE	(1/32" x 1/16") 0,8 x 1,6	2	17	F 707-06
C	T	PTFE	(1/32" x 1/16") 0,8 x 1,6	3	25	F 707-14
D	+	PTFE	(1/32" x 1/16") 0,8 x 1,6	4	25	F 707-18

	Type	Material	For tubing I.D x O.D. mm	Connections	Total length mm	Cat. No.:
A	straight	POM	(1/16" x 1/8") 1,6 x 3,2	2	17	F 707-04
B	straight	PTFE	(1/16" x 1/8") 1,6 x 3,2	2	17	F 707-08
C	T	PTFE	(1/16" x 1/8") 1,6 x 3,2	3	25	F 707-16
D	+	PTFE	(1/16" x 1/8") 1,6 x 3,2	4	25	F 707-20



BOLA Miniature Distributors

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	from -200°C to +200°C	+++ universal	30 bar

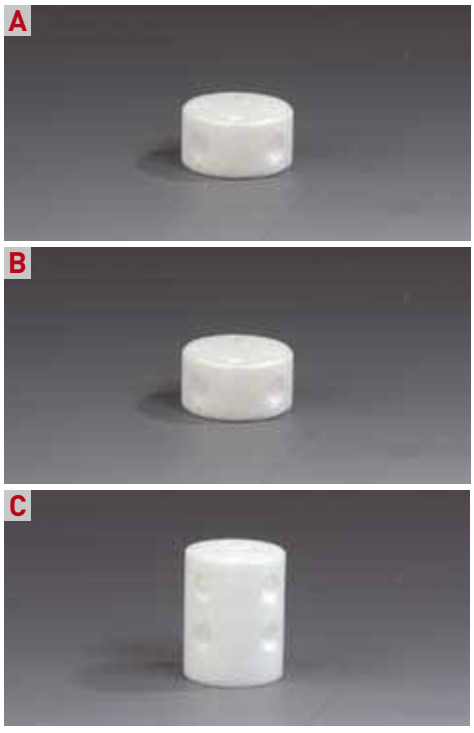
Product description:

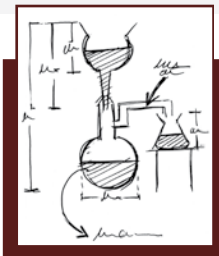
Blocks with up to nine connections. The tubing is connected by means of tube end fittings (see page 182) to a female thread UNF ¼" 28 G. With two mounting holes dia. 3,5 mm for fixing.

FDA conform

	For tubing I.D. x O.D. mm	Connections	O.D. mm	Height mm	Cat. No.:
A	(1/32" x 1/16") 0,8 x 1,6	3	28	15	F 710-01
B	(1/32" x 1/16") 0,8 x 1,6	4	28	15	F 710-05
C	(1/32" x 1/16") 0,8 x 1,6	9	28	36	F 710-09

	For tubing I.D. x O.D. mm	Connections	O.D. mm	Height mm	Cat. No.:
A	(1/16" x 1/8") 1,6 x 3,2	3	28	15	F 710-03
B	(1/16" x 1/8") 1,6 x 3,2	4	28	15	F 710-07
C	(1/16" x 1/8") 1,6 x 3,2	9	28	36	F 710-11





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BOLA Miniature 2-Way Stopcocks

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -10°C to +120°C**	**+++ universal**	**8 bar**

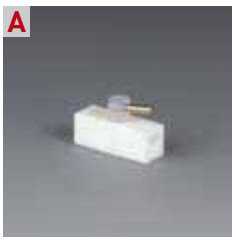
Product description:

2-way stopcock with straight bore and two connections. Available either with two female threads UNF ¼" 28 G or with one female thread UNF ¼" 28 G and one male thread UNF ¼" 28 G. Total height including stopcock plug made of FEP: 20 mm.

FDA conform

	For tubing I.D. x O.D. mm	Connections female thread	Connections male thread	Total length mm	Cat. No.:
A	(1/32" x 1/16") 0,8 x 1,6	2		32	F 730-02
B	(1/32" x 1/16") 0,8 x 1,6	1	1	35	F 730-06

	For tubing I.D. x O.D. mm	Connections female thread	Connections male thread	Total length mm	Cat. No.:
A	(1/16" x 1/8") 1,6 x 3,2	2		32	F 730-04
B	(1/16" x 1/8") 1,6 x 3,2	1	1	35	F 730-08



BOLA Miniature 3-Way Stopcocks

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -10°C to +120°C**	**+++ universal**	**8 bar**

Product description:

3-way stopcock with "L"-shaped or "T"-shaped bore and three connections. Available either with three female threads UNF ¼" 28 G or with two female threads UNF ¼" 28 G and one male thread UNF ¼" 28 G. Total height including stopcock plug made of FEP: 20 mm.

FDA conform

	For tubing I.D. x O.D. mm	Connections female thread	Connections male thread	Bore shape of stopcock	Total length mm	Cat. No.:
A	(1/32" x 1/16") 0,8 x 1,6	3		L	32	F 731-02
	(1/32" x 1/16") 0,8 x 1,6	3		T	32	F 731-06
B	(1/32" x 1/16") 0,8 x 1,6	2	1	L	42	F 731-10
	(1/32" x 1/16") 0,8 x 1,6	2	1	T	42	F 731-14

	For tubing I.D. x O.D. mm	Connections female thread	Connections male thread	Bore shape of stopcock	Total length mm	Cat. No.:
A	(1/16" x 1/8") 1,6 x 3,2	3		L	32	F 731-04
	(1/16" x 1/8") 1,6 x 3,2	3		T	32	F 731-08
B	(1/16" x 1/8") 1,6 x 3,2	2	1	L	42	F 731-12
	(1/16" x 1/8") 1,6 x 3,2	2	1	T	42	F 731-16

BOLA Miniature Manifold Blocks

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	from -10°C to +120°C	+++ universal	8 bar

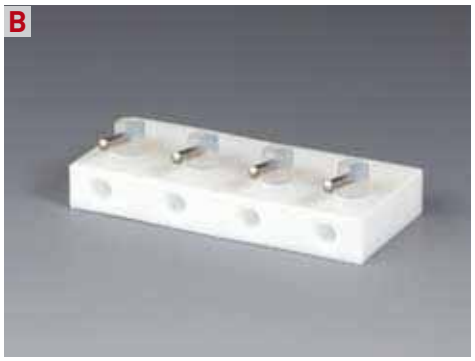
Product description:

Block made of PTFE with one inlet and four outlets with female thread UNF ¼" 28 G. Also available with four stopcocks with stopcock plugs made of FEP for easy interruption and control of flow. Suitable flanged tubing can be found on page 182.

FDA conform

	For tubing I.D. x O.D. mm	Number of stopcocks	Bore dia. mm	Inlet	Outlet	Cat. No.:
A	(1/32" x 1/16") 0,8 x 1,6		0,8	1	4	F 712-01
B	(1/32" x 1/16") 0,8 x 1,6	4	0,8	1	4	F 712-10

	For tubing I.D. x O.D. mm	Number of stopcocks	Bore dia. mm	Inlet	Outlet	Cat. No.:
A	(1/16" x 1/8") 1,6 x 3,2		1,6	1	4	F 712-03
B	(1/16" x 1/8") 1,6 x 3,2	4	1,6	1	4	F 712-12



BOLA Miniature Pressure Relief Valves

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	from -20°C to +150°C	+++ universal	5 bar

Product description:

Body made of PTFE with two connections with female thread UNF ¼" 28 G. Valve made of PPS with set screw and lock nut for adjusting and fixing pressure between 0,1 and 5 bar (factory setting 1,5 bar). Suitable flanged tubing can be found on page 182.

NEW

FDA conform

For tubing I.D. x O.D. mm	O.D. mm	Total height mm	Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	32	50	F 738-08

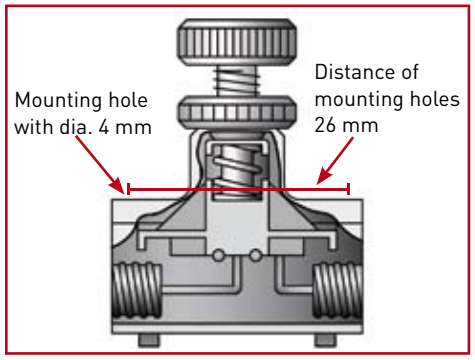
For tubing I.D. x O.D. mm	O.D.	Total height mm	Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	32	50	F 738-16

Product advantages:

» low dead volume
» flow direction is marked by an arrow
» two holes for panel mounting
» universal chemical resistance, the flowing product is only exposed to PTFE

Applications:

Pressure control valve with adjustable opening pressure. For preventing pressure drop during filling.



BOLA Universal Couplings

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

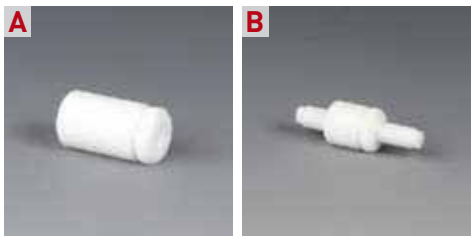
Product description:

Coupling made of PTFE for transition from M6 thread to UNF ¼" 28 G thread. The M6 thread is marked by a groove.

FDA conform

	Female thread	Female thread	Bore dia. mm	Cat. No.:
A	M 6	UNF 1/4" 28 G	0,8	**F 770-08**

	Male thread	Male thread	Bore dia. mm	Cat. No.:
B	M 6	UNF 1/4" 28 G	0,8	**F 772-08**



BOLA Miniature Screw-in Adaptors

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Adaptor made of PTFE for transition from female thread UNF ¼" 28 G to male thread NPT 1/8" or NPT ¼"

FDA conform

For tubing I.D. x O.D. mm	Female thread	Male thread	Bore dia. mm	Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	UNF 1/4" 28 G	NPT 1/8"	0,8	**F 716-02**
(1/32" x 1/16") 0,8 x 1,6	UNF 1/4" 28 G	NPT 1/4"	0,8	**F 716-06**

For tubing I.D. x O.D. mm	Female thread	Male thread	Bore dia. mm	Cat. No.:
(1/32" x 1/16") 1,6 x 3,2	UNF 1/4" 28 G	NPT 1/8"	1,6	**F 716-04**
(1/32" x 1/16") 1,6 x 3,2	UNF 1/4" 28 G	NPT 1/4"	1,6	**F 716-08**

BOLA Miniature Luer Connectors

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

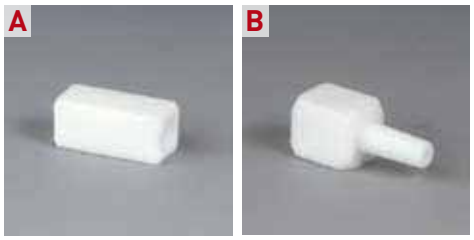
Product description:

Connector made of PTFE for transition from Luer connection to female thread UNF ¼" 28 G

FDA conform

	For tubing I.D. x O.D. mm	Female thread	Luer cone	Bore dia. mm	Cat. No.:
A	(1/32" x 1/16") 0,8 x 1,6	UNF 1/4" 28 G	female	1,0	**F 717-02**
B	(1/32" x 1/16") 0,8 x 1,6	UNF 1/4" 28 G	male	1,0	**F 717-06**

	For tubing I.D. x O.D. mm	Female thread	Luer cone	Bore dia. mm	Cat. No.:
A	(1/16" x 1/8") 1,6 x 3,2	UNF 1/4" 28 G	female	1,6	**F 717-04**
B	(1/16" x 1/8") 1,6 x 3,2	UNF 1/4" 28 G	male	1,6	**F 717-08**



BOLA Tube End Fittings

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +260°C**	**+++ universal**

Product description:

White tube end fittings made of PTFE. With male thread UNF ¼" 28 G; washers made of PA are included in delivery. Packing unit: 10 pieces, differing ordering quantities are rounded up to factor 10.

FDA conform

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	white		F 702-02

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	white		F 702-04

Material:	Temperature resistance:	Chemical resistance:
PP	**from -10°C to +100°C**	**++ very good**

Product description:

Coloured tube end fittings made of PP. With male thread UNF ¼" 28 G; washers made of PA are included in delivery. Packing unit: 10 pieces, differing ordering quantities are rounded up to factor 10.

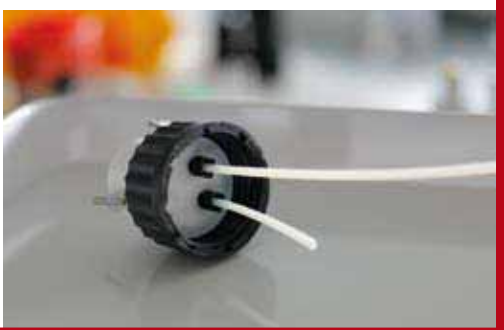
For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	natural (white)		F 702-06
(1/32" x 1/16") 0,8 x 1,6	black		F 702-10
(1/32" x 1/16") 0,8 x 1,6	red		F 702-18
(1/32" x 1/16") 0,8 x 1,6	orange		F 702-22
(1/32" x 1/16") 0,8 x 1,6	yellow		F 702-26
(1/32" x 1/16") 0,8 x 1,6	green		F 702-30
(1/32" x 1/16") 0,8 x 1,6	blue		F 702-34
(1/32" x 1/16") 0,8 x 1,6	violet		F 702-38
(1/32" x 1/16") 0,8 x 1,6	grey		F 702-42

SUITABLE: page **189**
Tubing for all screw joints

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	natural (white)		F 702-08
(1/16" x 1/8") 1,6 x 3,2	black		F 702-12
(1/16" x 1/8") 1,6 x 3,2	red		F 702-20
(1/16" x 1/8") 1,6 x 3,2	orange		F 702-24
(1/16" x 1/8") 1,6 x 3,2	yellow		F 702-28
(1/16" x 1/8") 1,6 x 3,2	green		F 702-32
(1/16" x 1/8") 1,6 x 3,2	blue		F 702-36
(1/16" x 1/8") 1,6 x 3,2	violet		F 702-40
(1/16" x 1/8") 1,6 x 3,2	grey		F 702-44

Applications:

Different colours for better distinction.



BOLA Double Tube End Fittings

Material: **PTFE**
Temperature resistance: **from -200°C to +260°C**
Chemical resistance: **+++ universal**

Product description:

Made of PTFE, with two male threads UNF ¼" 28 G. Packing unit: 10 pieces, differing ordering quantities are rounded up to factor 10.

FDA conform

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	white		F 703-02

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	white		F 703-04

BOLA Plugs

Material: **PTFE**
Temperature resistance: **from -200°C to +260°C**
Chemical resistance: **+++ universal**

Product description:

Made of PTFE. For closing unused ports of miniature fittings. With male thread UNF ¼" 28 G. Packing unit: 10 pieces, differing ordering quantities are rounded up to factor 10.

FDA conform

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	white		F 705-02

For tubing I.D. x O.D. mm	Colour		Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	white		F 705-04

BOLA Washers

Material: **PA**
Temperature resistance: **from -10°C to +100°C**

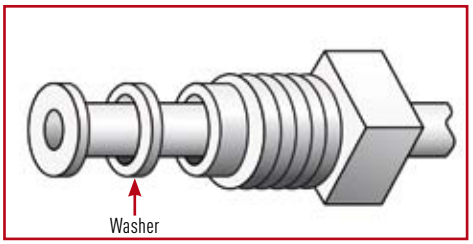
Product description:

Made of PA. For stabilising the flange and avoiding damages when tightening the tube end fitting. Packing unit: 10 pieces, differing ordering quantities are rounded up to factor 10.

FDA conform

For tubing I.D. x O.D. mm			Cat. No.:
(1/32" x 1/16") 0,8 x 1,6			F 728-08

For tubing I.D. x O.D. mm			Cat. No.:
(1/16" x 1/8") 1,6 x 3,2			F 728-16



BOLA Assortments of Tube End Fittings

Material:	Temperature resistance:	Chemical resistance:
PP	**from -10°C to +100°C**	**++ very good**

Product description:

Tube end fittings made of PP in 9 different colours, two fittings per colour. With male thread UNF ¼˝ 28 G; washers made of PA are included in delivery.
Colours: natural, black, orange, yellow, green, blue, violet and grey

Dimensions I.D. x O.D. mm			Cat. No.:
(1/32˝ x 1/16˝) 0,8 x 1,6			**F 704-02**

Dimensions I.D. x O.D. mm			Cat. No.:
(1/16˝ x 1/8˝) 1,6 x 3,2			**F 704-04**

Applications:

Different colours for better distinction.

BOLA Tubing

Product description:

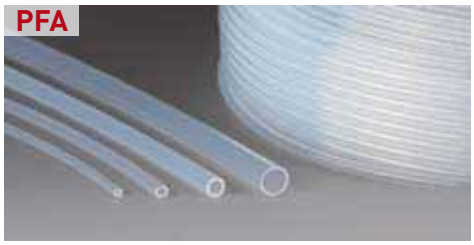
Tubing especially suitable for making flanges with BOLA Thermoelectric Flanging Tool (see page 190).

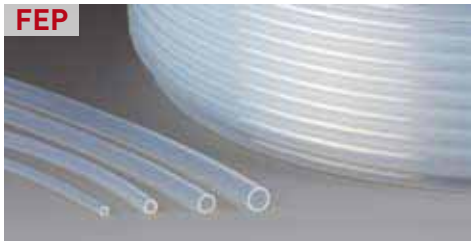
Choose suitable tubing for your application:

» PTFE: competitive standard tubing in laboratories, transparent to milky white colour, working temperature range between -200°C and + 260°C, universal chemical resistance

» PFA: transparent, non-porous and gastight tubing, wide temperature range between -270°C and + 260°C, universal chemical resistance

» FEP: transparent, non-porous and gastight tubing, working temperature range between -270°C and + 205°C, universal chemical resistance





FDA conform

Dimensions I.D. x O.D. mm		Cat. No.: PTFE -Tubing	Cat. No.: PFA -Tubing	Cat. No.: FEP -Tubing
0,5 x 1,6		**S 1810-09**		
(1/32˝ x 1/16˝) 0,8 x 1,6		**S 1810-10**	**S 1811-02**	**S 1815-04**
1,6 x 2,4		**S 1810-24**		
(1/16˝ x 1/8˝) 1,6 x 3,2		**S 1810-26**	**S 1811-04**	**S 1815-08**
2,4 x 3,2		**S 1810-33**		

SUITABLE: page **110**
Tubing for all screw joints

BOLA Thermoelectric Flanging Tools

Product description:

For making flanges at the ends of plastic tubing (e.g. PTFE, PFA or FEP)

Following sets are available:	For tubing I.D. mm	Version	Cat. No.:
1 x Basic flanging tool 230V/50 Hz 1 x Exchangeable flanging tip for flanging tubing I.D. 0,8 mm 1 x Tubing holder for tubing O.D. 1,6 mm (1/16˝) and 3,2 mm (1/8˝)	0,8	230 V 50 HZ	F 701-02
1 x Basic flanging tool 230V/50 Hz 1 x Exchangeable flanging tip for flanging tubing I.D. 1,6 mm 1 x Tubing holder for tubing O.D. 1,6 mm (1/16˝) and 3,2 mm (1/8˝)	1,6	230 V 50 HZ	F 701-04
1 x Basic flanging tool 150V/60 Hz 1 x Exchangeable flanging tip for flanging tubing I.D. 0,8 mm 1 x Tubing holder for tubing O.D. 1,6 mm (1/16˝) and 3,2 mm (1/8˝)	0,8	115 V 60 HZ	F 708-02
1 x Basic flanging tool 150V/60 Hz 1 x Exchangeable flanging tip for flanging tubing I.D. 1,6 mm 1 x Tubing holder for tubing O.D. 1,6 mm (1/16˝) and 3,2 mm (1/8˝)	1,6	115 V 60 HZ	F 708-04

BOLA Tubing Holders

Product description:

For tubing with O.D. 1,6 mm (1/16˝) and 3,2 mm (1/8˝).

For tubing O.D. mm			Cat. No.:
(1/16˝) 1,6 and (1/8˝) 3,2			F 706-06

Product advantages:

» safe fixing of the tubing during the flanging procedure

» easy assembly and handling

» injuries due to the hot flanging tips are avoided

BOLA Flanging Tips

Product description:

For flanging different inner diameters of tubing, suitable for BOLA Thermoelectric Flanging Tools on page 190.

For tubing I.D. mm			Cat. No.:
0,5			F 701-50
(1/32˝) 0,8			F 701-52
(1/16˝) 1,6			F 701-54
2,4			F 701-56

BOLA Standard Construction Kits

Product description:

For making flanges at the ends of plastic tubing (e.g. PTFE, PFA or FEP)

Following sets are available	For tubing I.D. mm	Version	Cat. No.:
1 x BOLA Thermoelectric Flanging Tool with exchangeable flanging tip for tubing I.D. 0,8 mm 1 x BOLA Tube End Fitting Set 5 x BOLA Plugs 10 x BOLA Miniature Couplings (straight) 2 x Miniature Couplings (T) 1 x BOLA Miniature Coupling (cross) 1 x 10 metres of PTFE tubing (I.D. 0,8 mm, O.D. 1,6 mm)	0,8	230 V 50 HZ	F 700-02
1 x BOLA Thermoelectric Flanging Tool with exchangeable flanging tip for tubing I.D. 1,6 mm 1 x BOLA Tube End Fitting Set 5 x BOLA Plugs 10 x BOLA Miniature Couplings (straight) 2 x BOLA Miniature Couplings (T) 1 x BOLA Miniature Coupling (cross) 1 x 10 metres of PTFE tubing (I.D. 1,6 mm x O.D. 3,2 mm)	1,6	230 V 50 HZ	F 700-04

BOLA Transition Fittings

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from -20°C to +120°C**	**+++ universal**	**5 bar**

Product description:

Fitting made of PTFE. One side with metric thread and connecting nut with compression rings for connecting tubing or tubes with O.D. 4, 6, 8 or 10 mm. Other side with female thread UNF ¼" 28 G for connecting flanged tubing with O.D. 1,6 or 3,2 mm by means of tube end fittings.

FDA conform

From tubing I.D. x O.D. mm	To tubing I.D. x O.D. mm	O.D. mm	Total length mm	Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	4 and 6	21	40	F 760-04
(1/32" x 1/16") 0,8 x 1,6	8 and 10	26	46	F 760-14

From tubing I.D. x O.D. mm	To tubing I.D. x O.D. mm	O.D. mm	Total length mm	Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	4 and 6	21	40	F 760-08
(1/16" x 1/8") 1,6 x 3,2	8 and 10	26	46	F 760-18

BOLA Joining Fittings

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PTFE	**from -20°C to +120°C**	**+++ universal**	**5 bar**	**suitable**

Product description:

Fitting made of PTFE. One side with connecting nut with compression rings for connecting tubing or tubes with O.D. 4, 6, 8 or 10 mm. Other side with laboratory screw joint for connecting tubing with O.D. 1,6 or 3,2 mm.

