

7 DISTILLATION/ACCESSORY



NORMAG - LABORATORY GLASSWARE



L 307 e.1

GENERAL

The distillation process is one of the most employed separating applications in laboratory, technique and production. It is used for material mixtures, which have concentration differences in the thermal balance between the vapour and liquid phase. The efficiency is decisively determined by the speed of the material and heat exchange from one phase into another.

There are two types of distillation

1. The ordinary distillation or direct flow distillation:
The separation of the liquid mixture, charged with a component, and their subsequent condensation. This distillation is successful for mixtures, whose components have boiling points which differ by at least 25° .
2. Rectification or reverse flow distillation:
Parts of the condensate are guided back to the boiling mixture in reflux flow to the rising vapour. The hereby forced material and heat exchange between the rising vapour and the reflux condensate increases the separation multiply. The effect is as higher as more intensive the two phases are in contact. Different component parts in the column enable this effect. The separation is successful for mixtures whose components have boiling points which differ by at least 0.5° .

The size of the column depends on the separating task. The diameter of the column is defined by the throughput and the strain of the column, while the height is defined by the required product purity. The un-controlled condensation at the walls is reduced to a minimum by insulation of the column with silver coated vacuum jackets (10^{-6} mbar) to reach a constant strain over the whole column length. The vacuum jacket has sight strips and bellows (one bellow/ 500 mm length).

The column type and its packing, which have also an influence on the column size, are chosen corresponding to the mixture to separate. Also costs, maximum permissible process temperature and operating pressure, corrosion resistance and contamination of the product decide about the column type.

The columns can be supplied with measuring connection on request.

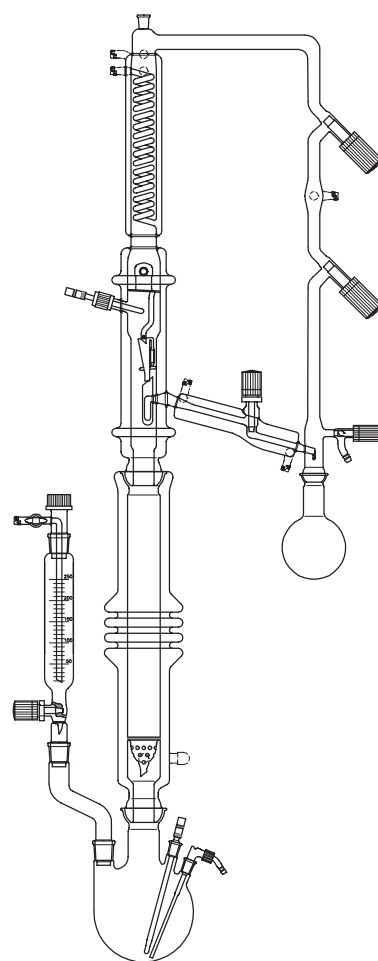
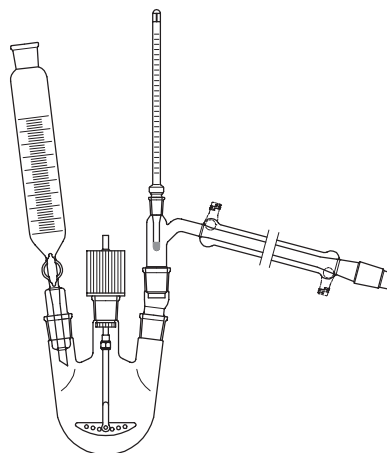
The column heads -vapour divider and liquid divider- are available in numerous variants, manually or automatically controlled.

Older manually controlled column heads have stopcocks as locking devices with all its known disadvantages: touching with grease, not tight towards outside, especially under vacuum operations, difficult to adjust because the reflux ratio is unknown and depending from stress. Glass needle valves provide a substantial better reproducibility of the adjustment but throughput fluctuations with changing of the viscosity are also appear.