FDA conform

From tubing I.D. x O.D. mm	To tubing I.D. x O.D. mm	O.D. mm	Total length mm	Cat. No.:
(1/32" x 1/16") 0,8 x 1,6	4 and 6	25	76	**F 762-04**
(1/32" x 1/16") 0,8 x 1,6	8 and 10	25	76	**F 762-08**

From tubing I.D. x O.D. mm	To tubing I.D. x O.D. mm	O.D. mm	Total length mm	Cat. No.:
(1/16" x 1/8") 1,6 x 3,2	4 and 6	25	74	**F 762-14**
(1/16" x 1/8") 1,6 x 3,2	8 and 10	25	74	**F 762-18**

BOLA HT Laboratory Screw Joints

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PPS	**from -50°C to +250°C**	**+++ universal**	**15 bar**	**suitable**

Product description:

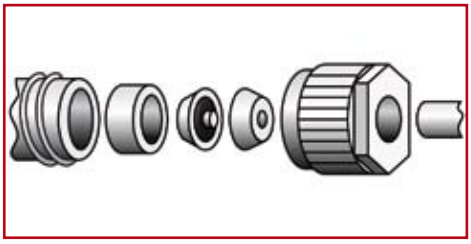
Black screw cap made of PPS, inner parts consisting of a v-ring (PPS), a tapered ring and a sealing ring (both PTFE) as well as an o-ring (not exposed to the medium). Good chemical resistance, suitable for temperatures from -50°C to + 250°C.

FDA conform

For tubing O.D. mm		Thread M 8 Cat. No.:	Thread M 10 Cat. No.:
(1/16") 1,6		**D 662-16**	**D 664-16**
3,0			**D 664-30**
(1/8") 3,2			**D 664-32**

Applications:

Connecting equipment and fittings with metric threads with hard-walled tubing or tubes made of glass, plastic or metal.



BOLA Replacement Inner Parts for HT Laboratory Screw Joints

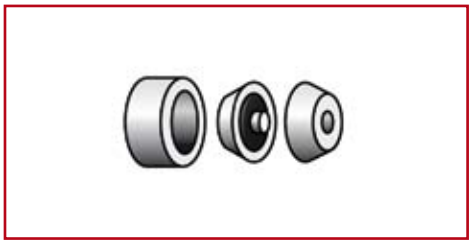
Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PPS	**from -50°C to +250°C**	**+++ universal**	**15 bar**	**suitable**

Product description:

Consisting of a v-ring (PPS), a tapered ring and a sealing ring (both PTFE) as well as an o-ring (not exposed to the medium). Good chemical resistance, suitable for temperatures from -50°C to + 250°C.

FDA conform

For tubing O.D. mm		Thread M 8 Cat. No.:	Thread M 10 Cat. No.:
(1/16") 1,6		D 672-16	D 674-16
3,0			D 674-30
(1/8") 3,2			D 674-32



BOLA Replacement Caps for HT Laboratory Screw Joints

Material:	Temperature resistance:	Chemical resistance:	Pressure:	Vacuum:
PPS	**from -50°C to +250°C**	**+++ universal**	**15 bar**	**suitable**

Product description:

Black screw cap made of glass-fibre reinforced PPS, with handy knurl and hexagon. Good chemical resistance, suitable for temperatures from -50°C to + 250°C.

FDA conform

For thread	O.D. mm	Length mm	Cat. No.:
M 8	12	19	D 670-08
M 10	14	25	D 670-10

SUITABLE: page **110**
Different tubing for all screw joints

BOLA Connection Bolts

Material:	Chemical resistance:	Pressure:
PEEK	**++ very good**	**280 bar**

Product description:

Connection bolt and sealing cone made of PEEK, suitable for female thread UNF 10-32 G. Exchangeable sealing cone available separately (Cat. No. F 834-10 on page 194), knurled nut reusable. Suitable for pressures up to max. 280 bar

FDA conform

For tubing/tube O.D. mm			Cat. No.:
(1/16") 1,6			F 833-10

BOLA Sealing Cones for Connection Bolts

FDA conform

Product description:

Replacement sealing cone made of PEEK, suitable for connection bolts Cat. No. F 833-10 on page 193.

For tubing/tube O.D. mm			Cat. No.:
(1/16") 1,6			F 834-10

BOLA Connection Bolts

Material:	Chemical resistance:	Pressure:
PEEK	++ very good	450 bar

FDA conform

Product description:

Connection bolt and sealing cone made of PEEK, suitable for female thread UNF 10-32G. Suitable for pressures up to max. 450 bar.

For tubing/tube O.D. mm			Cat. No.:
(1/16") 1,6			F 830-10

BOLA Connection Bolts

Material:	Chemical resistance:	Pressure:
PEEK	++ very good	400 bar

FDA conform

Product description:

Hexagonal connection bolt and double sided sealing cone made of PEEK, suitable for female thread UNF 10-32G. Exchangeable sealing cone available separately (Cat. No. F 837-10). Hexagonal nut reuseable. Suitable for pressures of up to max. 400 bar.

For tubing/tube O.D. mm			Cat. No.:
(1/16") 1,6			F 836-10

BOLA Double Sealing Cones for Connection Bolts

FDA conform

Product description:

Replacement double sided sealing cone made of PEEK, suitable for connection bolts Cat. No. F 836-10.

fFor tubing/tube O.D. mm			Cat. No.:
(1/16") 1,6			F 837-10

Filtration

Proved and tested, durable, optimally resistant against acids, caustic solutions and other aggressive chemicals: our solutions for efficient and safe filtration.

PRODUCT TIPS

Page 197
Cap for Scrubber Bottles

Page 203
HPLC Suction Filter

BOLA Filtration

What you should know about porous PTFE.

For the production of porous rods, tubes and tiles, PTFE particles are melted together.

The pore size can be determined both by the selection of the PTFE granules and the process parameters.

Due to the non-adhesive surface, filtering devices made of fluoroplastics (PTFE/PFA) are easy to clean and have a long durability.

Microporous PTFE has the same unique properties like "normal" PTFE:

» non-adhesive / dirt-repellent

» hydrophobic / water-repellent

» non-wettable

» no release of trace elements in the filtrate (no plasticisers)

» almost universal chemical resistance to acids, bases and solvents

» excellent temperature resistance between -200°C and + 260°C (temporarily even +300°C)

» autoclavable

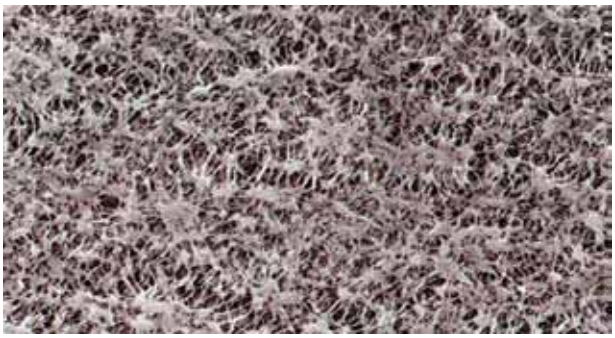
Information about pore sizes – what do these indications mean?

Class	Indication	Pore size in µm
00	P 500	250 - 500 *
0	P 250	160 - 250 *
1	P 160	100 - 160 *
2	P 100	40 - 100
3	P 40	16 - 40
4	P 16	10 - 16
5	P 1,6	1 - 1,6

* not feasible with PTFE at the moment

Typical applications – often asked.

Pore size	Application
50 µm	Filtration of coarse particles, distribution of gas in liquids
5 µm	Filtration of medium-sized particles, laboratory filtration, valve for packings (gas permeable, leak proof)
1 µm	Filtration of aqueous solvents, elimination of particles
0,45 µm	Prefiltration of aqueous solvents, HPLC solvents, protein solvents and alcohols, sterile filtration of air or other gases
0,2 µm	Ultracleaning of organic solvents and alcohols, sterile filtration of air or other gases
0,05 µm	Ultracleaning of solvents or gases (virus)



BOLA Scrubber Adaptors for Bottles

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**suitable**	**121°**

Product description:

Consisting of PTFE body with connecting nut and two lateral GL 18 threaded necks, a FEP inlet tube with a length of 300 mm and a gas distributor with finest bores. Easy in- and outlet of gas by means of hard-walled tubing (e.g. PTFE) which can be connected to the threaded necks by means of BOLA Laboratory Screw Joints (page 55). Elastic tubing can be connected by means of hose connectors (page 91). Inlet tube can be shortened individually. The special feature: the body of the adaptor can be turned independently from the connecting nut. This means, that the completely assembled adaptor can be removed and fixed on another bottle without the risk of disarranging the tubing. Suitable for bottles of company Duran Group (formerly Schott, Mainz) with GL 45 and GLS 80 thread and a volume between 100 and 5000 ml.

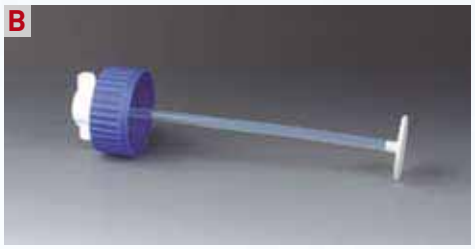
NEW

FDA conform

	For bottle thread	Gas inlet tube mm	Width incl. threaded necks mm	Cat. No.:
A	GL 45	300	76	**N 1660-14**
B	GLS 80	300	76	**N 1660-24**

A

B



BOLA Gas Distributors

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

With finest bores (4 x 0,4 mm) for steady sparkling of the flowing gas, only low pressure is necessary. Suitable for scrubber bottles and columns (page 148) with M 8x1 thread and for gas inlet tubes (page 198).

FDA conform

O.D. mm	Height mm	Receiver M	Suitable for Cat. No.:	Cat. No.:
28	24	8 x 1	A 117-.. / A 118-..	**N 1501-16**

BOLA Gas Frits

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

Microporous PTFE with pore size 3 µm for steady sparkling of the flowing gas. Suitable for scrubber bottles and columns (page 148) with M 8x1 thread and for gas inlet tubes (page 198).

FDA conform

O.D. mm	Length mm	Receiver	Suitable for Cat. No.:	Cat. No.:
15	15	M 6 x 1		**N 1503-28**
25	26	M 8 x 1	A 117-.. / A 118-..	**N 1503-32**
15	15	Ø 5 mm		**N 1503-36**
25	26	Ø 7 mm		**N 1503-40**

BOLA Gas Inlet Tubes

Material: **PTFE**
Temperature resistance: **from -200°C to +250°C**
Chemical resistance: **+++ universal**

Product description:

For constructing a gas washing equipment. Tube with inner diameter 5 mm, one side with hose connector dia. 9 mm for connecting tubing, other side with thread M 8x1 for connecting a gas frit or a gas distributor.

FDA conform

Length mm				Cat. No.:
200				**N 1502-02**
400				**N 1502-04**
600				**N 1502-06**


thread


hose connector

BOLA Vacuum Filters

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Filtration unit made of PTFE, multi-stage hose connector with integrated lock screw for connecting vacuum tubing with I.D. 6 mm or 8 mm, PTFE supporting disc to fit optionally available filtering discs (page 204). Collecting vessel made of PFA, filling vessel with lid for protection against contaminations also made of PFA. The filters are produced without plasticisers and have an almost universal chemical resistance. They do not release any trace elements into the filtrate. Due to the non-adhesive surface, they are easy to clean and can be reused.

FDA conform

For membrane dia. mm	Filtration surface cm^2	Capacity of filling /collecting vessel ml	O.D. mm	Total height mm	Cat. No.:
47	13,8	240	86	250	**N 1650-08**
47	13,8	500	100	290	**N 1650-16**
90	55,4	1.000	130	370	**N 1650-24**

Flow rate:

Flow capacity for water under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a thickness of 0,2 mm:

For membrane dia. mm	Pore size µm	Flow ml/min.
47	1,00	510
47	0,45	148
47	0,20	57
90	1,00	1.638
90	0,45	369
90	0,20	121

SUITABLE: page **204**
Dimensionally coordinated filtering membranes

BOLA Pressure Pre-Filters

Material:	Temperature resistance:	Chemical resistance:	Pressure:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**20 bar**	**121°**

Product description:

For direct fine filtration in front of HPLC columns. For filtering membranes (available optionally – page 204) with a diameter of 13 mm and a thickness between 0,1 and 3 mm, filtration surface of 132 mm^2 for filtration with nearly no dead volume. The membrane can be exchanged by hand. Connection threads on both sides UNF ¼" 28 G, suitable flanged tubing can be found on page 198.

FDA conform

For tubing I.D. mm	For filtering membrane with dia. mm		Cat. No.:
(1/32") 0,8	13		**F 780-08**
(1/16") 1,6	13		**F 780-16**

Example

BOLA Flow Filters

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	autoclave:
PTFE	**from -200°C to +160°C**	**+++ universal**	**suitable**	**121°**

Product description:

Suitable for overpressure or vacuum, usable for example as added filter or as large-area in-line apparatus in a line system. Suitable for temperatures up to +160°C. The optionally available filtering membranes (page 204) can be exchanged easily. Tubing can be connected to GL threads by means of the included laboratory screw joints.
The filters are produced without plasticisers and have an almost universal chemical resistance. They do not release any trace elements into the filtrate. Due to the non-adhesive surface, they are easy to clean and can be reused.

FDA conform

For membrane dia. mm	Filtration surface cm^2	Connecting thread GL	For tubing O.D. mm	Cat. No.:
25	3,1	14	3,2 and 6,0	**N 1670-08**
47	13,8	18	6,0 and 8,0	**N 1670-16**
90	52,0	25	8,0 and 10,0	**N 1670-24**

Flow rate:

Flow capacity under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a thickness of 0,2 mm:

For membrane dia. mm	Pore size µm	Product	Flow ml/min.
25	1,00	water	96
25	1,00	air	12.800
25	0,45	water	11
25	0,45	air	4.600
47	1,00	water	212
47	1,00	air	48.000
47	0,45	water	50
47	0,45	air	28.000
90	1,00	water	648
90	1,00	air	56.400
90	0,45	water	264
90	0,45	air	36.000

BOLA Vacuum Filter Funnels

Material:	Material:	Temperature resistance:	Chemical resistance:	Transparency:	autoclave:
PTFE	**PFA**	**from -200°C to +250°C**	**+++ universal**	**transparent**	**121°**

Product description:

Filtration unit made of PTFE with cone size 29 for connection to a vessel (must be suitable for vacuum) with socket size 29. Multi-stage hose connector with integrated lock screw for vacuum tubing with I.D. 6 and 8 mm, filtration surface 13,8 cm^2 , easily exchangeable filtering membrane dia. 47 mm (optionally available – page 204). Filling vessel made of PFA with PTFE lid for protection against contaminations.

FDA conform

Capacity of filling vessel ml	O.D. mm	Total height mm	Cat. No.:
125	62	188	**N 1658-08**

Flow rate:

Flow capacity for water under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a diameter of 47 mm and a thickness of 0,2 mm:

Pore size µm		Flow ml/min.
1,00		500
0,45		115
0,20		32

BOLA Filter Adaptors for Syringes

Material:	Temperature resistance:	Chemical resistance:	Pressure:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**2 bar**	**121°**

Example

Product description:

Adaptors can be screwed together into multi-stage filters (prefilter, main filter). The low weight of only 14 g or 44 g allows easy exchange of the optionally available filtering membranes (page 204).

FDA conform

For membrane dia. mm	Filtration surface cm^2	O.D. mm	Total height mm	Cat. No.:
13	0,78	21	35	**N 1666-08**
25	3,80	34	40	**N 1666-16**

Flow rate:

Flow capacity for water under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a thickness of 0,2 mm:

For membrane dia. mm	Pore size µm	Flow ml/min.
13	1,00	25
13	0,45	10
25	1,00	155
25	0,45	35

BOLA Single-Stage Flow Filter

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	autoclave:
PFA	**from -200°C to +160°C**	**+++ universal**	**suitable**	**121°**

Product description:

Filter made of PFA with connecting nut made of glass-fibre reinforced ETFE. Suitable for vacuum and overpressure up to max. 150 kPa (1.500 mbar) and for temperatures up to max. +160°C. Easy exchange of the optionally available filtering membrane (page 204). Couplings for connecting tubing (page 118) with O.D. 6,35 mm (1/4") are included.

FDA conform

For membrane dia. mm	For tubing O.D. mm	Filtration surface cm^2	O.D. mm	Cat. No.:
47	(1/4") 6,35	14,1	62	**N 1678-08**

Flow rate:

Flow capacity under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a diameter of 47 mm and a thickness of 0,2 mm:

Pore size µm	Product	Flow ml/min.
1,00	water	272
0,45	water	47
1,00	air	21.000
0,45	air	7.000

BOLA Three-Stage Flow Filter

Material:	Temperature resistance:	Chemical resistance:	Vacuum:	autoclave:
PFA	**from -200°C to +160°C**	**+++ universal**	**suitable**	**121°**

Product description:

Filter made of PFA with connecting nut made of glass-fibre reinforced ETFE. Suitable for vacuum and overpressure up to max. 150 kPa (1.500 mbar) and for temperatures up to max. +160°C. Multi-stage filtrations with up to 3 different filtering membranes are possible. Easy exchange of the optionally available filtering membrane (page 204). Couplings for connecting tubing (page 118) with O.D. 6,35 mm (1/4") are included.

FDA conform

For membrane dia. mm	For tubing O.D. mm	Filtration surface cm^2	O.D. mm	Cat. No.:
47	(1/4") 6,35	3 x 14,1	62	**N 1682-08**

Flow rate:

Flow capacity under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a diameter of 47 mm and a thickness of 0,2 mm:

Pore size µm	Product	Flow ml/min.
1,00	water	90
0,45	water	10
1,00	air	27.000
0,45	air	13.200

BOLA Suction Filters

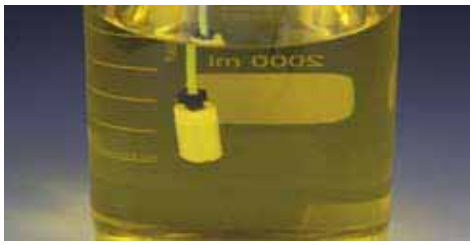
Material:	Temperature resistance:	Chemical resistance:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**121°**

Product description:

Consisting of a receiver made of PTFE with female thread UNF ¼" 28 G and an easily exchangeable frit made of porous PTFE (Cat. No. F 766-..). Ideal prefilters in front of pump systems for protecting gaskets, pistons or column packings against premature wearing due to contaminations. Suitable flanged tubing can be found on page 182.

FDA conform

Pore size µm	For tubing I.D. mm	Dia. of filter mm	Length of filter cm	Cat. No.:
2	(1/32") 0,8	14	25	**F 765-08**
2	(1/16") 1,6	14	25	**F 765-16**
10	(1/32") 0,8	14	25	**F 765-48**
10	(1/16") 1,6	14	25	**F 765-56**



BOLA Frits for Suction Filters

Material:	Temperature resistance:	Chemical resistance:	autoclave:
PTFE	**from -200°C to +250°C**	**+++ universal**	**121°**

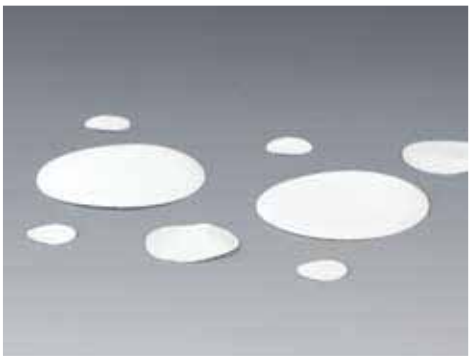
Product description:

Replacement frits made of porous PTFE, suitable for suction filters (Cat. No. F 765-.. on page 203).

FDA conform

Pore size µm	Dia. of filter mm	Length of filter cm	Cat. No.:
2	14	20	**F 766-08**
10	14	20	**F 766-48**

BOLA Filtering Membranes



Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Thickness 0,2 mm, packing unit: 10 pieces (see page 74 for further sizes)

Pore size µm	Dia. of membrane mm	Filtration surface mm²	Cat. No.:
0,05	13	132	**N 1690-08**
0,05	25	490	**N 1690-28**
0,05	47	1.735	**N 1690-48**
0,20	47	1.735	**N 1690-52**
0,45	47	1.735	**N 1690-56**
1,00	47	1.735	**N 1690-60**
5,00	47	1.735	**N 1690-64**

Flow rate:

Flow capacity under vacuum of 100 kPa (1000 mbar) using a PTFE filtering membrane with a diameter of 47 mm and a thickness of 0,2 mm:

Pore size µm	Product	Flow ml/min.
0,20	water	57
0,20	air	500
0,45	water	148
0,45	air	800
1,00	water	510
1,00	air	1.000
5,00	water	1.000
5,00	air	2.000

BOLA Filtering Discs

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

FDA conform

Product description:

Made of microporous PTFE, thickness 1 mm, packing unit: 10 pieces

Pore size µm	Dia. of membrane mm	Filtration surface mm²	Cat. No.:
5	47	1.735	**N 1564-10**

BOLA Filtering Tiles

Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Made of microporous PTFE, standard tiles with dimensions of 320 x 320 mm for cutting or stamping.

FDA conform

Pore size µm	Thickness mm		Cat. No.:
5	1		**N 1610-10**
10	1		**N 1616-10**
10	2		**N 1616-20**
10	3		**N 1616-30**

BOLA Filtering Rods

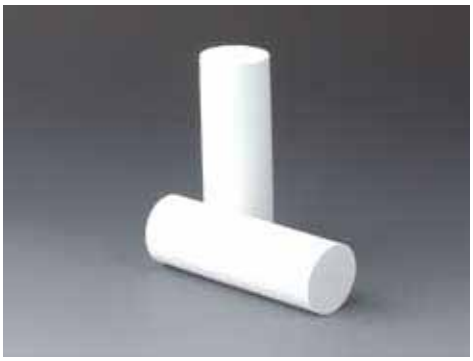
Material:	Temperature resistance:	Chemical resistance:
PTFE	**from -200°C to +250°C**	**+++ universal**

Product description:

Made of microporous PTFE for further treatment and processing. Diameter and length are nominal dimensions and can contain a machining tolerance.

FDA conform

Pore size µm	Dia. of rod mm	Length mm	Cat. No.:
5	28	100	**N 1505-28**
5	32	120	**N 1505-32**
10	28	100	**N 1510-28**
50	28	100	**N 1520-28**



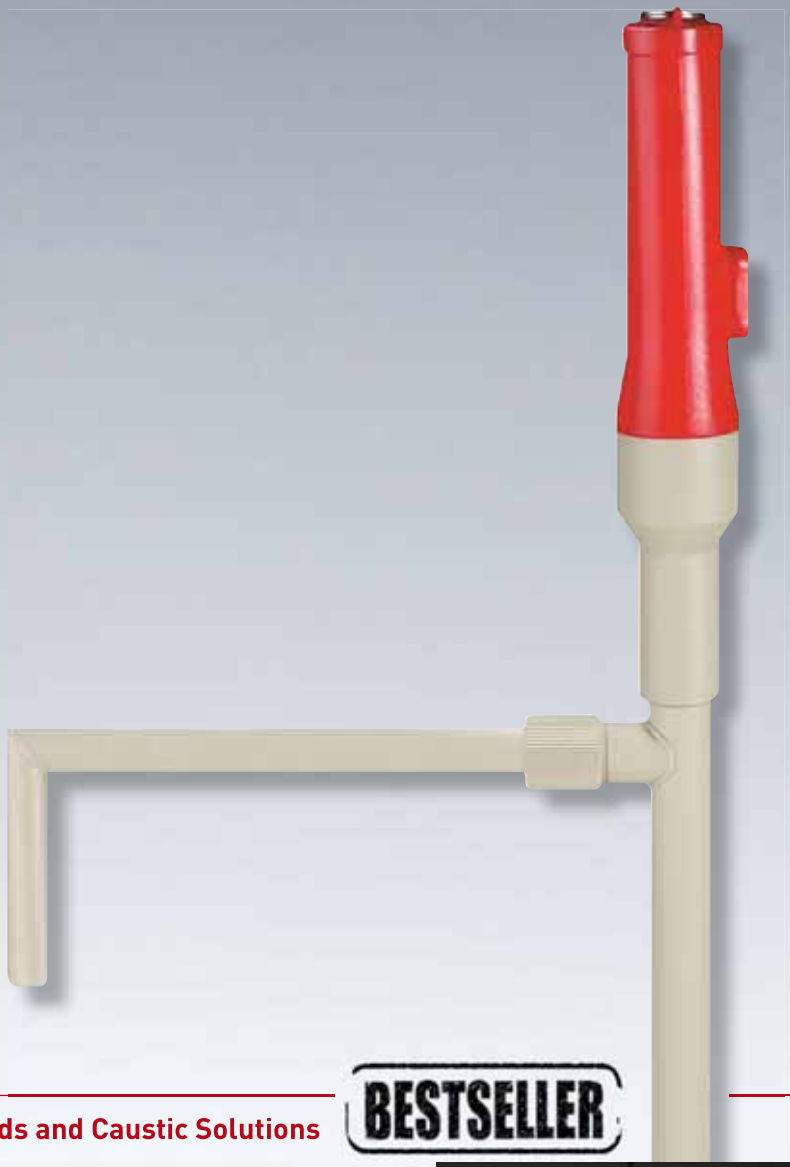
Pumps

For versatile use, easy handling, compact:
BOLA pumps are made to meet allmost all requirements
in practice and allow safe transfer of liquids.

PRODUCT TIPS

Page 209
Sampling Pump

Page 208
Battery-operated Pump



BOLA Cordless Pumps for Acids and Caustic Solutions

BESTSELLER

Material:	Temperature resistance:	Chemical resistance:
PP	**from +5°C to +60°C**	**++ very good**

FDA conform

Product description:

Made of polypropylene, PTFE, Hastelloy®, driven by two commercial 1,5 V batteries (we recommend the use of rechargeable batteries)

Length of suction pipe mm	Dia. of suction pipe mm	Cat. No.:
400	25	**G 870-01**
600	25	**G 870-11**

Product advantages:

- powerful – pumping capacity of up to 6 litres per minute free flowing
- compact construction
- battery operated and therefore usable anywhere
- easy handling
- very light weight (only 500 g including batteries)
- low-risk pumping
- also suitable for narrow mouth vessels with ground joint 29/32 or thread GL 45, carboys or barrels

Applications:

For pumping low viscous liquids (e.g. acids, bases etc.)

For ground joint 29/32

For thread GL 45

BOLA Sampling Pump

BESTSELLER

Material:	Material:	Temperature resistance:	Chemical resistance:
PTFE	**PP**	**from -10°C to +90°C**	**++ very good**

Product description:

Made of polypropylene and PTFE. A pull on the ball handle produces a slight vacuum in the sampling bottle. Due to this vacuum, the sample is sucked into the sampling bottle. Both glass bottles and plastic bottles with a GL 45 thread can be used as sampling bottles. The pump provides universal chemical resistance since the sample is only exposed to PTFE.

FDA conform

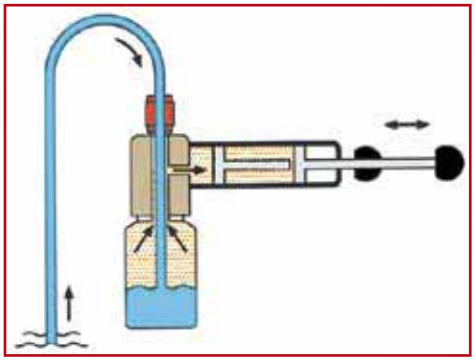
Thread for connection GL	For bottles with a capacity of ml		Cat. No.:
18	100 - 2.000		**A 124-16**

Product advantages:

- » compact construction
- » usable anywhere (no power or air supply needed)
- » easy handling
- » quick and low-risk pumping of ultrapure liquids
- » volume per stroke 50 ml
- » for tubing O.D. 6 mm

Applications:

For pumping liquids from sources that are not easily accessible; also suitable for liquids with a high viscosity, e.g. oils



SUITABLE: page **114**
Tubing for all screw joints

BOLA Micro Magnet for Glass Pumps

Material:	Temperature resistance:	Chemical resistance:	Pressure:
PTFE	**from +0°C to +150°C**	**+++ universal**	**1 bar**

Product description:

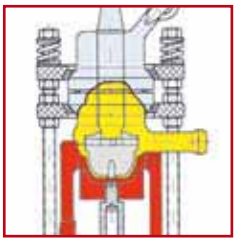
Made of PTFE, the magnet can be adjusted in height by means of the integrated screw. The strong magnet provides good power transmission.

FDA conform

Suitable for DN	Bore dia. mm	O.D. mm	Height mm	Cat. No.:
50	6	36	29	**G 876-14**

Applications:

Suitable for all common laboratory glass pumps, e.g. from company NORMAG®



We build your pump!

Besides the pumps shown on these pages we also construct and produce custom-made pumps. Those pumps are used in a multitude of appliances and plants.

Membrane pump with PTFE bellow piston, compressed-air drive.

Metering unit with inspection glass, sensor mount and compressed-air driven PTFE bellow piston.

Technical Information

Materials – Chemical resistance – Information about fluoroplastics, stirrer shafts and tubing – Determination of threads – Conversion tables

BOLA Materials

Fluoroplastics

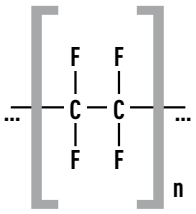
Belong to the family of thermoplastics. The higher the fluoric content, the better the thermal and chemical capacity of fluoropolymers.

Unique properties are:

- » universal chemical resistance
- » high thermal load capacity (-200 °C up to +260 °C)
- » resistance to all sterilisation temperatures
- » non-flammable
- » resistant to environmental changes (weather, light)
- » non-adhesive
- » ultra-low friction coefficient
- » unbreakable
- » physiologically safe
- » inert, no taste, odourless
- » UV-resistant

PTFE – Polytetrafluoroethylene

Already discovered in 1938 by research-chemists of DuPont (USA) it was not introduced or marketed until 1946. A partly crystalline fluoroplastic that belongs to the family of thermoplastics (but not suitable for injection moulding).
The remarkable chemical and thermal resistance results from the linkage force between carbon atoms and fluorine atoms and from the nearly complete shielding of the carbon chain by fluorine atoms.
PTFE has a thermal resistance of -260 °C up to +300 °C (for example no brittleness in boiling helium at -269 °C). This temperature range is reached by no other commercial plastic material.
Permanent temperature resistance depends on the load. This means that PTFE can be used from -200 °C to +260 °C at moderate mechanical load.
PTFE labware has a white appearance, a non-adhesive surface and excellent slip characteristics. Its fabrication is done by isostatic pressing processes or by machining of extruded semi-finished PTFE material.



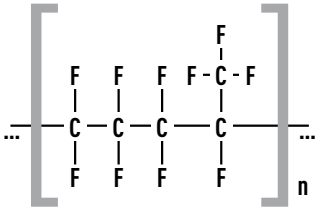
Trade name
Teflon®
by DuPont
Hostaflon®
by Dyneon
Fluon®
by ICI Fibres

PTFE – TFM

A further development of the classic Polytetrafluoroethylene (PTFE), with additional modifier Perfluorpropylvinylether.
Due to a five times lower molecular weight and a more homogeneous crystal structure, the single particles merge a nearly pore-free polymer structure. Compared to PTFE, the tightness as well as the barrier effect at the same wall thickness are doubled. This is particularly advantageous at high working temperatures. PTFE-TFM has a universal chemical resistance. Sticking of any contaminations is prevented by an extreme smooth surface. Special methods allow a simple and safe heat seal. This material is ideal for e. g. digestion vessels or gaskets.

FEP – Tetrafluoroethylene-Perfluoropropylene

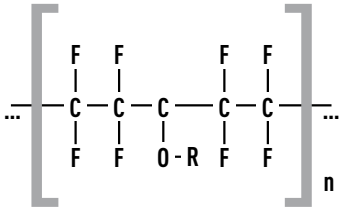
A molten copolymer of tetrafluoroethylene and perfluoropropylene with a high-molecular, partly crystalline structure which was introduced on the market in 1960.
Its mechanical and chemical properties are comparable with those of PTFE, however, the upper limit of the permanent working temperature is lower than that of PTFE (max. +205 °C).
FEP is a typical thermoplastic material which can be treated and machined by using established methods, although its high viscosity limits the speed of operation. FEP labware is translucent to transparent and non-porous.



Trade name
Teflon®
by DuPont
Neoflon®
by Daikin

PFA – Perfluoroalkoxy

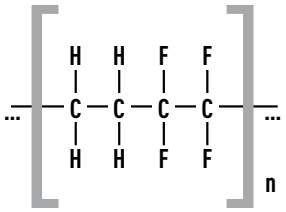
Fluorinated hydrocarbon with a high-molecular, partly crystalline structure.
Compared to PTFE it has additional side chains consisting of perfluorated alkoxy groups. The chemical and thermal properties of this thermoplastic fluoropolymer are equal to those of PTFE.
PFA labware is translucent to transparent, non-porous and particularly useful in high-purity work.



Trade name
Teflon®
by DuPont
Hostaflon®
by Dyneon

ETFE – Ethylene-Tetrafluoroethylene

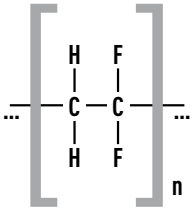
A modified copolymer of ethylene-tetrafluoroethylene. Unlike the homopolymer PTFE which can be treated only by means of pressing or sintering, ETFE can be thermoplastic processed. I. e. this plastic can be injection moulded with appropriate machines.
In laboratories, this material is mainly used for items reinforced with glass fibre such as screw caps or screw joints.



Trade name
Tefzel®
by DuPont
Hostaflon ET®
by Dyneon

PVDF – Polyvinylidene Fluoride

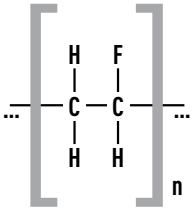
A fluoroplastic that can be machined or thermoplastic processed. Characterised by a good to excellent chemical resistance. Compared with PTFE, it is much harder and more rigid, but its functional temperature range is lower. Its advantages over other fluoroplastics are its easy processing, the high mechanical values and the low specific weight. Therefore it is used in many applications.



Trade name
Solef®
by Solvay
Dyflor®
by Dynamit

PVF – Polyvinylfluoride

Containing fluorine, it displays a stronger chemical linkage than common polymers and thus a better inherent stability. It shows its unique properties when used at temperatures ranging from -70 °C to +110 °C, whereas temperatures of up to max. +200 °C are withstood. Polyvinylfluoride does not contain any softener, is resistant to fading and can easily be cleaned due to its dirt-repelling surface. In particular, foils, films and bags for gas analysis are made of PVF.



Trade name
Tedlar®
by DuPont

BOLA Materials

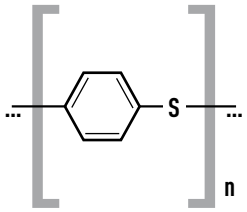
Technical Plastics

Mainly used for high working temperature ranges.
Their best known advantages are:

- low abrasion
- no corrosion
- excellent gliding properties
- high rigidity
- good chemical resistance
- dimensional accuracy
- high thermal resistance

PPS – Polyphenylsiloxan

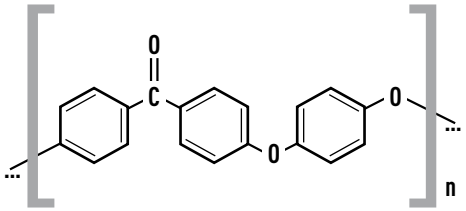
New technical high-performance plastic. This macromolecule consists of phenylene rings and one S-atom which provide a good chemical resistance even at high working temperatures. PPS is particularly suitable for the production of moulded pieces which are exposed to high mechanical and thermal stresses. Injection moulding is the most common processing technology for this material, in addition, single components can be made of semi-finished products by cutting. Special glass-fibre reinforced compounds offer an improved rigidity, sturdiness and dimensional stability under heat compared to non-reinforced compounds.



Trade name
Fortron®
by Hoechst
Ryton®
by Phillips
Petroleum
Chemicals
Alton®
by Intern.
Polymer Corp.

PEEK – Polyetheretherketone

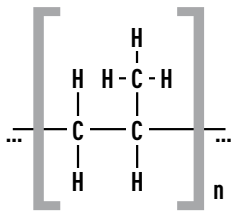
Partly crystalline thermoplastic that withstands high temperatures. Due to its unique properties, PEEK is mainly used for high-value and highly stressable components. The high upper working temperature (+250 °C), the good chemical stability and resistance to hydrolysis as well as the high mechanical values of this material will allow PEEK to become the material of the future. PEEK components are commonly used as HPLC fittings, screw joints or as tubing. Its natural colour is brown, its price is considerably higher than that of PTFE or PFA.



Trade name
Victrex®
by Victrex
Hostatec®
by Hoechst

PP – Polypropylene

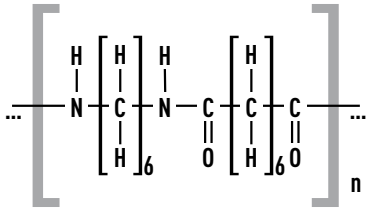
A polymer of ethylene with isostatic arrangement of methyl groups.
It does not belong to the family of fluoroplastics. PP can be autoclaved (at +121 °C) and is distinguished by good mechanical and chemical properties almost up to its softening point. PP labware is unbreakable and an economical alternative with, however, restricted chemical and thermal resistance.



Trade name
Norolen®
by BASF
Hostalen®
by BASF

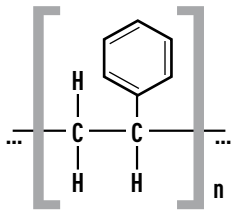
PA – Polyamides

Condensation polymers obtained either from amino acids respectively from their lactams (e. g. caproic lactam) or diamine and dicarboxylic acid (e. g. adipic acid and hexamethylene-diamine). In general, polyamides are defined according to the number of carbon atoms of their monomers, e. g. PA 6 = polycarbonic lactam or PA 12 = polylauric lactam. PA 6 is the most commonly used polyamide. All polyamides are characterised by high strength and scuff resistance. The application range varies from simple turned parts such as screws or nuts to plain bearings or toothed wheels.



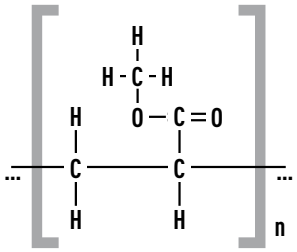
Trade name
Ultramid®
by BASF
Durethan®
by Bayer
Grilon®
by Ems Chemie

PS – Polystyrene
A polymerisation product of styrene. Polystyrene is one of the most commonly used plastic materials. For many years it has been processed by injection moulding, extruding or blowing. Because of its structure, it is transparent, hard and brittle. A disadvantage is its low thermal and chemical resistance.



Trade name
Lacqrene®
by ATO
Vestyron®
by Innovene
Edistir®
by Montedison

PMMA – Polymethylmethacrylate
An acrylic resin based on methyl methacrylate. It has become generally known under the trade name Plexiglas®. On the one hand, PMMA is approx. 60 times more elastic than window glass but on the other hand it is approx. 10 times more permeable than silicate glass. Of course, the hardness of its surface does not correspond to that of glass but compared with other materials it can easily be polished to high brilliance. As to weight, Polymethylmethacrylate is much more lightweight than normal window glass.



Trade name
Plexiglas®
by Röhm
Perspex®
by ICI
Oroglas®
by Rohm and Haas

Elastomers

Their main characteristic is their elasticity: Elastomers can easily be stretched and bent and return to their original shape and size after being released. These synthetic materials are most commonly used for o-rings, flat gaskets or resilient elements.

NBR – Acrylonitrile-Butadiene-Caoutchouc
Elastomer on the base of acrylonitrile-butadiene-caoutchouc which is mainly used as budget-priced sealing material (e. g. O-rings for stop-cocks). This material has a good resistance to mineral oils and fats as well as to HFA, HFB and HFC-hydraulic fluids. It has a very good elasticity. PERBUNAN® (its well-known trade name of BAYER AG) is not resistant to brake fluids on the basis of glycol, HFD liquids, aromatic compounds (e. g. Benzole), ester, keton and amines as well as in concentrated acids and caustic solutions. Due to its restricted chemical resistance, PERBUNAN® is not the ideal material for chemestry.

FPM – Fluorocaoutchouc
Elastomer on the base of fluorocaoutchouc, more familiar as VITON® (DuPont). Many O-rings, lip seals and sleeves are made of FPM. It has a very good resistance to heat, chemicals, weather and ozone. Furthermore, it is resistant to sulphurated mineral oils and fats and to hardly inflammable HFD liquids (basis phosphor ester or chlorinated hydrocarbon). It is not resistant to anhydrous ammonia, caustic soda, potassium, ketones, ether, dioxane, as well as some amines and organic acids. For BOLA products, FPM is mainly used as sealing material, mostly protected from the medium by a PTFE sealing lip.

EPDM
EPDM 3 is an elastomer on the base of ethylene-propylene-diene-caoutchouc which is mostly used for gaskets and O-rings. The main applications are in the area of hot water, steam and suds. It is not resistant to hydraulic fluids on the base of mineral oil but it is weather-proof, non-ageing and resistant to ozone. At BOLA, EPDM O-rings are mainly used for applications where VITON® O-rings are not sufficient.

FFKM – Perfluoro-Caoutchouc
An elastic sealing material with natural recovery and good accommodation to the sealing surfaces and a chemical resistance comparable with PTFE. FFKM O-rings have a very high chemical and thermal resistance. Such seals can withstand virtually all kinds of chemicals and can be used at long duration conditions with temperatures up to +260 °C. Perfluoro-caoutchouc is better known under the trade names KALREZ® by DuPont respectively CHEMRAZ® by Greene Tweed.

Materials - Physical Properties

Property	Standard	Unit	PTFE[1]	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA[3]	PPS	PEEK
Density	DIN 53 479	g/cm³	2.14–2.19	2.12–2.17	2.12–2.17	1.71–1.78	1.67–1.70	1.75–1.78	0.904–0.907	1.10–1.15	1.04–1.05	1.19	1.65	1.32
Service temperature without loading		°C	250–260	250–260	200–205	150–180	150–180	150–170	90–100	80–100	55–70	80	250	260
Inflammability			non-flammable	non-flammable	non-flammable	self extin-guishing	self extin-guishing	self extin-guishing	flammable	flammable	flammable	yes	self extin-guishing	V–0
Water absorption	DIN 53 495	%	<0.01	0.03	<0.01	<0.1	<0.1	0.03	<0.05	9–10	<0.3	–	0.02	0.5
Transparency			opaque	milky opaque	milky opaque	milky opaque	milky opaque	opaque	milky opaque	milky opaque	transparent	transparent	black	
Radioresistance		MGy	0.006	0.040	0.010	0.030	0.010	0.100	0.020	0.040	10	0.050	–	
Food suitability			Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	
Mechanical	**Standard**	**Unit**	**PTFE[1]**	**PFA**	**FEP**	**ETFE**	**ECTFE**	**PVDF**	**PP**	**PA**	**PS**	**PMMA[3]**	**PPS**	**PEEK**
Tensile strength 23 °C	DIN 53 456	N/mm²	29–39	27–32	19–25	36–48	41–54	38–50	25–40	40–60	35–60	72	195	
at 70°C			–	–	–	–	–	–	18–28	18–28	28–38	35	150	
at 150°C			14–20	15–21	4–6	8–12	3.5–4.5	7.5–10.5	–	–	–	–	70	
Limit of elasticity 23 °C	DIN 53 455	N/mm²	10	14	12	24	34	46	25–40	40–80	32–57	–	–	97
Elongation a. tear 23 °C	DIN 53 455	%	200–500	300	250–350	200–500	200–300	20–250	400–800	40–280	2–4	–	1.9	50
Tension E-module 23 °C	DIN 53 457	N/mm²	400–800	650	350–700	500–1200	1200–1800	800–1800	1100–2100	1600–2000	2900–3500	3300	14700	3600
Limit of bending stress at 23 °C	DIN 53 452	N/mm²	18–20	15	–	25–30	50	55	45–60	40–60	breaks	–	–	
Bending E-module	DIN 53 457	N/mm²	600–800	650–700	660–680	1000–1500	1700	1200–1400	800–1500	1000–1600	3000–3400	–	–	
Ball hardness 132/60	DIN 53 456	N/mm²	25–30	25–30	23–29	34–40	55–65	62–68	58–80	50–80	110–160	–	–	200
Rockwell hardness R	ASIM d-785		–	–	–	45–55	85–95	100–115	–	90–100	–	–	100	99
Shore hardness D	DIN 53 505		55–72	60–65	55–60	63–75	70–80	73–85	70–75	–	–	–	–	
Coefficient of friction dyn. against steel, dry	[2]		0.05–0.2	0.2–0.3	0.3–0.35	0.3–0.5	0.65	0.2–0.4	0.3–0.5	0.3–0.35	–	0.5	0.4	
Thermal	**Standard**	**Unit**	**PTFE[1]**	**PFA**	**FEP**	**ETFE**	**ECTFE**	**PVDF**	**PP**	**PA**	**PS**	**PMMA[3]**	**PPS**	**PEEK**
Melting temperature	ASTM 2116	°C	327	300–310	253–282	265–275	240–247	165–178	158–167	215–221	–	–	285	335
Dimensional stability u. heat A (18,5)Kp/cm²	DIN 53 461	°C	50–60	–	51	71–74	76	80–92	55–60	55–80	70–88	105	–	152
heat B (4,6) Kp/cm²	DIN ISO R 75		130–140	–	70	104	115	146–150	85–95	165–195	76–100	–	–	
Coeff. of linear thermal expansion		1K x 10⁻⁵	10–16	10–16	8–14	8–12	4–8	8–12	15–18	6–12	6–8	7	2.6– 4.8	
Thermal conductivity at 23 °C	DIN 52612	W/K x m	0.23	0.22	0.20	0.23	0.15	0.17	0.22	0.21–0.23	0.15–0.16	0.19	0.20	0.25
Specific heat at 23 °C		Kj /Kg x K	1.01	1.09	1.17	1.95	–	1.38	1.68	1.5–2.1	1.18–1.34	–	–	2.16
Oxygen value		%	>95	>95	>95	30	60	43	<30	<30	<30	1.47	56	35
Electrical	**Standard**	**Unit**	**PTFE[1]**	**PFA**	**FEP**	**ETFE**	**ECTFE**	**PVDF**	**PP**	**PA**	**PS**	**PMMA[3]**	**PPS**	**PEEK**
Dielectric constant at 10^3	DIN 53 483		2.0–2.1	2.06–2.1	2.1	2.6	2.6	7.8–9.0	2.26–2.4	4–12	2.4–2.74	3.6	4.0	3.2
at 10^6			2.0–2.1	2.06–2.1	2.06–2.1	2.6	2.5	6.4–7.6	2.25	3.5–9	2.5	2.7	4.1	3.2
Dielectric loss factor at 10^3	DIN 53 483	10^{-4}	0.3–0.5	0.2	2–8	6–8	90	120–200	<4	270–2700	1–20	0.06	2	3.0
at 10^6			0.7–1.0	0.8	2–8	50	90	1500–1900	<5	300–3300	1–14	0.02	20	
Volume resistivity	DIN 53 482	Ω x cm	10^{18}	10^{18}	10^{18}	10^{16}	10^{15}	10^{14}	$>10^{16}$	10^{12}	$>10^{11}$	10^{15}	$>10^{13}$	$5x10^{16}$
Surface resistivity	DIN 53 482	Ω	10^{17}	10^{17}	10^{16}	10^{14}	10^{14}	10^{13}	$>10^{13}$	10^{10}	$>10^{13}$	5×10^{13}	$>10^{15}$	10^{12}
Creep resistance	DIN 53 480		KA3c	–	KA3c	–	–	KA1	KA3c	KA3a-b	KA2-1	600	–	KC 150
Arc resistance	ASTM 495	sec	>360	–	>300	>75	135	>30	–	–	–	–	–	
Dielectric strength	DIN 53 481	KV/mm	40–80	50–80	50–80	60–90	50–80	40–80	60–90	30–80	60–90	30	25–28	25
Gas permeability	**Standard**	**Unit**	**PTFE[1]**	**PFA**	**FEP**	**ETFE**	**ECTFE**	**PVDF**	**PP**	**PA**	**PS**	**PMMA[3]**	**PPS**	**PEEK**
Nitrogen permeability		cm³/m² d/bar	0.7	–	3.8	4.7	1.5	0.06	4.3	0.5	0.27	1	–	
Oxygen permeability		cm³/m² d/bar	2.05	–	30	15.6	0.39	0.05	19	1.2	2.35	1	–	
Carbon dioxide permeability		cm³/m² d/bar	5.7	–	60	38	17	0.2	61	4	8	–	4	
Water vapor permeability		g/m²/d	0.03	–	2	0.6	9	4.5	2.1	1	14	300	–	

[1] Not extrudable thermoplastic » [2] Not a standardised test. Friction coefficient is subject to different effects and can therefore only be used as a guide.
[3] Tested partially by methods other than those stated; upon request additional physical characteristics available based on the actual test methods used.