Really constant, reproducible reflux ratios which are also independent from strain, viscosity and surface stress can only be reached with electromagnetic controlled vapour dividers and liquid dividers.

Column heads with electromagnetic control lead the product stream which exhausts at the upper end of the column in pre-chosen time intervals of same or different length as reflux back into the column or as distillate into the receiver. Thereby can be separated either the vapour or the liquid.

The separation of the vapour is recommended when in condensations two liquid phases or light volatile substances arise. In other cases, the separation of the liquid is appropriate.



PACKED COLUMNS

These columns can be suited to the respective separating problem in an easy way by choosing of the right packings as inlays for increasing the substance exchange. Therefore, they can be universally employed. The columns have a collecting cage in the lower part which has a low loss of pressure and that serves together with some bigger packings as pad for the column packing.

☞ All columns are delivered with evacuated (10^{-6} mbar) silver coated insulating jacket, sight strips and outer bellows (one bellow packing per 500 mm length).

Columns with bellows inside, bigger nominal sizes and in special lengths are available on request.

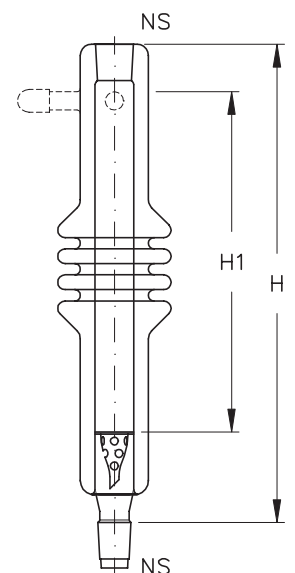
On request all columns are available with measuring connection GL 18. If this connection shall be sealed between basic ground joint and collecting cage, the column will be approx. 50 mm longer.

Packings do not belong to the delivery.

Columns with conical ground joint

These columns have a jacketed head ground joint socket and a non-jacketed basic ground joint cone.

DN	NS	H Filling height	H1	Filling volume (ml)	Catalogue No.
15	14/23	310	200	35	LSG 08030 01
15	14/23	410	300	55	LSG 08030 02
15	14/23	510	400	70	LSG 08030 03
15	14/23	610	500	90	LSG 08030 04
20	14/23	540	400	125	LSG 08030 13
25	29/32	940	800	400	LSG 08000 05
30	29/32	340	200	150	LSG 08000 11
30	29/32	440	300	215	LSG 08000 12
30	29/32	640	500	360	LSG 08000 13
30	29/32	740	600	425	LSG 08000 14
30	29/32	940	800	570	LSG 08000 15
30	29/32	1140	1000	710	LSG 08000 16
30	29/32	1340	1200	850	LSG 08000 17
30	29/32	1640	1500	1060	LSG 08000 18



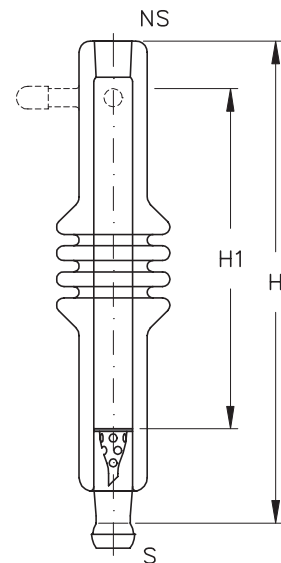
All ground joints are also available in other standard sizes, e.g. US-standard.

Columns, with conical/spherical ground joints

These columns have a jacketed head ground joint socket and a non-jacketed basic ground joint ball.

☞ These packed columns are also available with spherical ground joint balls in mm-size.