All information stated without engagement.

Materials - Chemical Resistance

Please note:

All information in our catalogue is based on current technical knowledge, experience and manufacturers' data. Users should check the suitability of parts and materials described in the catalogue before purchase.

BOLA does not accept any warranty claims as to suitability and fitness of purpose of the materials and products described in this catalogue. Users should avoid making any assumptions on, or interpretation of, the data herein. **Therefore we cannot provide warranty and cannot accept responsibility for any damage.**

Categories of substances

Classes of substances at +20 °C	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Aldehydes	+	+	+	+	+	+	o	o	–	–
Alcohols	+	+	+	+	+	+	+	–	o	o
Amines	+	+	+	+	+	o	o	o	+	–
Bases/Caustic solutions	+	+	+	+	+	+	+	o	o	–
Esters	+	+	+	+	+	o	+	+	–	–
Ether	+	+	+	o	o	o	o	o	–	–
Glycols	+	+	+	+	+	+	+	+	+	o
Ketones	+	+	+	o	o	o	o	+	–	–
Hydrocarbons, aliphatic	+	+	+	+	+	+	o	+	–	–
Hydrocarbons, aromatic	+	+	+	+	+	+	o	+	–	–
Hydrocarbons, halogenated	o	+	+	+	+	+	o	o	–	–
Mineral oils	+	+	+	+	+	+	–	+	+	o
Oxidizing agents, strong	+	+	+	o	o	+	o	–	–	–
Vegetable oils	+	+	+	+	+	+	o	+	+	o
Acids inorganic	+	+	+	o	o	+	+	–	+	o
Acids organic	+	+	+	o	o	+	+	–	o	+
Lubricating oils	+	+	+	+	+	+	+	+	+	+

Substances

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Accumulator acid	20	+	+	+	+	+	+	+	–	+	–
Acetaldehyde	100	+	+	+	+	+	+	o	–	–	o
Acetamide	100	+	+	+	+	+	+	+	+	+	o
Acetic acid	100	+	+	+	+	+	+	+	–	o	–
Acetic acid amide	100	+	+	+	+	+	+	+	+	+	o
Acetic acid anhydride	100	+	+	+	+	+	–	o	–	–	–
Acetic acid butyl ester	100	+	+	+	+	+	+	o	+	–	–
Acetic acid chloride	100	+	+	+	+	+	+	o	o	–	–
Acetic acid ethyl ester	100	+	+	+	+	+	–	o	+	–	–
Acetic acid pentyl ester	100	+	+	+	+	+	+	+	+	–	+
Acetic anhydride	100	+	+	+	+	+	–	o	–	–	–
Acetone	100	+	+	+	+	+	–	+	+	–	–
Acetonitrile	100	+	+	+	+	+	o	+	+	–	–
Acetophenone	100	+	+	+	+	+	+	+	–	–	–
Acetyl benzene	100	+	+	+	+	+	+	+	–	–	–
Acetyl chloride	100	+	+	+	+	+	+	o	o	–	–
Acetylene tetrachloride	100	+	+	+	–	–	+	–	+	–	–
Acetylsalicylic acid	100	+	+	+	+	+	+	+	+	+	–
Acetone-2	100	+	+	+	+	+	–	+	+	–	–
Acrylic acid butyl ester	100	+	+	+	+	+	o	o	+	–	–
Acrylic acid ethylic ester	100	+	+	+	+	+	o	o	+	–	–
Acrylonitrile	100	+	+	+	+	+	o	o	+	–	–
Adipic acid	100	+	+	+	+	+	+	+	+	+	–
Alcohol	100	+	+	+	+	+	+	+	–	o	o
Alcohol denatured	100	+	+	+	+	+	+	+	–	o	o
Alkyl acetone	100	+	+	+	+	+	+	+	–	o	–
Alkyl alcohol	100	+	+	+	+	+	+	+	–	o	–
Alkyl chloride	100	+	+	+	+	+	o	o	–	–	–
Allylether acetate	100	+	+	+	+	+	+	+	–	o	–
Alum	100	+	+	+	+	+	+	+	–	o	–
Alumina	100	+	+	+	+	+	+	+	+	o	o
Aluminium acetate	100	+	+	+	+	+	+	+	+	o	o
Aluminium chloride	100	+	+	+	+	+	+	+	o	+	o
Aluminium fluoride	100	+	+	+	+	+	+	+	+	+	–
Aluminium hydroxide	100	+	+	+	+	+	+	+	+	o	o
Aluminium hydroxidacetate	100	+	+	+	+	+	+	+	+	o	o
Aluminium nitrate	100	+	+	+	+	+	+	+	+	o	o
Aluminium oxide	100	+	+	+	+	+	+	+	+	o	o
Aluminium sulfate	100	+	+	+	+	+	+	+	+	o	o
Amino acid	100	+	+	+	+	+	+	+	+	+	o
Aminoacetic acid	100	+	+	+	+	+	+	+	+	+	o
Aminobenzene	100	+	+	+	o	o	+	+	+	–	o
Amino methane	100	+	+	+	+	+	+	+	–	o	+
Ammonia	100	+	+	+	+	+	+	+	o	o	–
Ammonia solution	100	+	+	+	+	+	+	+	o	o	–
Ammonium acetate	100	+	+	+	+	+	+	+	+	+	+
Ammonium alum	100	+	+	+	+	+	+	+	+	o	–

Definitions and abbreviations:

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

Materials - Chemical Resistance

Substances

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Ammon.aluminiumsulfate	100	+	+	+	+	+	+	+	+	o	–
Ammonium carbonate	100	+	+	+	+	+	+	+	+	+	–
Ammonium chloride	100	+	+	+	+	+	+	+	o	+	–
Ammonium fluoride	100	+	+	+	+	+	+	+	o	+	–
Ammonium hydroxide	25	+	+	+	+	+	+	+	o	o	–
Ammonium nitrate	100	+	+	+	+	+	+	+	o	o	o
Ammonium oxalate	100	+	+	+	+	+	+	+	o	+	o
Ammon. peroxodisulfate	100	+	+	+	+	+	+	+	–	+	–
Ammonium persulfate	100	+	+	+	+	+	+	+	–	+	–
Ammonium phosphate	100	+	+	+	+	+	+	+	–	+	o
Ammonium sulfate	100	+	+	+	+	+	+	+	+	o	o
Ammonium sulfide	100	+	+	+	+	+	+	+	+	o	–
Ammon nitrate	100	+	+	+	+	+	+	+	o	o	o
Ammon salpeter	100	+	+	+	+	+	+	+	o	o	o
Ammon sulfate	100	+	+	+	+	+	+	+	+	o	o
Amyl acetate	100	+	+	+	+	+	+	+	+	–	+
Amyl alcohol	100	+	+	+	+	+	+	+	o	+	o
Aniline	100	+	+	+	o	o	+	+	+	–	o
Anisole	100	+	+	+	+	+	+	o	+	–	–
Anone	100	+	+	+	+	+	+	o	+	–	–
Antichlor	100	+	+	+	+	+	+	+	o	+	+
Antifreezing compound	100	+	+	+	+	+	+	+	+	o	o
Antimonous chloride	100	+	+	+	+	+	+	+	–	+	o
Antimony butter	100	+	+	+	+	+	+	+	–	+	o
Antimony trichloride	100	+	+	+	+	+	+	+	–	+	o
Aqua Regia	100	+	+	+	+	+	o	–	–	–	–
Arsenic acid	100	+	+	+	+	+	+	+	o	+	–
Arsenic (V)-oxide hydrate	100	+	+	+	+	+	+	+	o	+	–
Asphalt	100	+	+	+	+	+	+	o	+	+	o
Aviation gasoline	100	+	+	+	+	+	+	o	+	–	–
Azotic acid	65	+	+	+	+	+	o	–	–	–	–
B											
Barium carbonate	100	+	+	+	+	+	+	+	+	+	+
Barium chloride	100	+	+	+	+	+	+	+	+	+	+
Barium cyanide	100	+	+	+	+	+	+	–	+	+	o
Barium hydroxide	100	+	+	+	+	+	+	o	+	+	–
Barium sulfate	100	+	+	+	+	+	+	+	+	+	o
Barium sulfide	100	+	+	+	+	+	+	o	+	+	o
Baryta hydrate	100	+	+	+	+	+	+	o	+	+	–
Battery acid	20	+	+	+	+	+	+	+	–	+	+
Beer	100	+	+	+	+	+	+	+	+	+	+
Benzaldehyde	100	+	+	+	+	+	+	+	+	–	o
Benzoic acid	100	+	+	+	+	+	+	+	–	o	o
Benzene	100	+	+	+	+	+	+	o	+	–	–
Benzene diol-1,3	50	+	+	+	+	+	+	+	–	o	o
Benzyl acetate	100	+	+	+	+	+	+	+	+	–	o
Benzyl alcohol	100	+	+	+	+	+	+	–	–	–	–

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Benzyl chloride	100	+	+	+	+	+	+	–	–	–	–
Benzoic aldehyde	100	+	+	+	+	+	+	+	+	–	o
Benzoyl chloride	100	+	+	+	+	+	+	–	–	–	–
Benzylsulfonic acid	100	+	+	+	+	+	+	o	–	–	–
Benzyl acetate	100	+	+	+	+	+	+	+	+	–	o
Bisulfite SO_2	100	+	+	+	+	+	+	+	o	o	o
Bitumen	100	+	+	+	+	+	+	o	+	+	o
Bone glue	100	+	+	+	+	+	+	+	+	o	o
Borax	100	+	+	+	+	+	+	+	+	+	o
Boric acid	100	+	+	+	+	+	+	+	o	+	o
Bornanone-2	100	+	+	+	+	+	+	+	+	+	o
Brake fluid	100	+	+	+	+	+	+	+	+	+	o
Brine	25	+	+	+	+	+	+	+	+	+	+
Bromine	100	+	+	+	+	+	+	–	–	–	–
Bromomethane	100	+	+	+	+	+	+	o	o	–	–
Butadiene-1,3	100	+	+	+	+	+	+	–	o	–	–
Butane	100	+	+	+	+	+	+	+	+	o	o
Butane acid	100	+	+	+	+	+	+	–	o	–	o
Butane diacid	100	+	+	+	+	+	+	+	+	–	–
Butanol	100	+	+	+	+	+	+	+	o	+	o
Butyl acetate	100	+	+	+	+	+	+	o	+	–	–
Butyl alcohol	100	+	+	+	+	+	+	+	o	+	o
Butyl glycolate	100	+	+	+	+	+	+	+	+	+	+
Butyl ether	100	+	+	+	+	+	+	–	+	–	–
Butyl phenol	100	+	+	+	+	+	+	o	–	–	–
Butyric acid	100	+	+	+	+	+	+	–	o	–	o
C											
Calcium acetate	100	+	+	+	+	+	+	+	+	o	o
Calcium bicarbonate	100	+	+	+	+	+	+	+	+	+	+
Calcium carbonate	100	+	+	+	+	+	+	+	+	+	+
Calcium chloride	100	+	+	+	+	+	+	+	+	o	–
Calcium hydrogen carbonate	100	+	+	+	+	+	+	+	+	+	+
Calcium hydroxide	100	+	+	+	+	+	+	+	+	o	–
Calcium hypochloride	100	+	+	+	+	+	+	+	–	o	–
Calcium nitrate	100	+	+	+	+	+	+	+	+	+	–
Calcium oxide	100	+	+	+	+	+	+	+	+	+	+
Calcium sulfate	100	+	+	+	+	+	+	+	–	–	–
Calcium sulfide	100	+	+	+	+	+	+	+	–	–	–
Camphor	100	+	+	+	+	+	+	+	+	o	o
Camphora	100	+	+	+	+	+	+	+	+	o	o
Camphoric oil	100	+	+	+	+	+	+	+	+	+	o
Carbamide	100	+	+	+	+	+	+	+	+	+	+
Carbolic acid	100	+	+	+	+	+	+	o	–	–	–
Carbon disulfide	100	+	+	+	+	+	+	–	+	–	–
Carbon tetrachloride	100	+	+	+	+	+	+	o	–	–	–
Carbonic acid	100	+	+	+	+	+	+	+	+	o	o
Caustic baryta	100	+	+	+	+	+	+	o	+	+	–

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– **Poor resistance** – the plastic material can be deformed or destroyed.

Materials - Chemical Resistance

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Caustic potash	100	+	+	+	+	+	+	+	o	o	o
Caustic potash solution	100	+	+	+	+	+	+	+	o	o	o
Caustic soda	85	+	+	+	+	+	+	+	o	+	–
Cellosolve®	100	+	+	+	+	+	+	+	–	–	–
Cetyl alcohol	100	+	+	+	+	+	+	+	+	+	+
Chalk	100	+	+	+	+	+	+	+	+	+	+
Chlorine	100	+	+	+	+	+	+	o	–	–	–
Chloral hydrate	100	+	+	+	+	+	+	o	–	–	–
Chloric acid	25	+	+	+	+	+	+	+	–	–	–
Chloroacetic acid	100	+	+	+	+	+	+	+	–	o	–
Chlorobenzene	100	+	+	+	+	+	+	o	+	–	–
Chloroethane	100	+	+	+	+	+	+	o	o	–	–
Chloroethanol-2	100	+	+	+	+	+	+	o	–	–	–
Chloroethyl	100	+	+	+	+	+	+	o	o	–	–
Chlorethylene	100	+	+	+	o	o	+	–	–	–	–
Chloroform	100	+	+	+	o	o	+	+	o	–	–
Chlorofluorocarbon (FFC)	100	+	+	+	+	+	+	+	–	o	o
Chloromethane	100	+	+	+	+	+	–	o	o	–	–
Chloropropene-3	100	+	+	+	+	+	o	o	–	–	–
Chlorosulfonic acid	100	+	+	+	+	+	+	–	–	–	–
Chlorotoluene	100	+	+	+	+	+	+	–	–	–	–
Chromium(VI) oxide	100	+	+	+	+	+	+	+	–	o	–
Chromic acid	50	+	+	+	+	+	+	o	–	–	–
Chromic anhydride	100	+	+	+	+	+	+	+	–	o	–
Chromic sulfuric acid	100	+	+	+	+	+	+	o	–	–	–
Chromium trioxide	100	+	+	+	+	+	+	+	–	o	–
Citric acid	10	+	+	+	+	+	+	+	–	+	o
Coal tar particles	100	+	+	+	+	+	+	o	+	+	o
Cod liver oil	100	+	+	+	+	+	+	+	+	+	+
Copper chloride	100	+	+	+	+	+	+	+	–	+	+
Copper(I) cyanide	50	+	+	+	+	+	+	+	+	+	o
Copper(II) nitrate	100	+	+	+	+	+	+	+	o	+	+
Copper(II) sulfate	100	+	+	+	+	+	+	+	+	o	o
Cresol	100	+	+	+	+	+	+	o	–	–	–
Cumene	100	+	+	+	+	+	+	o	+	–	–
Cyclohexane	100	+	+	+	+	+	+	o	+	–	–
Cyclohexanol	100	+	+	+	+	+	+	o	+	–	–
Cyclohexanone	100	+	+	+	+	+	+	o	+	–	–
D											
D-Glucose	100	+	+	+	+	+	+	+	+	+	+
Decahydronaphthalene	100	+	+	+	+	+	+	o	+	–	o
Decalin	100	+	+	+	+	+	+	o	+	–	o
Decane	100	+	+	+	+	+	+	o	+	o	–
Denatured alcohol	100	+	+	+	+	+	+	+	–	o	o
Desiccator grease	100	+	+	+	+	+	+	+	o	–	–
Dextrin	100	+	+	+	+	+	+	+	+	+	+
Dextrose	100	+	+	+	+	+	+	+	+	+	+

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Diacetone	100	+	+	+	+	+	–	+	–	o	o
Diacetone alcohol	100	+	+	+	+	+	–	+	–	o	o
Diaminoethane	100	+	+	+	+	+	+	+	–	–	–
Dibutyl ether	100	+	+	+	+	+	+	–	+	–	–
Dichloroacetic acid	100	+	+	+	+	+	+	+	–	o	–
Dichlorobenzene	100	+	+	+	+	+	+	o	+	–	–
Dichloroethane	100	+	+	+	+	+	+	–	+	–	–
Dichloromethane	100	+	+	+	o	o	–	o	o	–	–
Diesel fuel	100	+	+	+	+	+	+	+	+	–	o
Diethanolamine	100	+	+	+	+	+	–	+	+	o	o
Diethyl ether	100	+	+	+	+	+	+	–	+	–	–
Diethylamine	100	+	+	+	+	+	–	+	+	o	o
Diethyle ketone	100	+	+	+	o	o	–	o	+	–	–
Diethylene glycol	100	+	+	+	+	+	+	+	+	o	o
Diethylene oxide	100	+	+	+	+	+	–	o	+	–	–
Diglycol	100	+	+	+	+	+	+	+	+	o	o
Dihydroxybenzene	100	+	+	+	+	+	+	+	–	–	+
Dihydroxybenzene-1,3	50	+	+	+	+	+	+	+	–	o	o
Diisobuthyl ketone	100	+	+	+	o	o	–	o	+	–	–
Dimethyl benzene	100	+	+	+	+	+	+	o	+	–	–
Dimethyl ether	100	+	+	+	+	+	+	–	+	–	–
Dimethyl formamide	100	+	+	+	o	o	–	+	o	–	–
Dimethyl sulfoxide	100	+	+	+	+	+	–	+	+	+	o
Dimethylamine	100	+	+	+	+	+	–	+	+	o	o
Dioxane	100	+	+	+	+	+	–	o	+	–	–
Diphenyl ether	100	+	+	+	+	+	+	–	+	–	–
Diphenyl oxide	100	+	+	+	+	+	+	–	+	–	–
Dipropylene glycol	100	+	+	+	+	+	+	+	+	+	+
Disodium tetraborate	100	+	+	+	+	+	+	+	+	+	o
Disulfide	100	+	+	+	+	+	+	–	+	–	–
DMSO	100	+	+	+	+	+	–	+	+	+	o
E											
Eau de Javelle	20	+	+	+	+	+	+	o	–	+	–
Ethanal	100	+	+	+	+	+	+	o	–	–	o
Ethane diacid	100	+	+	+	+	+	+	o	+	–	–
Ethane diamine-1,2	100	+	+	+	+	+	+	+	–	–	–
Ethane diol-1,2	100	+	+	+	+	+	+	+	+	+	+
Ethanol	100	+	+	+	+	+	+	+	–	o	o
Ether	100	+	+	+	+	+	+	–	+	–	–
Ethyl acetate	100	+	+	+	+	+	–	o	+	–	–
Ethyl acrylate	100	+	+	+	+	+	o	o	+	–	–
Ethyl alcohol	100	+	+	+	+	+	+	+	–	o	o
Ethyl benzene	100	+	+	+	o	o	o	o	+	–	–
Ethyl chloride	100	+	+	+	+	+	+	o	o	–	–
Ethyl ether	100	+	+	+	+	+	+	–	+	–	–
Ethylene chlorohydrine	100	+	+	+	+	+	+	o	–	–	–
Ethylene glycol	100	+	+	+	+	+	+	+	+	+	+

Definitions and abbreviations:

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

Materials - Chemical Resistance

Substances

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Ethylene glycol ethyl ether	100	+	+	+	+	+	+	+	–	–	–
Ethylene methyl ketone	100	+	+	+	+	+	+	+	+	–	–
Ethylene oxide	100	+	+	+	+	+	+	o	+	–	–
Ethylenediamine	100	+	+	+	+	+	+	+	–	–	–
F											
Fatty acids	100	+	+	+	+	+	+	+	+	+	+
Ferric chloride	100	+	+	+	+	+	+	+	+	+	o
Ferric nitrate	100	+	+	+	+	+	+	+	+	+	+
Ferric sulfate	100	+	+	+	+	+	+	+	+	+	o
Fertilizer	100	+	+	+	+	+	+	+	+	o	o
Fixing baths	100	+	+	+	+	+	o	+	+	–	–
Fluorhydric acid	45	+	+	+	+	+	+	+	–	–	–
Fluorine	100	+	+	+	+	+	+	o	–	–	–
Fluosilicic acid	100	+	+	+	+	+	+	+	–	o	o
Formaldehyde	40	+	+	+	+	+	+	+	o	–	–
Formic acid	100	+	+	+	+	+	+	+	–	+	o
Formic acid amide	100	+	+	+	+	+	+	+	o	–	–
Formalin	40	+	+	+	+	+	+	+	o	–	–
Formamide	100	+	+	+	+	+	+	+	o	–	–
Fruit juice	100	+	+	+	+	+	+	+	+	o	+
Fuel oil	100	+	+	+	+	+	+	+	+	+	+
Furfural	100	+	+	+	+	+	o	–	o	–	–
Furfurol	100	+	+	+	+	+	o	–	o	–	–
Furfuryl aldehyde	100	+	+	+	+	+	o	–	o	–	–
G											
Gasoline, aromatic	100	+	+	+	+	+	+	o	+	–	–
Gasoline, leaded	100	+	+	+	+	+	+	o	+	–	–
Gasoline, test	100	+	+	+	+	+	+	o	+	–	–
Gasoline, unleaded	100	+	+	+	+	+	+	o	+	–	–
Gelatine	100	+	+	+	+	+	+	+	+	+	o
Glacial acetic acid	100	+	+	+	+	+	+	+	–	o	–
Glauber's salt	100	+	+	+	+	+	+	+	o	+	+
Glue	100	+	+	+	+	+	+	+	+	o	o
Glycerin	100	+	+	+	+	+	+	+	+	+	+
Glycine	10	+	+	+	+	+	+	+	+	+	o
Glycocoll	10	+	+	+	+	+	+	+	+	+	o
Glycol	100	+	+	+	+	+	+	+	+	+	+
Glycolic acid	100	+	+	+	+	+	+	+	+	o	o
Grape sugar	100	+	+	+	+	+	+	+	+	+	+
Grease and oil	100	+	+	+	+	+	+	+	+	+	+
Gypsum	100	+	+	+	+	+	+	+	–	–	–
H											
Heptane	100	+	+	+	+	+	+	o	+	–	–
Hexadecanol	100	+	+	+	+	+	+	+	+	+	+
Hexafluorosilicic acid	100	+	+	+	+	+	+	+	–	o	o
Hexane	100	+	+	+	+	+	+	o	+	–	–
Hexane diacid	100	+	+	+	+	+	+	+	+	+	–

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Hexane triol-1,2,6	100	+	+	+	+	+	+	+	+	+	+
Hexanol	100	+	+	+	+	+	+	+	o	+	o
Hexyl alcohol	100	+	+	+	+	+	+	+	o	+	o
Hydrazine hydrate	100	+	+	+	o	o	–	–	–	–	o
Hydrobromic acid	100	+	+	+	+	+	+	+	–	–	–
Hydrochloric acid	37	+	+	+	+	+	+	+	–	o	o
Hydrocyanic acid	100	+	+	+	+	+	+	+	o	o	o
Hydrofluorocarbons	100	+	+	+	+	+	+	+	–	o	o
Hydrofluoric acid	45	+	+	+	+	+	+	+	–	–	–
Hydrogen peroxide	90	+	+	+	+	+	+	+	–	+	–
Hydrogen sulfide	100	+	+	+	+	+	+	–	+	–	–
Hydrogen sulfite	100	+	+	+	+	+	+	+	o	o	o
Hydroquinone	100	+	+	+	+	+	+	+	–	–	+
Hydrosulfide	100	+	+	+	+	+	+	–	+	–	–
Hydroxybenzoic acid	100	+	+	+	+	+	+	+	+	+	+
Hydroxyacetic acid	100	+	+	+	+	+	+	+	+	o	o
Hydroxypropionic acid-2	100	+	+	+	+	+	+	+	o	+	o
I											
Iodine	100	+	+	+	+	+	+	o	–	–	–
Iodine tincture	100	+	+	+	+	+	+	o	–	–	–
Isobutyl acetate	100	+	+	+	+	+	+	o	+	–	–
Isobutyl alcohol	100	+	+	+	+	+	+	+	–	o	o
Isooctane	100	+	+	+	+	+	+	+	+	–	o
Isopropanol	100	+	+	+	+	+	+	+	o	+	+
Isopropyl acetate	100	+	+	+	+	+	o	o	+	–	–
Isopropyl alcohol	100	+	+	+	+	+	+	+	o	+	+
Isopropyl benzene	100	+	+	+	+	+	+	o	+	–	–
Isopropyl ether	100	+	+	+	+	+	+	–	+	–	–
Isovaleron	100	+	+	+	o	o	–	o	+	–	–
J											
Javelle water	20	+	+	+	+	+	+	o	–	+	–
K											
Kerosene	100	+	+	+	o	o	+	o	+	–	–
Kerosine	100	+	+	+	o	o	+	o	+	–	–
L											
Lactic acid	100	+	+	+	+	+	+	+	o	+	o
Lanoline	100	+	+	+	+	+	+	+	+	+	+
Lead(II) acetate	100	+	+	+	+	+	+	+	+	o	o
Lead sugar	100	+	+	+	+	+	+	+	+	o	o
Lead tetraethyl	100	+	+	+	+	+	+	+	+	o	–
Lime	100	+	+	+	+	+	+	+	+	+	+
Linseed oil	100	+	+	+	+	+	+	+	+	+	+
Lubricating oil	100	+	+	+	+	+	+	+	+	+	+
M											
Machinery oil	100	+	+	+	+	+	+	+	+	+	o
Magnesium carbonate	100	+	+	+	+	+	+	o	+	+	+
Magnesium chloride	100	+	+	+	+	+	+	+	+	o	o

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o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

Materials - Chemical Resistance

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Magnesium hydroxide	100	+	+	+	+	+	+	+	+	o	o
Magnesium nitrate	100	+	+	+	+	+	+	+	+	o	o
Magnesium sulfate	100	+	+	+	+	+	+	+	+	o	o
Maleic acid	100	+	+	+	+	+	+	+	o	o	o
Marble lime hydrate	100	+	+	+	+	+	+	+	+	o	–
MEK	100	+	+	+	+	+	+	+	+	–	–
Menthol	100	+	+	+	+	+	+	+	o	o	+
Mercury	100	+	+	+	+	+	+	o	+	o	+
Mercury(II)-chloride	100	+	+	+	+	+	+	+	+	+	+
Mercury(II)-cyanide	50	+	+	+	+	+	+	+	+	+	o
Mercury(II)-nitrate	100	+	+	+	+	+	+	+	o	+	+
Methacrylic ester	100	+	+	+	o	o	o	–	+	–	–
Methanal	40	+	+	+	+	+	+	+	o	–	–
Methanol	100	+	+	+	+	+	+	+	–	o	o
Methoxyethanol	100	+	+	+	+	+	+	+	+	+	+
Methoxybenzene	100	+	+	+	+	+	+	o	+	–	–
Methoxybutanol	100	+	+	+	o	o	o	o	+	–	–
Methyl acetate	100	+	+	+	+	+	–	o	+	–	–
Methyl alcohol	100	+	+	+	+	+	+	+	–	o	o
Methyl amine	100	+	+	+	+	+	+	+	–	o	+
Methyl benzene	100	+	+	+	+	+	+	o	+	–	–
Methyl bromide	100	+	+	+	+	+	+	o	o	–	–
Methyl butyl ketone	100	+	+	+	o	o	o	o	+	–	–
Methyl cellosolve	100	+	+	+	+	+	+	+	+	+	+
Methyl chloride	100	+	+	+	+	+	–	o	o	–	–
Methyl cyanide	100	+	+	+	+	+	o	+	+	–	–
Methyl ether	100	+	+	+	+	+	+	–	+	–	–
Methyl ethyl ether	100	+	+	+	+	+	+	–	+	–	–
Methyl ethyl ketone	100	+	+	+	+	+	+	+	+	–	–
Methyl ethyl ketone-2	100	+	+	+	+	+	+	+	+	–	–
Methyl glycol	100	+	+	+	+	+	+	+	+	+	+
Methyl isobutyl ketone	100	+	+	+	o	o	+	o	+	–	–
Methyl methacrylate	100	+	+	+	o	o	o	–	+	–	–
Methyl phenylketone	100	+	+	+	+	+	+	+	–	–	–
Methylenchlorid	100	+	+	+	o	o	–	o	o	–	–
Methyl pentanone	100	+	+	+	o	o	+	o	+	–	–
Milk	100	+	+	+	+	+	+	+	+	+	+
Mineral oil	100	+	+	+	+	+	+	+	+	+	+
Mineral oil, non-aromatic	100	+	+	+	+	+	+	+	+	+	o
Monochloroacetic acid	100	+	+	+	+	+	+	+	–	o	–
Montanic wax	100	+	+	+	+	+	+	o	+	+	o
N											
Naphta	100	+	+	+	o	o	+	o	+	–	–
Nickel chloride	100	+	+	+	+	+	+	+	o	+	+
Nickel sulfate	100	+	+	+	+	+	+	+	o	+	+
Nitrate of sodium	100	+	+	+	+	+	+	+	o	+	+
Nitril triethanol	100	+	+	+	+	+	+	+	+	+	+

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Nitrobenzene	100	+	+	+	+	+	+	–	o	–	–
Nitrogen monoxide	100	+	+	+	+	+	+	+	+	+	+
Nitromethane	100	+	+	+	+	+	+	o	o	–	–
Nitrous acid	50	+	+	+	+	+	+	+	–	o	o
Nitrous oxide	100	+	+	+	+	+	+	+	o	–	–
Nonyl alcohol	100	+	+	+	+	+	+	+	o	+	o
O											
Octadecan acid	100	+	+	+	+	+	+	+	+	+	+
Octane	100	+	+	+	+	+	+	+	+	–	o
Oil, essential	100	+	+	+	+	+	+	o	+	–	o
Oleic acid	100	+	+	+	+	+	+	o	+	–	–
Oleum	100	+	+	+	–	–	–	–	–	–	–
Oleum Jecoris	100	+	+	+	+	+	+	+	+	+	+
Oxalic acid	100	+	+	+	+	+	+	o	+	–	–
Oxalic acid diammonium salt	100	+	+	+	+	+	+	+	o	+	o
Oxidiethanol	100	+	+	+	+	+	+	+	+	o	o
Oxirane	100	+	+	+	+	+	+	o	+	–	–
Oxolane	100	+	+	+	o	o	o	o	+	–	–
Ozocerite	100	+	+	+	+	+	+	o	+	+	o
Ozone	100	+	+	+	+	+	+	+	+	o	o
P											
Palmitic acid	100	+	+	+	+	+	+	o	+	–	–
Paraffins	100	+	+	+	+	+	+	+	+	+	+
Pentanol	100	+	+	+	+	+	+	+	o	+	o
Pentanol-1	100	+	+	+	+	+	+	+	o	+	o
Pentanone-3	100	+	+	+	o	o	–	o	+	–	–
Pentyl acetate	100	+	+	+	+	+	+	+	+	–	+
Perchloric acid	100	o	o	o	o	o	+	o	–	o	–
Perchloroethylene	100	+	+	+	–	–	+	–	+	–	–
Perfume	100	+	+	+	+	+	+	o	+	–	o
Peroxide of hydrogen	90	+	+	+	+	+	+	+	–	+	–
Petroleum	100	+	+	+	o	o	+	o	+	–	–
Petroleum ether	100	+	+	+	+	+	+	–	+	–	–
Phenol	100	+	+	+	+	+	+	o	–	–	–
Phenyl ether	100	+	+	+	+	+	+	–	+	–	–
Phenylamine	100	+	+	+	o	o	+	+	+	–	o
Phenylethanon-1	100	+	+	+	+	+	+	+	–	–	–
Phenylmethanol	100	+	+	+	+	+	+	–	–	–	–
Phosphoric acid	85	+	+	+	+	+	+	+	–	o	–
Phosphorous chloride	100	+	+	+	+	+	+	o	o	–	–
Phosphorus trichloride	100	+	+	+	+	+	+	o	o	–	–
Phthalate	100	+	+	+	+	+	+	+	+	–	o
Phthalate ester	100	+	+	+	+	+	+	+	+	–	o
Pikric acid	100	+	+	+	o	o	+	+	–	o	–
Potash	100	+	+	+	+	+	+	+	o	o	+
Potassium acetate	100	+	+	+	+	+	+	+	o	o	o
Potass. aluminium sulfate	100	+	+	+	+	+	+	+	–	o	–

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Materials - Chemical Resistance

Substances

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Potassium bicarbonate	100	+	+	+	+	+	+	+	+	+	+
Potassium bichromate	100	+	+	+	+	+	+	+	o	o	o
Potassium bromide	100	+	+	+	+	+	+	+	o	o	+
Potassium carbonate	100	+	+	+	+	+	+	+	o	o	+
Potassium chlorate	100	+	+	+	+	+	+	+	+	+	+
Potassium chloride	100	+	+	+	+	+	+	+	+	+	+
Potassium chromate	100	+	+	+	+	+	+	+	o	+	+
Potassium cyanide	50	+	+	+	+	+	+	+	+	+	o
Potassium dichromate	100	+	+	+	+	+	+	+	o	o	o
Potassium ferrocyanide	100	+	+	+	+	+	+	+	o	+	o
Potassium ferricyanide	100	+	+	+	+	+	+	+	o	+	o
Pota. hexacyanoferrate(II)	100	+	+	+	+	+	+	+	o	+	o
Pota. hexacyanoferrate(III)	100	+	+	+	+	+	+	+	o	+	o
Potassium hydroxide	100	+	+	+	+	+	+	+	o	o	o
Potassium hypochlorite	20	+	+	+	+	+	+	o	–	+	–
Potassium iodide	100	+	+	+	+	+	+	+	+	o	+
Potassium nitrate	100	+	+	+	+	+	+	+	o	+	+
Potassium perchlorate	25	+	+	+	+	+	+	+	+	+	+
Potassium permanganate	100	+	+	+	+	+	+	+	–	o	+
Potassium persulfate	100	+	+	+	+	+	+	+	+	o	o
Propane	100	+	+	+	+	+	+	–	o	–	–
Propanediol-1,2	100	+	+	+	+	+	+	+	+	+	+
Propanoic acid	100	+	+	+	+	+	+	+	–	o	o
Propanol	100	+	+	+	+	+	+	+	o	+	+
Propan-2-ol	100	+	+	+	+	+	+	+	o	+	+
Propantriol	100	+	+	+	+	+	+	+	+	+	+
Propen-2-ol-1	100	+	+	+	+	+	+	+	–	o	–
Propyl alcohol	100	+	+	+	+	+	+	+	o	+	+
Propylene glycol	100	+	+	+	+	+	+	+	+	+	+
Propylene oxide	100	+	+	+	o	o	o	+	+	–	o
Prussiate of potash , red	100	+	+	+	+	+	+	+	o	+	o
Prussiate of potash , yell.	100	+	+	+	+	+	+	+	o	+	o
Pyridine	100	+	+	+	o	o	–	+	–	–	–
Q											
Quinol	100	+	+	+	+	+	+	+	–	–	+
R											
Resorcinol	50	+	+	+	+	+	+	+	–	o	o
S											
Salicylic acid	100	+	+	+	+	+	+	+	+	+	+
Salmiac	100	+	+	+	+	+	+	+	o	o	–
Salt, red	100	+	+	+	+	+	+	+	o	o	o
Selenite	100	+	+	+	+	+	+	+	–	–	–
Silicic acid	100	+	+	+	+	+	+	+	+	o	o
Silicone oils	100	+	+	+	+	+	+	+	+	+	+
Silver acetate	100	+	+	+	+	+	+	+	o	o	o
Silver cyanide	50	+	+	+	+	+	+	+	+	+	o
Silver nitrate	100	+	+	+	+	+	+	+	o	+	+

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Soda ash	100	+	+	+	+	+	+	+	o	o	+
Soda lye	85	+	+	+	+	+	+	+	o	+	–
Sodium acetate	100	+	+	+	+	+	+	+	o	o	o
Sodium benzoate	100	+	+	+	+	+	+	+	o	o	o
Sodium bicarbonate	100	+	+	+	+	+	+	+	+	+	+
Sodium bisulfate	100	+	+	+	+	+	+	+	+	+	o
Sodium bisulfite	100	+	+	+	+	+	+	+	o	+	–
Sodium bromide	100	+	+	+	+	+	+	+	o	o	+
Sodium carbonate	100	+	+	+	+	+	+	+	o	o	+
Sodium chromate	100	+	+	+	+	+	+	+	o	+	o
Sodium chlorate	100	+	+	+	+	+	+	+	–	+	+
Sodium chloride	100	+	+	+	+	+	+	+	+	+	+
Sodium chlorite	100	+	+	+	+	+	+	+	–	+	+
Sodium cyanide	50	+	+	+	+	+	+	+	+	+	o
Sodium dithionite	100	+	+	+	+	+	+	+	o	+	+
Sodium fluoride	100	+	+	+	o	o	+	+	o	+	+
Sodiu. hydrogen carbonate	100	+	+	+	+	+	+	+	+	+	+
Sodiu. hydrogen sulfate	100	+	+	+	+	+		+	+	+	o
Sodiu. hydrogen sulfite	100	+	+	+	+	+		+	o	+	–
Sodium hydroxide	85	+	+	+	+	+	+	+	o	+	–
Sodium hyposulfite	100	+	+	+	+	+	+	+	o	+	+
Sodium nitrate	100	+	+	+	+	+	+	+	o	+	+
Sodium nitrite	100	+	+	+	+	+	+	+	o	+	+
Sodiu. perborate Tetrahydrate	100	+	+	+	+	+	+	+	o	+	–
Sodium perchlorate	25	+	+	+	+	+	+	+	+	+	+
Sodium peroxide	100	+	+	+	+	+	+	o	+	+	o
Sodium peroxodisulfate	100	+	+	+	+	+	+	+	o	+	+
Sodium persulfate	100	+	+	+	+	+	+	+	o	+	+
Sodium phosphate	100	+	+	+	+	+	+	+	o	+	+
Sodium silicate	100	+	+	+	+	+	+	+	o	+	+
Sodium sulfate Decahydrate	100	+	+	+	+	+	+	+	o	+	+
Sodium sulfide	100	+	+	+	+	+	+	+	o	+	+
Sodium sulfite	100	+	+	+	+	+	+	+	o	+	+
Sodium superoxide	100	+	+	+	+	+	+	o	+	+	o
Sodiu. tetraborate Decahydra.	100	+	+	+	+	+	+	+	+	+	o
Sodium thiosulfate	100	+	+	+	+	+	+	+	o	+	+
Soft soap	25	+	+	+	+	+	+	+	o	+	+
Stearic acid	100	+	+	+	+	+	+	+	+	+	+
Styrene	100	+	+	+	+	+	+	o	+	–	–
Styrolene	100	+	+	+	+	+	+	o	+	–	–
Sublimate	100	+	+	+	+	+	+	+	+	+	+
Succinic acid	100	+	+	+	+	+	+	+	+	–	–
Sulfuric acid	98	+	+	+	+	+	+	o	–	–	–
Sulfuric acid fuming	100	+	+	+	–	–	–	–	–	–	–
Sulfur dioxide	100	+	+	+	+	+	+	+	–	o	o
T											
Table salt	100	+	+	+	+	+	+	+	+	+	+

Definitions and abbreviations:

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

Materials - Chemical Resistance

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Tallow	100	+	+	+	+	+	+	+	+	+	+
Tannic acid	100	+	+	+	+	+	+	+	+	o	–
Tannins	100	+	+	+	+	+	+	+	+	o	–
Tartaric acid	100	+	+	+	+	+	+	+	+	o	o
Tensides, non alkaline	5	+	+	+	+	+	+	+	+	+	+
Tetrachloroethane	100	+	+	+	–	–	+	–	+	–	–
Tetrachloroethylene	100	+	+	+	–	–	+	–	+	–	–
Tetrachloromethane	100	+	+	+	+	+	+	o	–	–	–
Tetraethyl lead	100	+	+	+	+	+	+	+	+	o	–
Tetrahydrofuran	100	+	+	+	o	o	o	o	+	–	–
Tetrahydronaphtalene	100	+	+	+	+	+	+	o	+	–	o
Tetralin	100	+	+	+	+	+	+	o	+	–	o
Tetramethylene oxide	100	+	+	+	o	o	o	o	+	–	–
THF	100	+	+	+	o	o	o	o	+	–	–
Thionyl chloride	100	+	+	+	+	+	o	–	–	–	–
Thinner (Solvol)	100	+	+	+	+	+	+	+	o	–	–
Toluol	100	+	+	+	+	+	+	o	+	–	–
Transformer oil	100	+	+	+	+	+	+	+	+	+	+
Trichlorobenzene	100	+	+	+	+	+	+	–	o	–	–
Trichloroacetic acid	100	+	+	+	+	+	+	o	–	o	o
Trichloroethylene	100	+	+	+	+	+	+	–	+	–	–
Trichloromethane	100	+	+	+	o	o	+	+	o	–	–
Triethanolamine	100	+	+	+	+	+	+	+	+	+	+
Triethylene glycol	100	+	+	+	+	+	+	+	+	+	+
Trifluorotrichloroethane	100	+	+	+	+	+	+	–	o	–	–
Triglycerides	100	+	+	+	+	+	+	+	+	+	+
Triglycol	100	+	+	+	+	+	+	+	+	+	+
Trimethylpentane-2,2,4	100	+	+	+	+	+	+	+	+	–	o
Trinitrophenol-2,4,6	100	+	+	+	o	o	+	+	–	o	–
Turpentine	100	+	+	+	+	+	+	o	+	–	–
Turpentine substitute	100	+	+	+	+	+	+	o	+	–	o
U											
Urea	100	+	+	+	+	+	+	+	+	+	+
Uric acid	100	+	+	+	+	+	+	+	+	+	o
Urine	100	+	+	+	+	+	+	+	+	+	+
V											
Vaseline	100	+	+	+	+	+	+	+	+	+	+
Vinyl acetate	100	+	+	+	o	o	+	–	–	–	–
Vinegar	100	+	+	+	+	+	+	+	o	+	–
Vinyl acetate	100	+	+	+	o	o	+	–	–	–	–
Vinyl chloride	100	+	+	+	o	o	+	–	–	–	–
Vinylbenzene	100	+	+	+	+	+	+	o	+	–	–
Vinyl cyanide	100	+	+	+	+	+	o	o	+	–	–
Vinylidene chloride	100	+	+	+	o	o	+	–	–	–	–
W											
Washing agents	5	+	+	+	+	+	+	+	+	+	+
Washing-up liquid	5	+	+	+	+	+	+	+	+	+	+

Substance at +20 °C	Conc. in %	PTFE	PFA	FEP	ETFE	ECTFE	PVDF	PP	PA	PS	PMMA
Water	100	+	+	+	+	+	+	+	+	+	+
Water demineralized	100	+	+	+	+	+	+	+	+	+	+
Water glass	100	+	+	+	+	+	+	+	+	+	+
Wine spirit	100	+	+	+	+	+	+	+	–	o	o
Woll fat	100	+	+	+	+	+	+	+	+	+	+
Woll wax	100	+	+	+	+	+	+	+	+	+	+
X											
Xylol	100	+	+	+	+	+	+	o	+	–	–
Y											
Yeasts	100	+	+	+	+	+	+	+	+	+	+
Z											
Zinc carbonate	100	+	+	+	+	+	+	+	o	o	+
Zinc chloride	100	+	+	+	+	+	+	+	+	+	+
Zinc nitrate	100	+	+	+	+	+	+	+	o	+	+

Definitions and abbreviations:

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

Fluoroplastics - Cleaning Worth Knowing

All fluoroplastics, PTFE, PFA and FEP have a smooth, non-wetting surface and can usually be cleaned without any problems. Abrasive scouring agents might damage the surface and result in a milkiness of the vessels – especially those made of PFA and FEP. You may use all neutral detergents (pH 7). For a stronger contamination we recommend to use an alkaline detergent up to pH 12. Clean or dry vessels in a laboratory washing machine only when they are completely opened.