DN	NS	S	H	Filling height H1	Filling volume (ml)	Catalogue No.
30	29/32	40/25	340	200	150	LSG 08001 21
30	29/32	40/25	440	300	215	LSG 08001 22
30	29/32	40/25	640	500	360	LSG 08001 23
30	29/32	40/25	740	600	425	LSG 08001 24
30	29/32	40/25	1140	1000	710	LSG 08001 26
30	29/32	40/25	1340	1200	850	LSG 08001 27
30	29/32	40/25	1640	1500	1060	LSG 08001 28

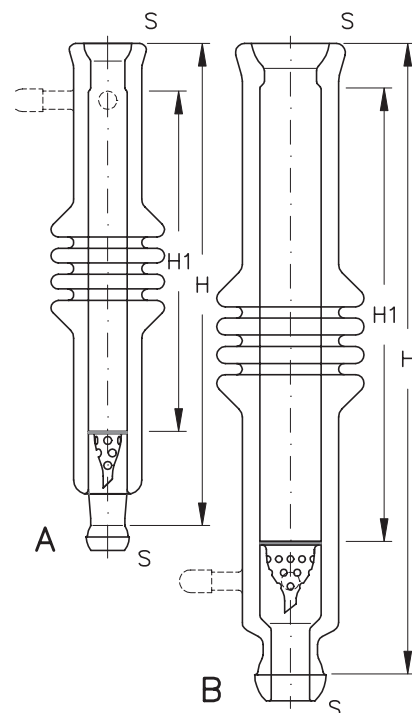


Columns, with spherical ground joints

These columns have a jacketed head ground joint cup and a non-jacketed basic ground joint ball in design A resp. jacketed basic ground joint ball in design B.

☞ These packed columns are also available with spherical ground joint balls and cups in mm-size.

DN	S	H	Filling height H1	Filling volume (ml)	Design	Catalogue No.
30	40/25	330	200	150	A	LSG 08001 41
30	40/25	430	300	215	A	LSG 08001 42
30	40/25	630	500	360	A	LSG 08001 43
30	40/25	730	600	425	A	LSG 08001 44
30	40/25	1130	1000	710	A	LSG 08001 46
30	40/25	1330	1200	850	A	LSG 08001 47
30	40/25	1630	1500	1060	A	LSG 08001 48
50	64/40	460	400	800	B	VAB 08045 21
50	64/40	760	600	1200	B	VAB 08045 22
50	64/40	960	800	1600	B	VAB 08045 23
50	64/40	1160	1000	2000	B	VAB 08045 24
50	64/40	1360	1200	2400	B	VAB 08045 25
50	64/40	1660	1500	3000	B	VAB 08045 26



All ground joints are also available in other standard sizes, e.g. US-standard.

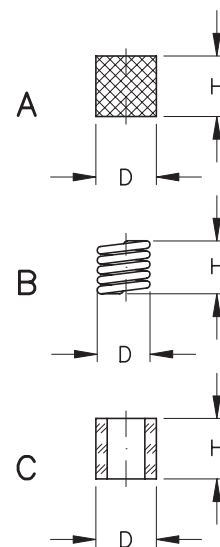
Packings

The listed packings are only a selection of possible packing types. Experiences have shown that the majority of application purposes can be covered with them. On request we supply also packings in other sizes and types for special applications.

Wire mesh rings made of stainless steel in design A provide a high separating efficiency and a low loss of pressure. A disadvantage is the low corrosion resistance. Wilson-spirals made of Borosilicate glass 3.3 in design B provide a higher corrosion resistance but have a lower separating efficiency and a higher loss of pressure.

Corrosion resistant Raschig rings, also made of Borosilicate glass 3.3 in design C, provide the lowest separating efficiency and higher loss of pressure. But they are preferably used for products which are easy to separate. When dirty substances are used they can be economical exchanged.

Size	D	H	Material	Design	Catalogue No.
3 x 3	3	3	1.4401	A	SZT 09403 22
6 x 6	6	6	1.4401	A	SZT 09403 18
8 x 8	8	8	1.4401	A	SZT 09403 20
10 x 10	10	10	1.4401	A	SZT 09403 21
3	3	3	Glass	B	SZT 09403 29
7	7	7	Glass	B	SZT 09403 30
3 x 3	3	3	Glass	C	SZT 09403 41
6 x 6	6	6	Glass	C	SZT 09403 42
8 x 8	8	8	Glass	C	SZT 09403 43
10 x 10	10	10	Glass	C	SZT 09403 44



VIGREUX COLUMNS

They have a lower separating efficiency as columns filled with Raschig rings but distinguish by small operation volumes and low loss of pressure. Therefore, they are preferably used at low pressures (up to 5 mbar) and small substance volumes.

☞ All columns are delivered with evacuated (10^{-6} mbar) silver coated insulating jacket, sight strips and outer bellows (one bellow packing per 500 mm length).

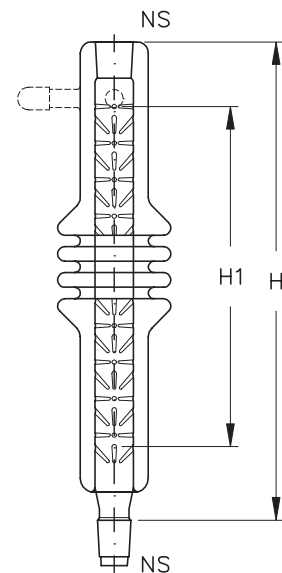
Columns with bellows inside, bigger nominal sizes and in special lengths are available on request.

On request all columns are available with measuring connection GL 18. If this connection shall be sealed between basic ground joint and collecting cage, the column will be approx. 50 mm longer.

Columns, with conical ground joint

They are fitted with jacketed head ground joint socket and a non-jacketed basic ground joint cone.


DN	NS	H	Effective length H1	Catalogue No.
15	14/23	300	200	LSG 08035 01
15	14/23	400	300	LSG 08035 02
15	14/23	600	500	LSG 08035 03
25	29/32	420	300	LSG 08008 21
25	29/32	620	500	LSG 08008 23
25	29/32	720	600	LSG 08008 24
25	29/32	1120	1000	LSG 08008 26
25	29/32	1320	1200	LSG 08008 27



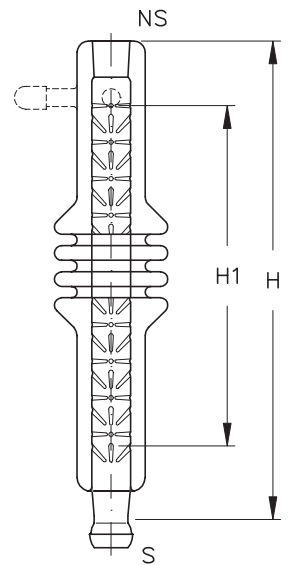
All ground joints are also available in other standard sizes, e.g. US-standard.

Columns, with conical/spherical ground joints

These columns have a jacketed head ground joint socket and a non-jacketed, basic ground joint ball.


 These Vigreux columns are also available with spherical ground joint balls in mm-size.

DN	NS	S	H	Effective length H1	Catalogue No.
25	29/32	40/25	420	300	LSG 08008 31
25	29/32	40/25	620	500	LSG 08008 33
25	29/32	40/25	720	600	LSG 08008 34
25	29/32	40/25	1120	1000	LSG 08008 36
25	29/32	40/25	1320	1200	LSG 08008 37

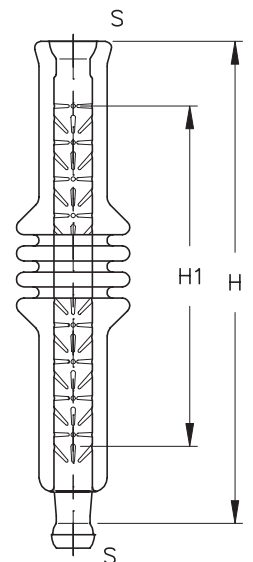


Columns, with spherical ground joints

These columns have a jacketed head ground joint cup and a non-jacketed, basic ground joint ball.