Cleaning and re-utilisation of tubing

In principle, fluoroplastic tubing shall only be reused provided the material which shall be conveyed is known and rated with + in the chemical resistance chart. If the first conveyed products or components of chemical compounds are unknown, the reuse of tubing cannot be recommended. Appropriate detergents are all water-soluble substances (such as salts, acids, lyes, etc.). Volatile solvents such as alcohols, ester, ketones, low-boiling hydrocarbons, chlorinated hydrocarbon, etc. will be reversibly dispended during aerated storage provided the substance was not absorbed by the inner layer of the tubing. After use with toxic or hazardous materials as well as with substances which only can be removed by using organic solvents, the tubing should be professionally disposed. Prior to reuse, cleaned tubing has to go through a visual inspection, respectively in case of doubt an inspection as per EN 12115 has to be made.

Autoclaving at +121 °C

Vessels made of PTFE, PFA or FEP can be autoclaved or sterilised at +121 °C. This can for example be made in the steam space or in dry conditions at +160 °C. All vessels with screw covers or stoppers have to be open while being autoclaved. Autoclaving of closed vessels will result in their deformation or destruction.

Cleaning for trace analysis

To prevent contamination with cations or anions in trace analysis, the vessels should first be filled with a 1NHCL and HNO_3 solution. This solution should be allowed to stand for a maximum of 6 hours at room temperature. The vessels should then be rinsed with clean deionized water.

Pressure resistance of bottles

Due to their thin walls, standard PTFE, PFA or FEP bottles should not be pressurised (from inside). Pressurisation could result in permanent deformation. More suitable for such applications are BOLA digestion vessels on page 163 or BOLA reaction vessels on page 154.

Plastics in microwave ovens

Plastics in general and fluoroplastics with their high thermal resistance in particular are suitable for microwave energy. The microwaves heat solely the contents of the vessel. Fluoroplastic vessels are particularly suitable for heating of aggressive chemicals such as acids or solvents. However, it should be noted that produced vapours are sufficiently drawn off. The more, a controlled drainage to a collecting vessel has to be arranged in case of bursture of the rupture membrane in the digestion vessel. Other vessels or containers than digestion vessels may only be heated when open.

Response times of temperature probes

The response time of a temperature probe is determined by introducing the probe to a step change in temperature and measuring how long the probe takes to reach a certain proportion of its final, steady-state reading. Normally, T_{50} (the time taken to reach 50% of the final reading) or T_{90} (the time taken to reach 90% of the final reading) are stated.

Field-proven method of determination: Put the temperature probe in an ice cold water bath and let it reach a steady-state. Then transfer it quickly to a column of steam and monitor its resistance until a steady state is reached again.

Fluoroplastics - Heating

It is difficult to heat PTFE due to its bad heat transmission and since the max. surface temperature may not be exceeded. There are different methods to heat PTFE vessels:

» **Heating by a heating mantle with surface sensor:**
When heating with a heating mantle, a large surface of the vessel is covered. This supports the heat transmission and reduces the heating period. The mantle must have a sensor on its surface. This probe measures the temperature on the surface of the PTFE and switches the mantle of upon exceeding +260 °C. Only this way temporary overheating and harmful decomposition products are avoided.

We advise against the use of "usual" heating mantles and control systems. Their use may result in the same effects as the use of hotplates (see below).

» **Heating by a thermostat:**
The heat transmission is provided by the bath medium (oils or other liquids). Controlled by an adjusted thermostat the temperatures on the surface of the PTFE vessel will not become too high. Depending on the immersion depth, a big surface for a good heat transmission is provided. The only disadvantage is the danger which occurs when working with oils at high temperatures.

Not appropriate methods are:

» Flame (e.g. gas burner):
With this method, the surface temperature cannot be controlled. Due to temporary overheating harmful decomposition products can occur.

» Hotplate:
Overheating can occur as well. Usual hotplates can only be switched on or off. During the heating period, the plate is heated with full energy so that it almost glows. Afterwards, the hotplate is switched off and only heats for a few seconds. This so-called „pointing" is enough to exceed the maximum temperature of +260 °C. It does not make sense to put the adjusting knob only to +150 °C. PTFE labware char on the underside and glue to the hotplate. The thermoplastics PFA and FEP melt directly, similar to a hot-melt-type adhesive. This can be prevented by putting an aluminium foil between hotplate and vessels but dangers for health cannot be avoided.

Safety advice

Main risks and adversarial effects
Fluoroplastics are inert plastics, at normal use there are no risks for human health and environment. If the material is exposed to temperatures of more than +350 °C, it is possible that hazardous materials such as HF, COF_2 and others are released and can cause bad chemical burns which are not immediately noticeable.

Symptoms after contact
The materials released during thermal decomposition are very dangerous when getting in contact with eyes, skin or when being breathed in.

» Eyes: Redness, irritation, burning
» Skin: Redness, irritation, burning
» Breathing in: Headache, shortness of breath, illness, shivering, fever ("polymerisation-fever", raised pulse).
Special instructions for the case of breathing in:
The symptoms might only start some hours after breathing in. It is extremely important to seek medical advice to avoid lasting impacts!

First aid procedures
After breathing in it is extremely important to seek medical advice. The person concerned should immediately be brought to a place with fresh air. It is also necessary to give him/her oxygen. In case of apnoea it is necessary to give artificial respiration, possibly by mouth-to-mouth resuscitation.

» In case of eye contact rinse immediately with water for at least 15 minutes.

» In case of skin contact wash immediately with water and soap (especially the skin under the nails).
» Additionally seek medical advice!

Dangers of fire
There are possible risks due to acid and toxic production which can occur during thermal decomposition (HF and COF_2).

Precautionary measures in case of fire:
Take away the product from the fire but be careful. Stay against the wind direction and in sufficient distance. Appropriate extinguishing agents are water, CO_2, foam, earth/sand. Wear special clothes such as respirator and skin protection against HF-vapours.

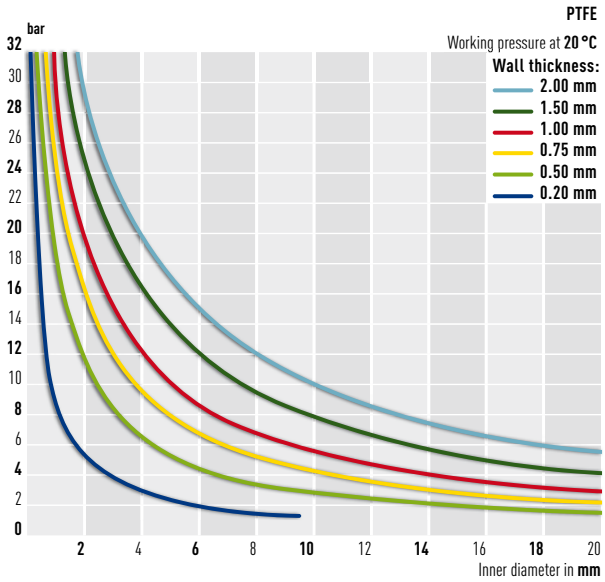
Tubing - Pressure Resistance

PTFE Tubing

The graph on the right side will help you to determine the recommended working pressure (approx. 0.25 x short time burst pressure) for PTFE tubing. For working temperatures above +20 °C the working pressures stated in this graph have to be multiplied by the corresponding reduction factor. For temperatures below +20 °C no reduction factors have to be considered.

Example:
For PTFE tubing with inner diameter of 6 mm and a wall thickness of 1 mm the working pressure at +20 °C is about 8.8 bar. At a temperature of +50 °C, this value has to be reduced to 7.6 bar (**pressure** 8.8 bar **x reduction factor** 0.87 **=** 7.65 **bar**).

Temperature °C	50	75	100	150	200	250
Reduction Factor	0.87	0.77	0.68	0.53	0.39	0.28

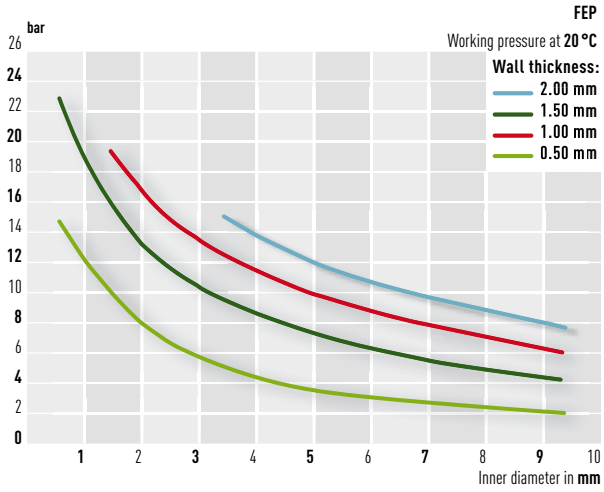


FEP Tubing

The graph on the right side will help you to determine the recommended working pressure (approx. 0.25 x short time burst pressure) for FEP tubing. For working temperatures from -50 °C to +150 °C the working pressures stated in this graph have to be multiplied by the corresponding reduction factor.

Example:
For FEP tubing with inner diameter of 6 mm and a wall thickness of 1 mm the working pressure at +20 °C is about 7.8 bar. At a temperature of +50 °C, this value has to be reduced to 6.1 bar (**pressure** 7.8 bar **x reduction factor** 0.78 **=** 6.1 **bar**).

Temperature °C	-50	0	20	50	100	150
Reduction Factor	1.13	1.04	1.00	0.78	0.45	0.21

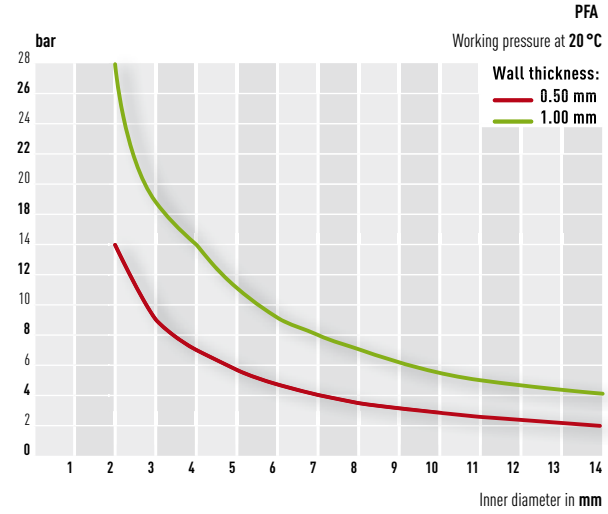


PFA Tubing

The graph on the right side will help you to determine the recommended working pressure (approx. 0.25 x short time burst pressure) for PFA tubing. For working temperatures above +20 °C the working pressures stated in this graph have to be multiplied by the corresponding reduction factor. For temperatures below +20 °C no reduction factors have to be considered.

Example:
For PFA tubing with inner diameter of 6 mm and a wall thickness of 1 mm the working pressure at +20 °C is about 14 bar. At a temperature of +50 °C, this value has to be reduced to 12 bar (**pressure** 14 bar **x reduction factor** 0.86 **=** 12 **bar**).

Temperature °C	50	100	200	250
Reduction Factor	0.86	0.50	0.26	0.21



Tubing - Choice and Assembly

Choice of wall thickness

When choosing the wall thickness, a couple of issues have to be considered:

» What max. pressure will be applied?
In the charts on page 226 the minimum wall thickness can easily be found.
» To which temperatures will the tubing be exposed?
The maximum pressure has to be reduced by the stated factors.
» Shall the tubing be applied under vacuum?
Then the wall thickness has to be sufficient (rule of thumb)

Rule of thumb for determination of wall thickness:

outer-Ø x 0.1 (0.15) **= wall thickness**

For a "normal" use in the lab, this rule of thumb offers a certain security concerning pressure and temperature, e. g. PTFE tubing with an outer diameter of 8 mm should have a wall thickness of 0.8 to 0.9 mm. In this case you should choose a wall thickness of 1 mm.

Fitting and tubing have to fit

Practice has proved that tubing varies in diameter. We therefore recommend to check before assembly whether the tubing outer diameter corresponds to the nominal size (e. g. Ø 6 mm). The values in the right chart will be helpful.
The surface of PTFE tubing can be damaged if V-rings are inserted by force and result in leakage.

Nominal-Ø of screw joint in mm	0.5–3,2	4.0–14	> 16
Recommended max. tolerance of tube/tubing in mm	± 0.05	± 0.1	± 0,25

Easy assembly

First check whether your laboratory screw joint (inner diameter) fits your tubing (outer diameter). If it is still difficult to put the tubing inside the inner parts of the laboratory screw joint, a trick can be helpful. Just either sharpen the tubing with a simple sharpener or cut it diagonally. You should now be able to easily put the tubing through the inner parts.

Transition from imperial to metric tubing

With BOLA Tube Fittings and Reducing Unions, transition from imperial to metric tubing or connections between both can easily be made. For example: A pipe socket of an analytical device with an outer diameter of 1/4" shall be connected to a PTFE tubing with an outer diameter of 8 mm.
Needed components: Reducing union 6 mm to 8 mm (Cat.No. D 526-10) and a set of tapered V-rings Ø 1/4" (6.35 mm; Cat.No. D 502-03).
By exchanging the 6 mm V-rings with the 1/4" V-rings, the pipe socket can be connected to the 1/4" reducing union and the 8 mm PTFE tubing on the other side.

Tubing - Useful hints

Thin tubing
at vacuum and high temperatures

At high temperatures, under vacuum or with thin wall thickness we recommend to support the tubing in the laboratory screw joint. This can for example be made by using a short piece of glass or metal tube. Consequently, the tubing cannot turn off to the inside and become leaky. This trick allows also to connect elastic, gummy tubing to GL threads by means of BOLA Laboratory Screw joints.

Dimensional tolerances
of PTFE, PFA and FEP tubing

All tubing listed herein match the sizes of the BOLA screw joint system. Therefore you can be sure that all fittings and connectors fit together. Practice has proved that all kinds of tubing have certain tolerances in both outer diameter and wall thickness. All tubing stated herein have been checked several times. This inspection based on strict rules stipulated by BOLA that exceed the demands for dimensions or quality control usually applied on the market.

In addition to the outer diameter, the wall thickness is important to evaluate the quality of tubing. We, at BOLA have stipulated stricter limits for the tolerances of the wall thickness than usually applied. Above all, we do not allow cumulative tolerances of the tubing dimensions to result in incorrect wall thickness. Thus, the wall thickness may only vary according to the outer diameter as stated in the chart on the right.

In addition, all tubing is carefully tested whether they show any faults in material (e. g. inclusion of impurities), any longitudinal or horizontal nerves or any reliefs at the outer and inner diameter.

Nominal outer-Ø mm	0.4–2.9	3.0–10.0	10.1–16.0	16.1–22.0	> 22.1
Tolerance outer-Ø mm	± 0.05	± 0.10	± 0.15	± 0.20	± 0.20

Wall thickness mm	0.1–0.3	0.4–1.0	1.1–2.0	> 2.1
Tolerance mm	± 0.025	± 0.05	± 0.10	± 0.20

Example:
Nominal outer-Ø 16 mm ; min.-Ø 15.85 mm; max.-Ø 16.15 mm
Wall thickness 1 mm ; min. wall. 0.95 mm; max. wall. 1.05 mm

Both tolerances must not be added so that an even bigger discrepancy of outer or inner diameter would be possible!

Processing of heat shrinkable PTFE tubing

Shrinking should be done at a temperature of +340 °C +/-10 °C. (At approx. +327 °C the appearance of PTFE changes from white to transparent). Please note that the part to be coated has to withstand the shrinking temperature. Temperatures exceeding +350 °C lead to overheating of the heat shrinkable tubing and destroy its plastic memory (shrinking capacity). Thus, the tubing becomes unusable. Steady heating and cooling from all sides provides the best result, otherwise creases and tearing can arise. Appropriate heat sources are ovens or air heaters. We strongly advise against using gas flames as this can lead very easily to irregular overheating. Longitudinal shrinkage can occur during shrinking. The longitudinal shrinkage is approx. 15 %.

Safety instructions:
Use adequate ventilation to assure removal of toxic vapours which may be produced by overheating!

Bending radius of PTFE, PFA and FEP tubing

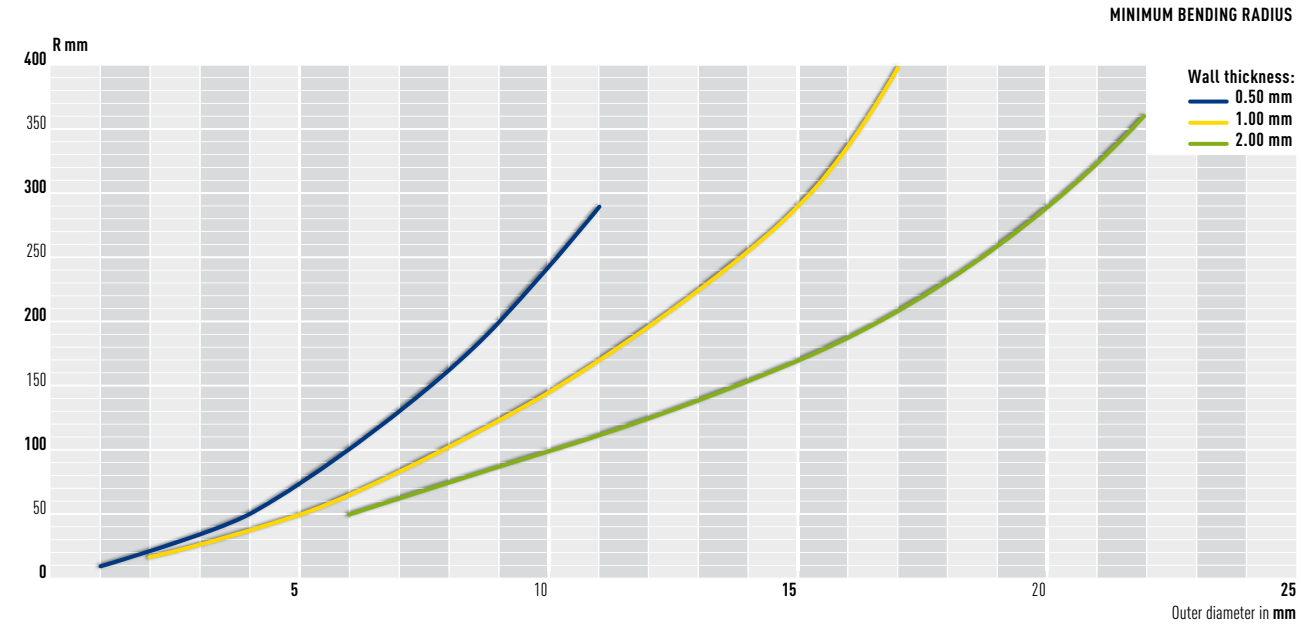
During the assembly of devices with fluoroplastic tubing we are often confronted with the problem of how to create the smallest bending radius when the space is limited. To avoid buckling of the tubing with all its negative aspects, the following graph will be helpful to determine the smallest possible bending radius.

Take the outer diameter indicated on the horizontal axis, then follow the line upwards until it crosses with the appropriate wall thickness. From this intersection, follow the line to the left until it reaches the vertical axis which shows the minimum bending radius.

Rule of thumb for the bending radius:

$$\frac{\text{outer}^2\text{-Ø}}{\text{wall thickness}} = \text{min. bending radius}$$

As reference value, the smallest possible bending radius can be determined by the square of the outer diameter divided by the wall thickness.

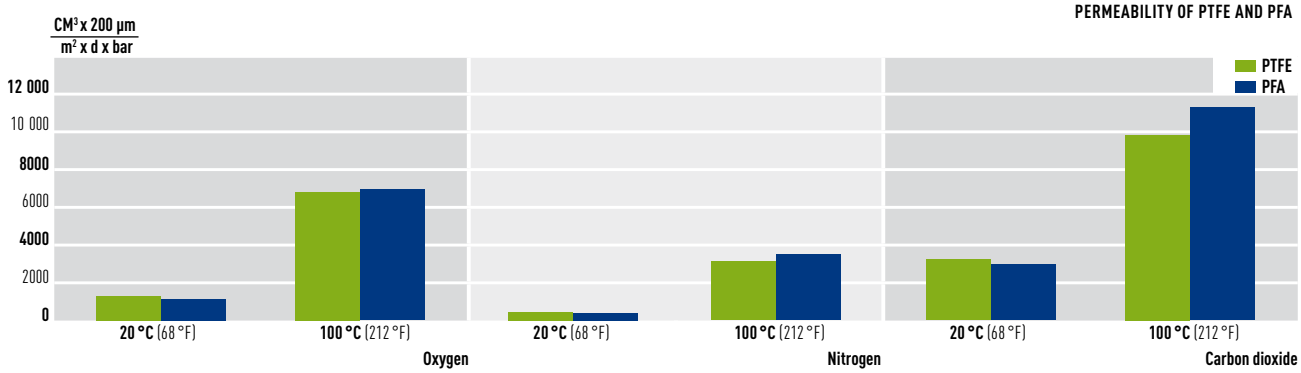


Example: A PTFE tubing with outer diameter 14 mm and a wall thickness of 2 mm has a minimum bending radius of 88 mm.

Permeability of PTFE and PFA

Because of its special processing and the resulting structural conditions, PTFE has a higher permeability than other thermoplastics. PFA has at the same wall thickness a lower permeability than PTFE due to its tight molecular structure.

For applications with low permeability or diffusion rates, PFA and FEP tubing should be used.



Stirrer Shafts - Choice

With the following we would like to assist you in the choice of stirrer shafts. All stated values are experienced data established by experimentation and practical testing. All stirring elements are made for clockwise rotation (view from the top of the stirring agitator).

The **diameter of the stirring shaft** depends on the products used as well as on their viscosity. The higher the viscosity, the larger the shaft diameter. If you are in doubt, you should choose always the larger shaft diameter, in most cases it is possible to reduce the chucking diameter.

Stirrer shafts with a diameter of 8, 10 and 16 mm are most commonly used. For standard applications up to a rotation speed of 350 rpm and a max. length of 600 mm, a shaft diameter of 10 mm will be sufficient. For stirring of high viscous products or shaft lengths over 600 mm, it should be checked whether the use of a stirrer shaft with 16 mm will make sense. Furthermore, adequate stirrer bearings and chucks at the agitor should be available.

Do not forget that the ideal diameter of the stirring element also will go through the "bottleneck" of your vessel, e. g. a ground joint or a flange. A tiltable stirrer blade might be helpful.

Example Propeller Stirrer Shaft:
Assumption: Inner diameter of the vessel (D) = 300 mm

1. Determination of the outer diameter of the stirring element
R = (0.2 to 0.4) x D, thereafter follows 90 mm = 0.3 x 300 mm.
Recommended outer diameter of the stirrer element is 90 mm.

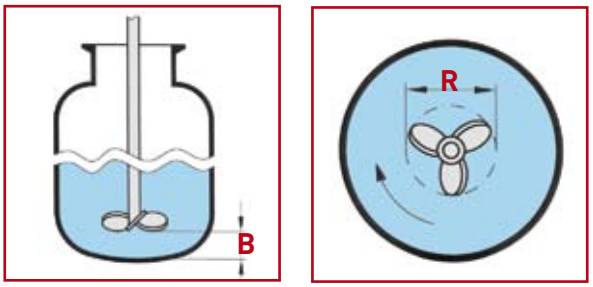
2. Determination of the distance of the stirrer to the bottom
B = (1 to 1,5) x R, thereafter follows 120 mm = 1,2 x 100 mm.
The recommended distance of the stirrer to the bottom is 120 mm.

Signs and symbols:
D Inner diameter of the vessel
R Outer diameter of the stirring element (stirring diameter)
B Distance of the stirrer to the bottom
H Height of the stirring element

Propeller stirrer shafts

Stirrer shaft with several, inclined, arched and partly twisted blades. Also with draught tube. Stirring effect is based on a mainly axial flow which moves away from the agitator; changes in the blade inclination or rotating direction result in a change of the flow direction.

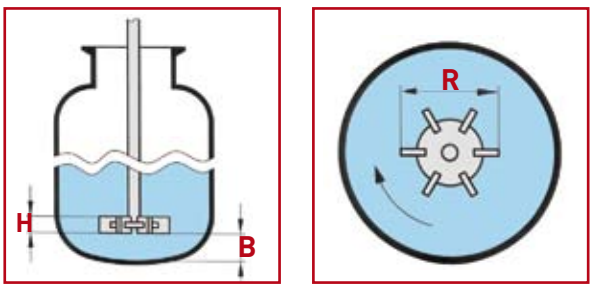
R = (0.2 to 0.4) x D
B = (1.0 to 1.5) x R



Discoidal stirrer shafts

Stirrer shaft with a blade with several, plane or curved paddles. Stirring effect is based on a radial, outwards directed flow with axial suction from the bottom and the top. The dispersing liquid is exposed to a high shearing.

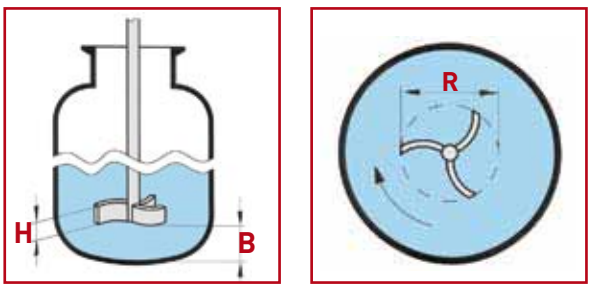
R = (0.3 to 0.4) x D
H = 0.2 x R
B = R



Impeller stirrer shafts

Stirrer shaft with three angular, arched paddles. The stirring effect is based on a radial flow which is diverted axially due to the ground level position of the stirrer.

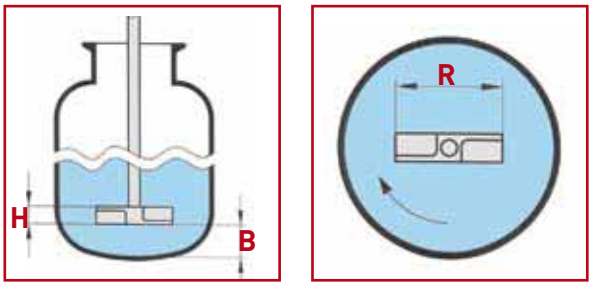
R = (0.50 to 0.70) x D
H = (0.12 to 0.17) x R
B = (0.08 to 0.18) x R



Stirrer Shafts with rigid paddle

Stirrer with a narrow blade. The stirring effect is based on a radial and axial flow. The product is opposed to shear forces ranging from moderate to strong.

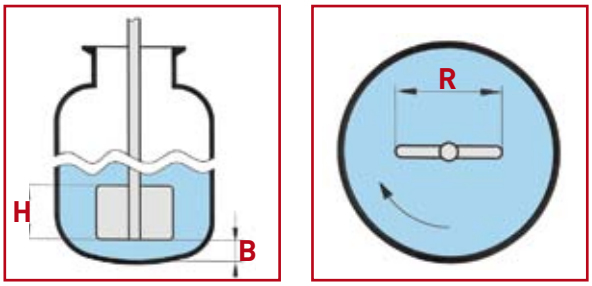
R = (0.70 to 0.9) x D
H = (0.05 to 0.1) x R
B = (0.10 to 0.2) x R



Stirrer Shafts with rigid blade

Solid, plane blade in user-defined form. Stirring effect due to different rotation speeds of the product displaced by stirring and the residual vessel content.

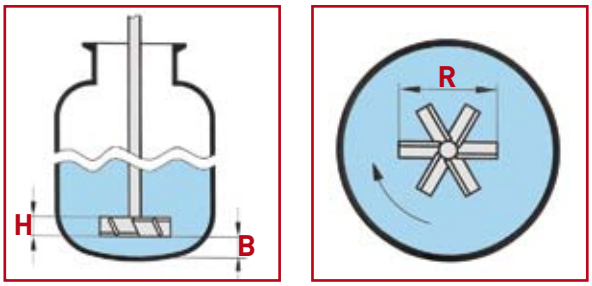
R = (0.4 to 0.5) x D
H = (0.9 to 1) x R
B = 0.3 x R



Stirrer Shafts with angular blades

Stirrer shaft with several inclined, rectangular, straight blades (special form a2 = 90 degrees, also curved blades). The stirring effect is based on an axially directed flow combined with an increased shear rate. Reversion of the flow can be obtained by changing the inclination of the blades or the rotation direction.

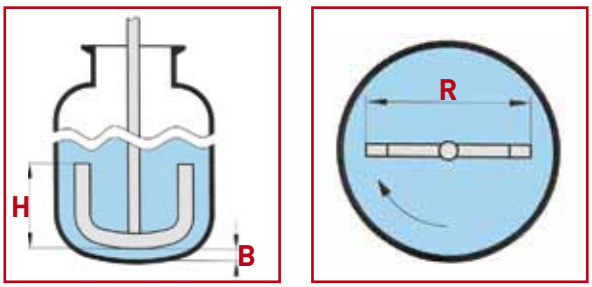
R = (0.30 to 0.40) x D
H = (0.15 to 0.25) x R
B = (0.50 to 1.00) x R



U-shaped stirrer shafts

Anchor stirrer blade adapted to the vessel's wall, reaches from edge to edge. The stirring effect is based on a mainly tangential flow with poor axial forces.

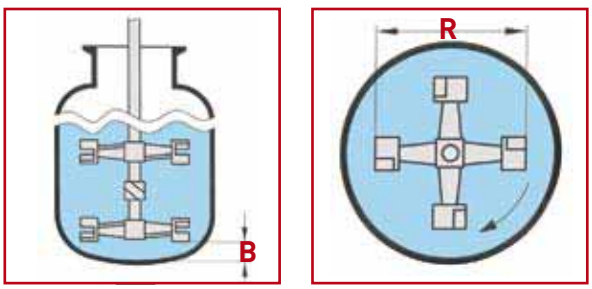
R = (0.90 to 0.95) x D
H = (0.50 to 1.00) x R
B = (0.003 to 0.005) x R



Double impulse stirrer shafts

Stirrer shaft with two contrarily aligned blades on a radial arm. The stirring effect is based on an axial flow with poor radial forces. Analogue to the conveying direction of the blades an axial flow arises near to the shaft. The conveying direction of the outer paddles is adapted to the mixing demands.

R = 0.70 x D
H = 0.20 x R
B = 0.28 x R

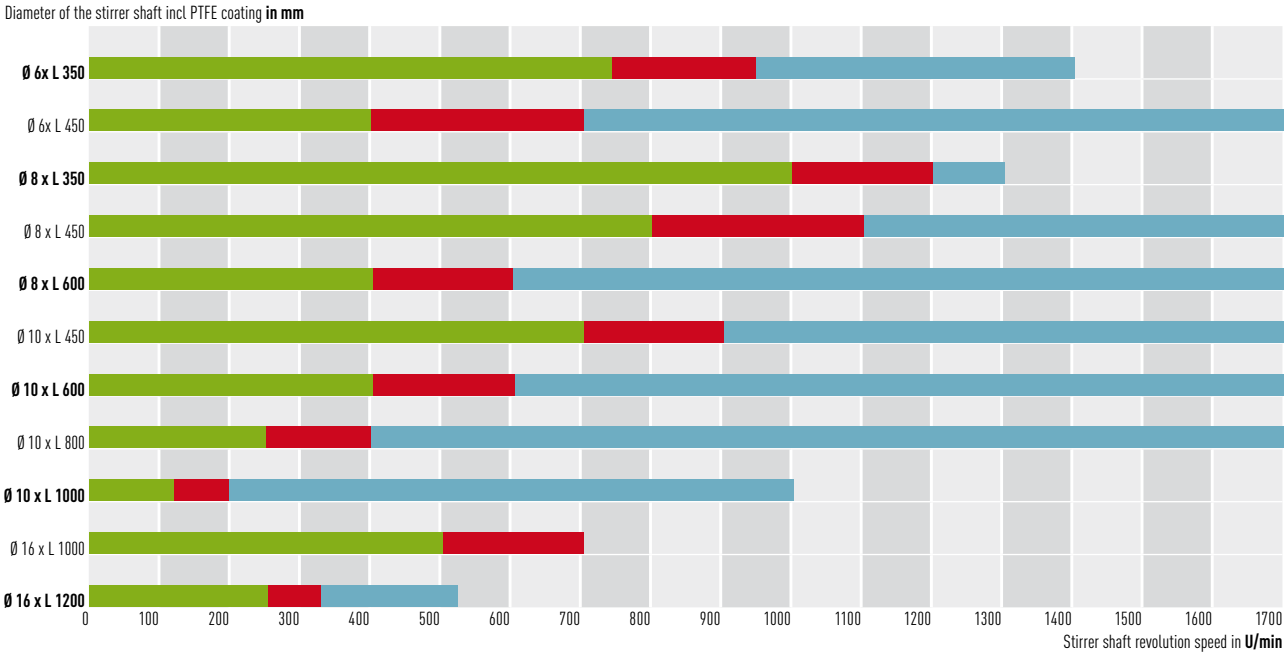


Stirrer shafts - Maximum Revolutions Per Minute

We would like to give advice on the appropriate RPMs, but unfortunately this question is not easy to answer. The following data are based on field-experience tests done with BOLA stirrer shafts.

Those tests have shown that it is not possible to state a maximum RPM but the range in which the shafts vibrate heavily. Such vibrations are called resonance. At a certain speed, a superposition of the oscillations takes place and the resonance becomes visible as vibrations. Due to those vibrations the bearings of the agitator are exposed to high stresses and in worst case accidents can be caused by tipping over agitators. The use of liquids as medium can reduce vibrations, worn out agitator bearings or insufficient stability of the agitator support increase vibrations.

In practice, these "critical RPMs" should simply be avoided by either staying below or skipping quickly this "critical RPM range" to obtain a quiet running stirrer shaft. **In general:** the longer a stirrer shaft is, the larger its diameter should be.



The chart
shall help you to choose the right stirrer shaft respectively to determine the maximum RPM. As many different parameters affect the quiet running of a stirrer shaft, it is recommended that the user will test it under his own conditions.

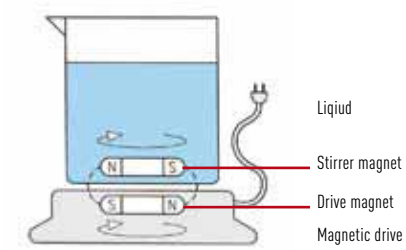
Please note that for double impulse stirrer shafts the critical RPM range lies 200 rpm below the stated values.

- » **Green Area –** indicates up to which rpm the shaft will not be affected by vibration
- » **Red Area –** marks the critical RPM range. These rpms should be avoided whenever possible.
- » **Blue Area –** is reached after quick skipping of the critical RPM range, vibration seldom occurs, however, agitators and stirrer shafts are extremely stressed by high RPMs. Therefore we recommend to use stirrer shafts only in the green range – if possible.

Stirrer - Magnetic Stirring

Magnetic stirring is a widely used method of stirring and mixing in liquid media. This process can be used over a broad temperature range and with virtually any chemical agent, as well as in open and closed systems, under pressure or vacuum.

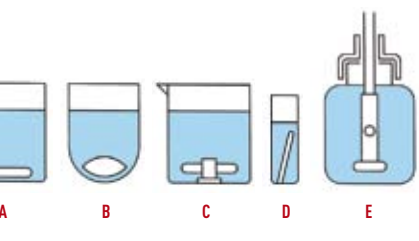
The basic system consists of two components:
a stirrer magnet placed in the liquid and a magnetic drive located outside the vessel. Both, stirrer magnet and magnetic drive form a magnetic circuit. For trouble-free stirring in liquids with different viscosities the magnetic drive shall have a wide range of different speeds. That is why the strength and form of the magnetic circuit between stirrer magnet and drive magnet is so important.



The stirrer magnet is a bar magnet encapsulated in a material which protects the magnet and prevents contamination of the liquid medium.

The core of the stirrer magnet is usually Alnico V, a less used alternative is Samarium-Cobalt. Due to its exceptional chemical and thermal (-200 °C to +260 °C) properties, Polytetraflouroethylene is the most preferred encapsulant. It can easily be processed, is readily sterilised and satisfies FDA and USP Class IV requirements.

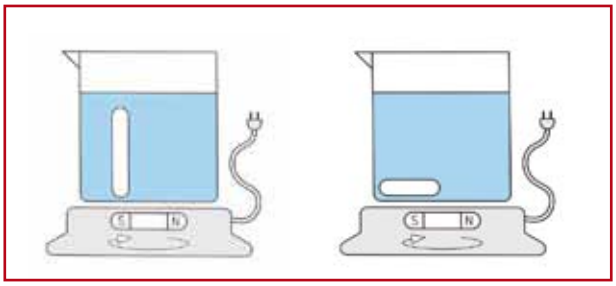
In principle, it is difficult to find the most effective magnetic stirring bar for a particular application, but important factors are the vessel shape and the viscosity of the stirring medium. In a petri dish, a long stirring bar at low speed will be effective, in a round bottom vessel egg-shaped (oval) magnetic stirrers will be a suitable choice. The ideal configuration is where the magnet of the stirring bar and the magnet of the drive are of equal length and with a minimum distance between them.



A Cylindrical magnetic stirring bar » **B** Oval or Egg-shaped magnetic stirring bar » **C** Magnetic stirring bar with bearing neck » **D** Magnetic stirring bar for cuvettes » **E** Magnetic stirring bar for culture bottles » **F** Custom manufacture for flanged reactors

The increase of the magnetic strength by using a SmCo magnet may be advantageous for many applications. However, this can have also negative consequences:

» **Migration**
Where the stirrer magnet and drive magnet have very different lengths, the stirrer magnet can migrate to a pole of the drive magnet.



» **Braking**
A very powerful force between drive and stirrer magnet can result in a braking effect. Due to the pressure of the stirrer magnet on the bottom of the vessel, the speed of rotation is reduced and rotation can even be prevented.

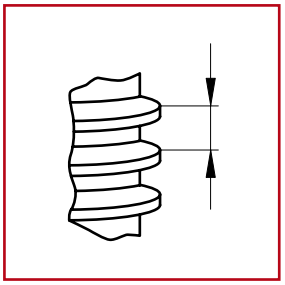
In general, no advice for or against a certain stirring bar form can be given. In case of doubt, a test of different stirring bars under your own conditions may be helpful.

The second part of this stirring system is the **magnetic drive** that consists in its simplest form of a simple, speed controlled induction motor or a stepper motor. In some cases the motor incorporates automatic reversing to improve mixing. Normally, the drive magnet is a simple square bar magnet, a U-magnet or a composite SSMC-magnet. Its rotation induces rotation of the stirrer magnet in the liquid. The designated speed can be adjusted by an incorporated speed control.

Determination – Thread Types

In daily practice it is often necessary to choose a suitable fitting. Due to the multitude of different threads this is not always easy. The following drawings shall give you some assistance.

Like shown on the picture, it can be helpful to determine the thread size by putting it on our drawing which is, of course, in full size. Also all information on outer diameter and thread pitch (i. e. distance from thread tip to thread tip) can be determined with a little skill. The form can mostly be recognised easily.



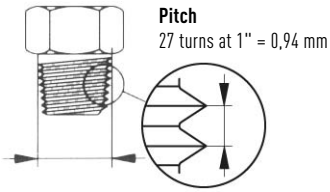
We will help you should you still have problems in determining your thread. Just send us a sample or counterpiece, we will be glad to help you with your choice. But please understand that we are not able to determine fitting threads on faxed copies.

NPT (National Pipe Taper) thread

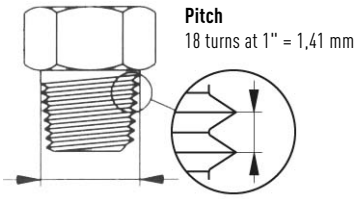
American pipe thread or BSP (British Standard Pipe) thread

Easy recognisable by its tapered outer and inner diameter which is self-sealing. Therefore, NPT threads are also known as "sealing thread" or "tightly threaded connection".

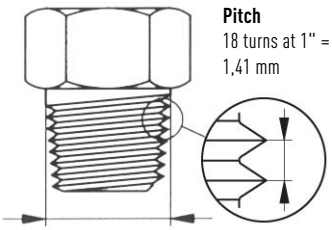
NPT 1/8" – outer-Ø = 9,9 mm



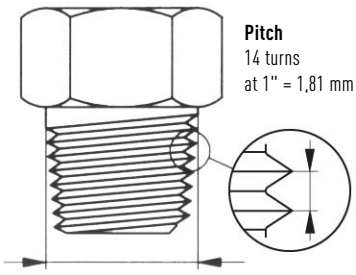
NPT 1/4" – outer-Ø = 13,2 mm



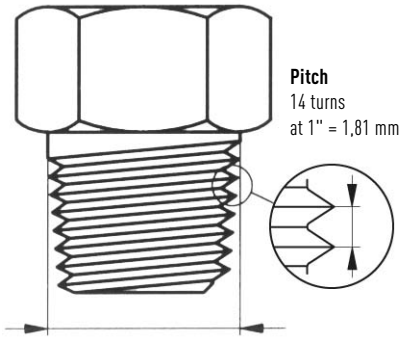
NPT 3/8" – outer-Ø = 16,6 mm



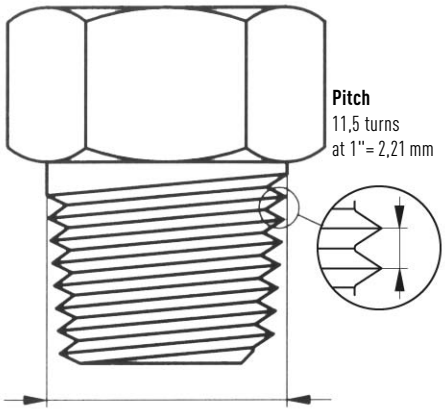
NPT 1/2" – outer-Ø = 20,6 mm



NPT 3/4" – outer-Ø = 26 mm



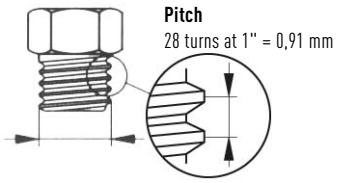
NPT 1" – outer-Ø = 32,5 mm



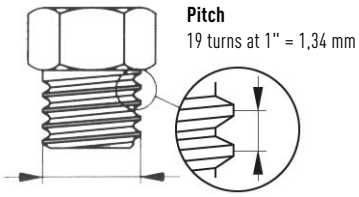
R or G thread (Whitworth)

Cylindrical threads which are mainly used in countries with imperial system. The size of e. g. R 3/4" does not stand for a diameter. Thus the corresponding size has to be determined according to charts.

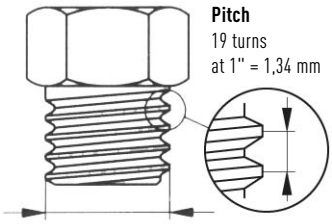
G 1/8" – outer-Ø = 9,6 mm



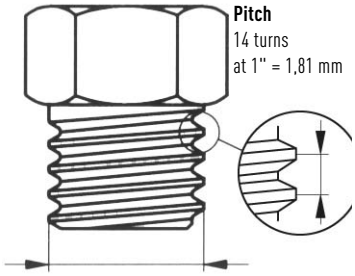
G 1/4" – outer-Ø = 13 mm



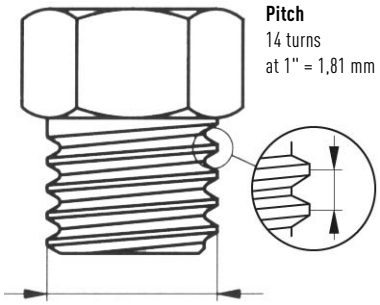
G 3/8" – outer-Ø = 16,5 mm



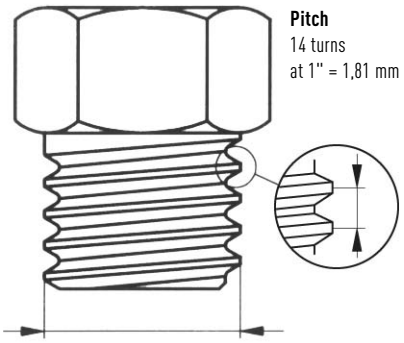
G 1/2" – outer-Ø = 20,8 mm



G 5/8" – outer-Ø = 22,8 mm



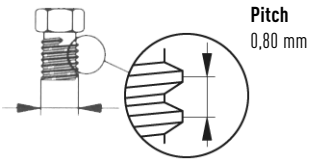
G 3/4" – outer-Ø = 26,3 mm



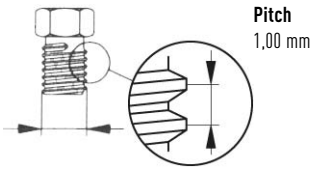
M thread (metric ISO-thread) – standard in Europe

Cylindrical inner and outer diameter which is precise in millimetres. The extremely fine taper of this thread allows the best possible force transmission. Metric threads are designated by a capital M plus an indication of their nominal outer diameter, for instance M 10. A taper deviating from the standard is marked with an appendix like for instance M 10 x 0.75.