 These Vigreux columns are also available with spherical ground joint balls and cups in mm-size.

DN	S	H	Effective length H1	Catalogue No.
25	40/25	420	300	LSG 08008 41
25	40/25	620	500	LSG 08008 43
25	40/25	720	600	LSG 08008 44
25	40/25	1120	1000	LSG 08008 46
25	40/25	1320	1200	LSG 08008 47



All ground joints are also available in other standard sizes, e.g. US-standard.

BUBBLE CAP TRAY COLUMNS

They have a constant high efficiency over a wide range of loading. Bubble cap tray columns (also with nominal size DN 30) are especially interesting for analysis, whose results will be later translated into a larger dimension. Also the separating efficiency per column length is relative high.

Due to the relative high loss of pressure and operating volume, these columns are only used for pressures higher than 50 mbar and for larger substance volumes.

Since in bubble cap tray columns a good heat transfer is reached due to the high operating pressure and the constant high efficiency, this column is also available without silver coated high vacuum jacket.

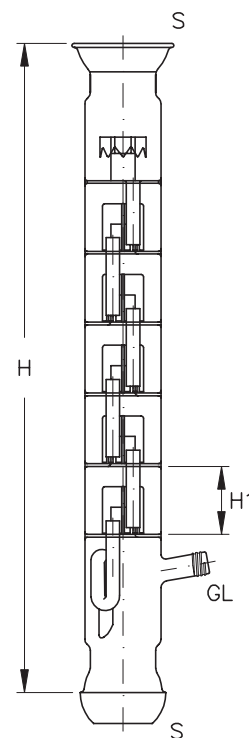
☞ All jacketed columns are delivered with evacuated (10^{-6} mbar) silver coated insulating jacket, sight strips and outer bellows (one bellow packing per 500 mm length).

Bigger nominal sizes, special lengths, columns with inner bellows and spherical ground joints in mm-size are available on request.

Columns with additional temperature and sampling arms are available on request.

Columns, with spherical ground joints

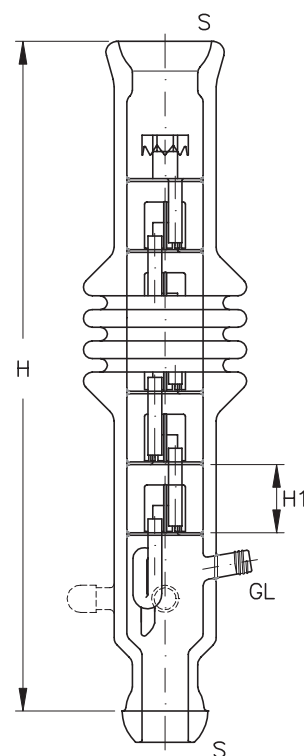
DN	S	H	H1	GL	Number of plates	Catalogue No.
30	40/25	350	40	18	5	VAB 08575 02
30	40/25	580	40	18	10	VAB 08565 02
50	64/40	500	50	18	5	VAB 08570 02
50	64/40	750	50	18	10	VAB 08560 02



All ground joints are also available in other standard sizes, e.g. US-standard.

Columns with spherical ground joints and insulating jacket

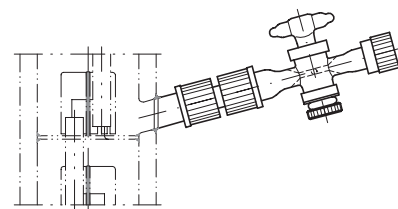
DN	S	H	H1	GL	Number of plates	Catalogue No.
30	40/25	440	40	18	5	VAB 08515 02
30	40/25	650	40	18	10	VAB 08505 02
50	64/40	540	50	18	5	VAB 08510 02
50	64/40	800	50	18	10	VAB 08500 02



Sampler

The sampler is fitted with a standard stopcock NS 14/23 with bore 3 mm, connected with thread GL 18. A screw cap with silicone seal is set on the outer end of the stopcock. Very small substance volumes can be taken under normal pressure and under vacuum with an injection syringe and can be classified e.g. gas chromatographically.