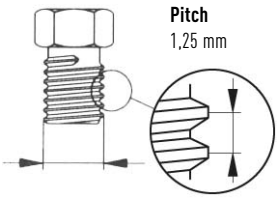
M 5 – outer-Ø = 5 mm



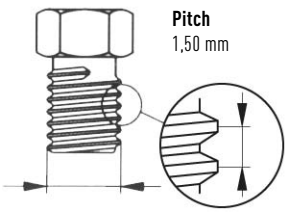
M 6 – outer-Ø = 6 mm



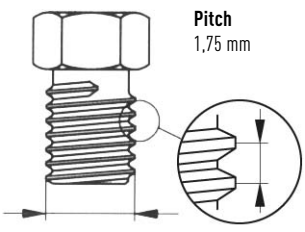
M 8 – outer-Ø = 8 mm



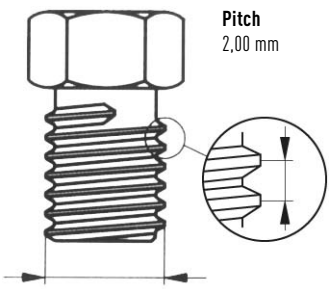
M 10 – outer-Ø = 10 mm



M 12 – outer-Ø = 12 mm



M 16 – outer-Ø = 16 mm



Determination – Thread Types

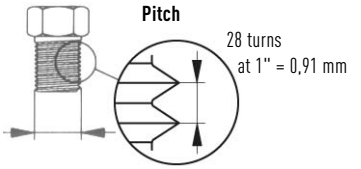
UNF 1/4"-28G thread

It has its origin in the USA. Mainly used in chromatography/HPLC applications. Most common sizes are UNF 1/4"-28G and UNF 10-32G. The digits 28 G and 32 G stand for the number of thread pitches at a length of one inch (25.4 mm).

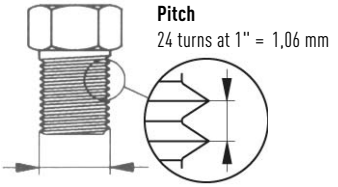
UNF 1/4"-28G versus M 6

Without exception all BOLA HPLC fittings come with the most common HPLC thread UNF 1/4"-28G. In addition, fittings and distributors with the very similar thread M 6 are used. These threads can only be distinguished by exact determination of their outer diameter or by using a test mandrel (it is possible to screw in a tube end fitting in the counterpart of the other thread for at least 2-3 rotations). The UNF 1/4" thread has an outer diameter of 6.35 mm, the M 6 thread has precisely 6 mm (work tolerances are possible). We recommend to use only the UNF 1/4"-28G thread to avoid confusion and double inventory.

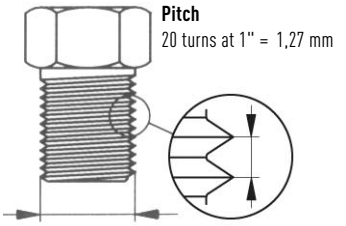
UNF 1/4"-28G – outer-Ø = 6,2 mm



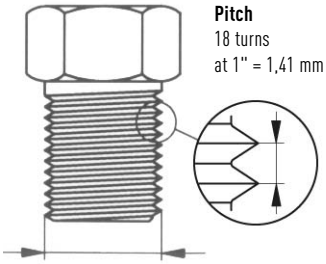
UNF 3/8"-28G – outer-Ø = 9,4 mm



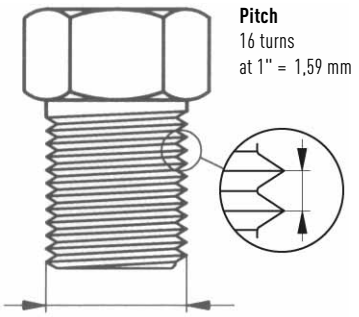
UNF 1/2"-28G outer-Ø = 12,6 mm



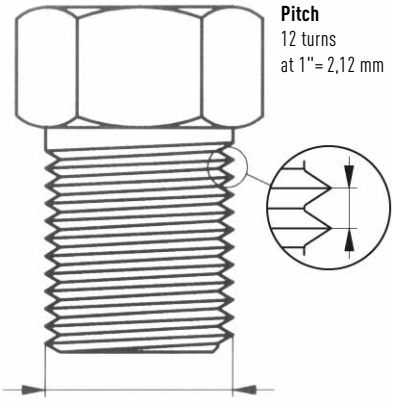
UNF 5/8"-18G – outer-Ø = 15,7 mm



UNF 3/4"-16G – outer-Ø = 18,9 mm

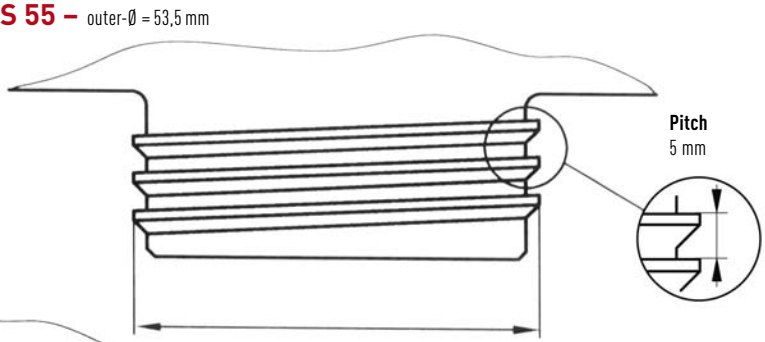


UNF 1"-12G – outer-Ø = 25,2 mm

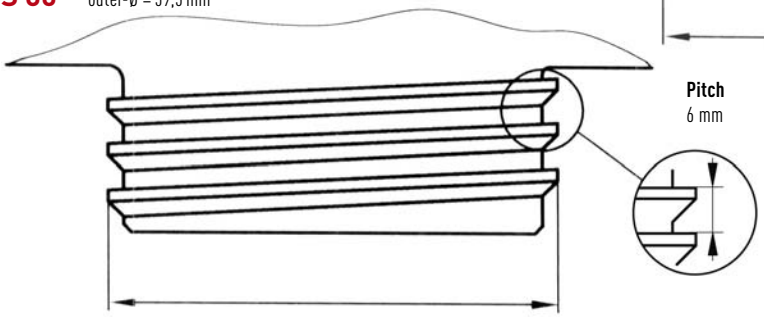


CANISTER THREADS

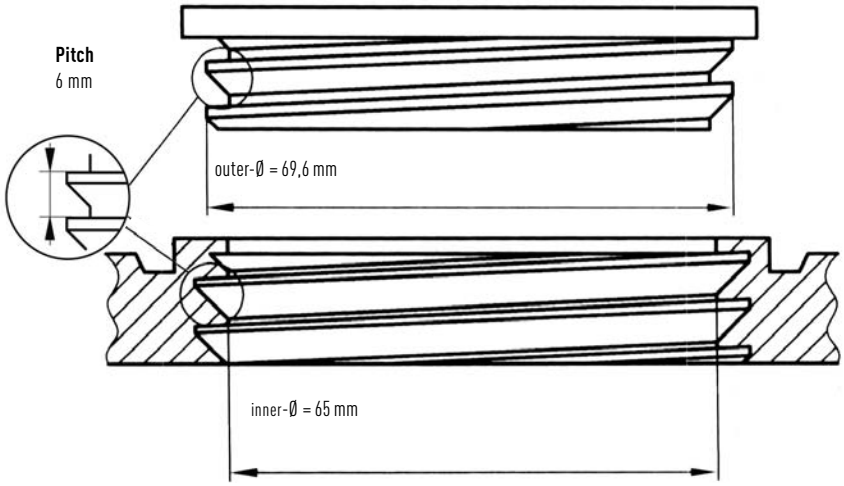
S 55 – outer-Ø = 53,5 mm



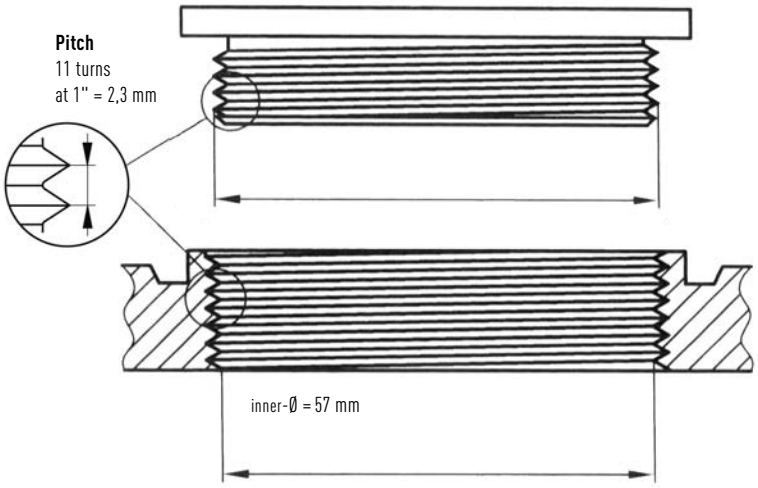
S 60 – outer-Ø = 59,5 mm



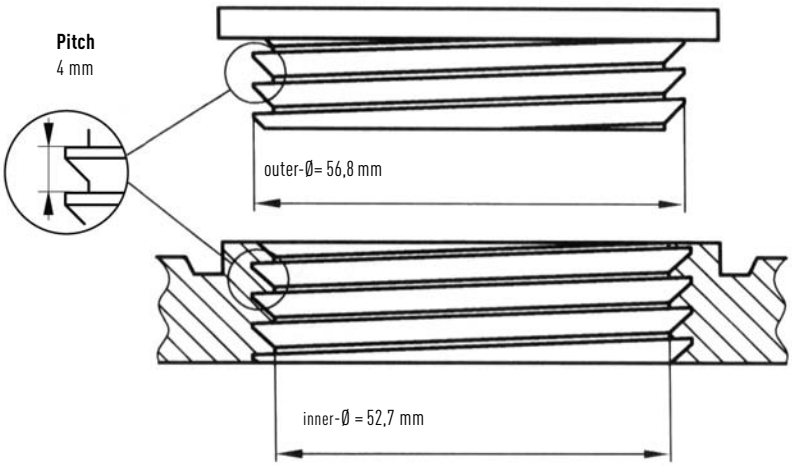
BCS 70 x 6 MAUSER 2"®



R 2" – outer-Ø = 58,5 mm



BCS 56 x 4 Tri Sure" ®



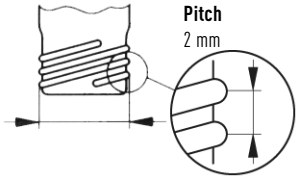
Determination – Thread Types

GL-threads

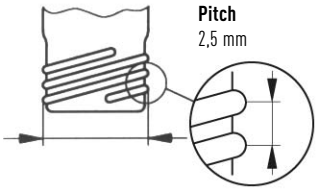
GL threads are round threads, i. e. there are only round and no sharp ends at the flanks of the screw thread. Due to its simple shape and the round ends of the flanks, this thread can easily be formed on glass pipes.

The extremely high pitch and the large flanks give this thread an important carrying power.

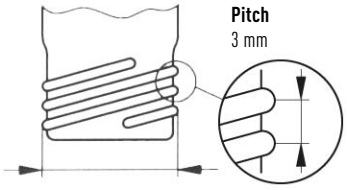
GL 12 – outer-Ø = 12 mm



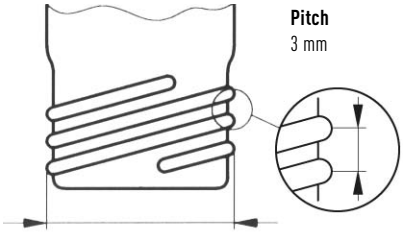
GL 14 – outer-Ø = 14 mm



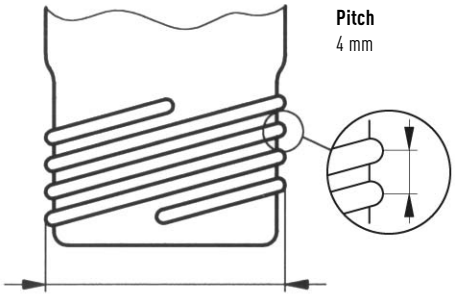
GL 18 – outer-Ø = 18 mm



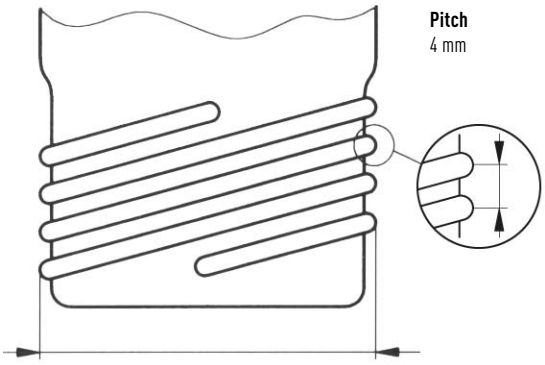
GL 25 – outer-Ø = 25 mm



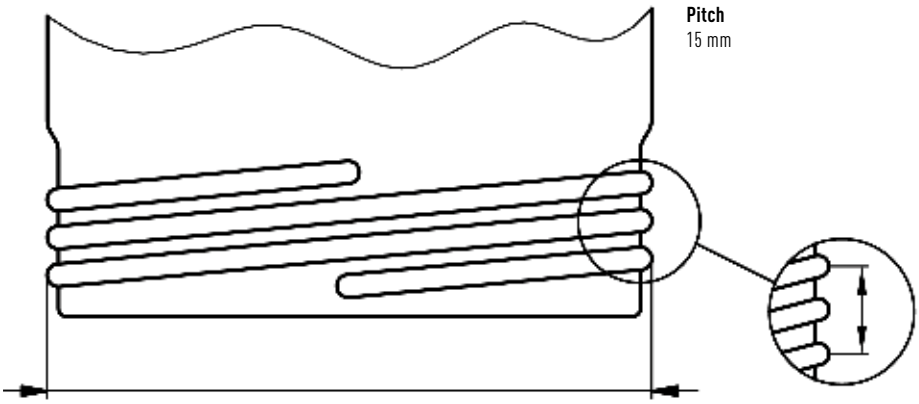
GL 32 – outer-Ø = 32 mm



GL 45 – outer-Ø = 45 mm



GLS 80 – outer-Ø = 80 mm



Conversion Factors

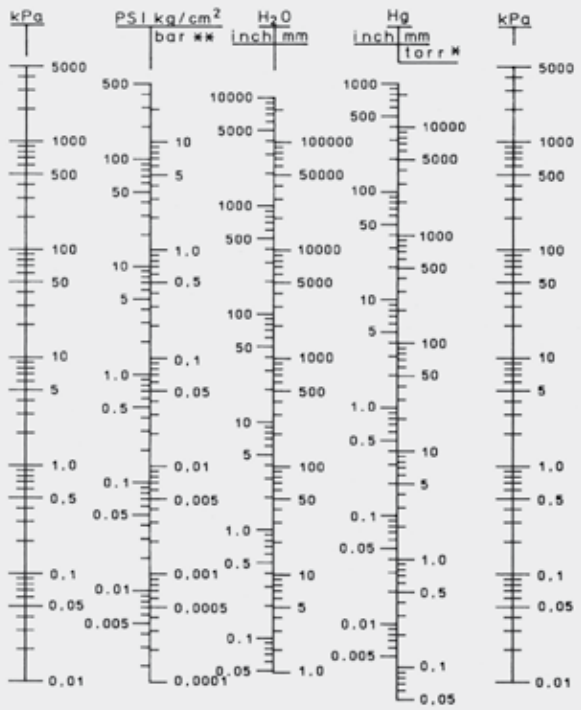
Inches to Millimeters

Inch Fractional notation "	Inch Decimal notation "	Millimeters Decimal notation mm
1/16	0.062	1.57
1/8	0.125	3.18
3/16	0.188	4.78
1/4	0.250	6.35
5/16	0.313	7.95
3/8	0.375	9.53
7/16	0.438	11.13
1/2	0.500	12.70
9/16	0.563	14.30
5/8	0.625	15.88
11/16	0.688	17.48
3/4	0.750	19.05
13/16	0.813	20.65
7/8	0.875	22.23
15/16	0.938	23.83
1	1	25.40
2	2	50.80
3	3	76.20
4	4	101.60
5	5	127.00
6	6	152.40
7	7	177.80
10	10	254.00

Millimeters to Inches

Millimeters mm	Decimal Inches in "
1.0	0.039
1.8	0.071
2.0	0.079
3.0	0.118
3.2	0.126
4.0	0.157
4.3	0.169
4.6	0.181
5.0	0.197
6.0	0.236
7.0	0.276
8.0	0.315
9.0	0.354
10.0	0.394
20.0	0.787
30.0	1.181
40.0	1.575
50.0	1.969
60.0	2.362
70.0	2.756
80.0	3.150
90.0	3.543
100.0	3.937

Conversion diagram for pressure



*1 torr = 1 mm Hg = 0.535 in H_2O » **1 bar 0 1.02 kg/cm² = 14.5 psi » 1 psi 0 6.895 kPa 0 0.07031 kg/ cm²

Pressure

Bar	PSI	MPA
1	14.49	0.1
2	28.99	0.2
3	43.48	0.3
5	72.46	0.5
10	144.93	1.0
20	289.86	2.0
30	434.78	3.0
50	724.64	5.0
100	1449.28	10.0

Conversion Factors

Measure of capacity

		British	Liquids Canada, USA	Dryers Canada, USA
1 minim		0.0592 mlit	0.06161 mlit	
1 dram	60 minim	3.5515 mlit	3.69670 mlit	
1 pint		568.2600 mlit	473.18 mlit	
1 quart	2 pint	1.1365 lit	0.9464 lit	1.1012 lit
1 gallon	4 quart	4.5560 lit	3.7850 lit	4.4100 lit
1 bushel	8 gallon	36.3690 lit	35.2390 lit	35.2390 lit
1 barrel	36 gallon	163.6600 lit	115.6300 lit	115.6300 lit
1 quarter	8 bushel	290.9500 lit	242.0000 lit	242.0000 lit

Mass

	Imperial to Metric		Metric to Imperial
1 grain (gr)	0.0648 g	1 g	15.432 gr
1 dram (dr)	1.7718 g	1 g	0.56439 dr
1 ounce (oz)	28.3500 g	1 g	0.0353 oz
1 pound (lb)	4.45359 kg	1 kg	2.205 lb
1 slug	1.00000 kg	1 kg	0.0685 slug
1 ton (short)	907.18500 kg	1 to	1.102 ton short
1 ton (long)	1.01605 to	1 to	0.984 ton long

Weights

1 g	0.035 oz	15.432 gr	
1 kg	2.2046 lb	35.274 oz	
1 to	2204.6000 lb	0.9842 ton long	1.1023 ton short
1 gr	0.0648 g		
1 oz	28.3500 g		
1 lb	0.4536 kg		
1 ton (short)	0.907 to		
1 ton (long)	1.016 to		

Length

1 mm	0.03937 in	15.432 gr	
1 cm	0.39370 in		
1 m	39.3700 in	3.28083 ft	1.0936 yd
1 km	3280.83 ft	1093.61 yd	0.62137 stat mi
1 in	25.4 mm	2.54 cm	0.0254 m
1 ft	304.8 mm	30.48 cm	0.3048 m
1 yd	0.9144 m		
1 stat mi (mile)	1.609 km		

Temperatures

Celsius (Fahrenheit - 32) x 0.555555556	Fahrenheit (Celsius x 1.8) +32
0	32
1	34
5	41
10	50
25	77
50	122
75	167
100	212
125	257
150	302
175	347
200	392
225	437
250	482
275	527

Temperatures

	Imperial to Metric		Metric to Imperial
1 lb mass/in³	27.68000 g/cm³	1 g/cm³	0.362 lb mass/in.³
1 lb mass/ft ³	0.01600 g/cm³	1 g/cm³	62.400 lb mass/ft.³
1 lb mass/imp gal	0.09978 g/cm³	1 g/cm³	10.022 lb mass/igal
1 lb mass/US gal	0.11980 g/cm³	1 g/cm³	8.3500 lb mass/USgal

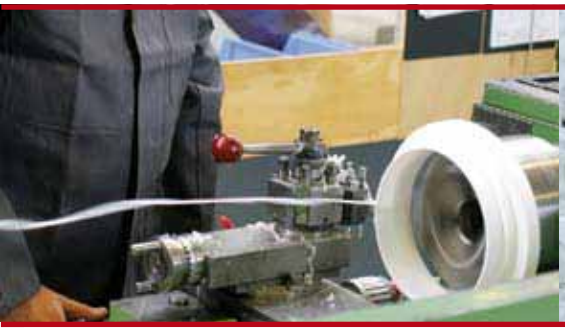
Volume

1 l	61.025 in³	0.0353 ft	1.0567 USqt
1 cm³	0.0610 in³		
1 m³	264.2 USgal	1.308 yd	35.314 m³
1 in³	16.387 cm³		
1 ft³	28.317 l	0.02832 m³	
1 yd³	0.7645 m³		
1 USgal	3.7853 l		
1 GBgal	4.545 l	1.2 USgal	
1 qt	0.94363 l		

Surfaces

	Imperial to Metric		Metric to Imperial
1 in²	6.4516 cm²	1 cm²	0.1550 in²
1 ft² (144 in²)	0.0929 m²	1 m²	10.7636 ft²
1 yd² (9 ft²)	0.8361 m²	1 m²	1.19599 yd²
1 rd²	25.2930 m²	1 m²	0.0395 rd²
1 stat mi²	2.5899 km²	1 km²	0.387 stat mi²

BOLA's commitment



For the environment

BOLA takes its responsibility for the environment seriously. Our responsibility is not only a respectful handling of natural resources but also avoiding waste and integration of recycling in the production process.

» Even during the machining of PTFE (e. g. drilling, turning or milling) all cuttings are collected by means of suction through a special tube system directly on our machines. All chips as well as remnants of semi-finished items are sorted according to their purity and stored contamination-free in large containers before later being recycled. During recycling, all chips and remnants are converted by a specially developed process into usable semifinished items.

» With regard to the environment, disposable products are no longer in our mind. Therefore all our products are designed for long-time use.

» Generation of chips can be avoided by using moulded parts. In addition, moulding reduces the consumption of PTFE powder and energy.

» Products made of the most common fluoroplastics are free of plasticizers and solvents. Thus, they are not harmful for the environment.

For the Caritas workshop in Gerlachsheim

Approximately 100 workplaces for disabled and mentally sick persons have been created in Gerlachsheim since 1983.

This facility offers a comprehensive range of work and care propositions and facilitates the integration of disabled and mentally sick persons in society and working life in close collaboration with the psychiatric ward of the County Hospital Tauberbischofsheim, the society for open psychiatry, the social-psychiatric service, the integrational service, group homes for disabled people, attendants and family members.

The most important objective is to enhance their performance and results, which are comparable to the requirements of private enterprises and thus pave the way for a normal working life including an independent way of life.

BOLA supports the objectives of the Caritas workshop with orders in the fields of assembly and packing.

For "Class 2000"

"Class 2000" is an integrated educational concept that has been developed by primary school teachers and specialists of the areas medicine, psychology, as well as sport and nutrition science. The main objective is to convey life competences to school children and teenagers so that they will be able to cope with the challenges of life. Self-esteem and courage are strengthened – the best prevention of alcohol or drug addiction and violence. BOLA is committed to these objectives and gladly supports the project "Class 2000".

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