Catalogue No. VAB 08547 01



All ground joints are also available in other standard sizes, e.g. US-standard.

LIQUID DIVIDER MANUAL OPERATED

These column heads with integrated condensers serve for the adjustment of the reflux ratio of distillation columns, i.e. the separation of the arising condensate in reflux and drain, manual operated. When the valve which is located in the drain tube is fully opened, the separator is adjusted for total distillation drain since the reflux tube is sealed higher than the drain tube. The reflux ratio can be changed infinitely variable up to total reflux by turning the valve. If two valves are in the drain tube, one valve will only serve for on/off function.

Manual operated liquid dividers are suitable, subject to design, for operations under vacuum and/or normal pressure. The used glass needle valves permit a fine adjustment and working under exclusion of air and/or moisture.

☞ Measuring connections are delivered with GL 18 but on request also available with standard ground joint NS 14/23.

Cooling water connections: glass thread GL 14 complete with threaded hose connection GL 14.

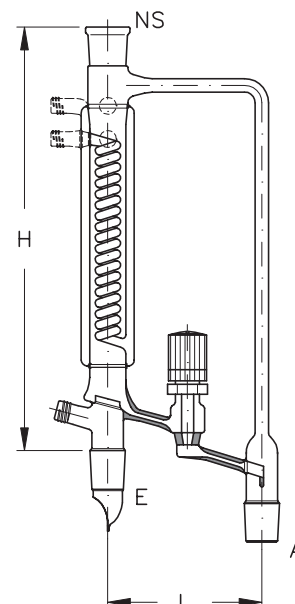
The use of an electronic operated liquid divider is recommended when the reflux ratio need to be exactly adjusted and shall be reproducible (see page 7.14).

Manual operated liquid divider with spherical joints are also available in mm-size.

Liquid divider, with vertical glass needle valve

This combination from jacketed condenser and glass needle valve GNV 8 provides a good value column head for operations under normal pressure. It is also a variant of the distilling links described on page 7.27 for smaller spaces.

Inlet E	Outlet A	NS	H	L	Catalogue No.
NS 29/32	NS 14/23	29/32	350	125	LSG 01202 11
NS 29/32	NS 29/32	29/32	350	125	LSG 01202 12
S 40/25	NS 29/32	29/32	350	125	LSG 01202 14



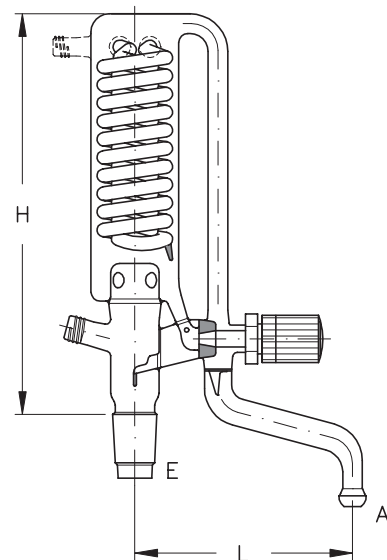
All ground joints are also available in other standard sizes, e.g. US-standard.

Liquid divider, with reflux caps with holes

This variant is fitted with integrated reflux cap with holes and horizontal glass needle valve GNV 8. This avoids an uncontrolled reflux, even of small distilling volumes. The jacketed condenser is replaced by a double coil condenser.

This variant is suitable for operation under normal pressure.

Inlet E	Outlet A	H	L	Catalogue No.
NS 14/23	S 19	230	135	SAA 11069 02
NS 29/32	S 19	265	140	SAA 11070 02
S 40/25	S 19	265	140	SAA 11073 02

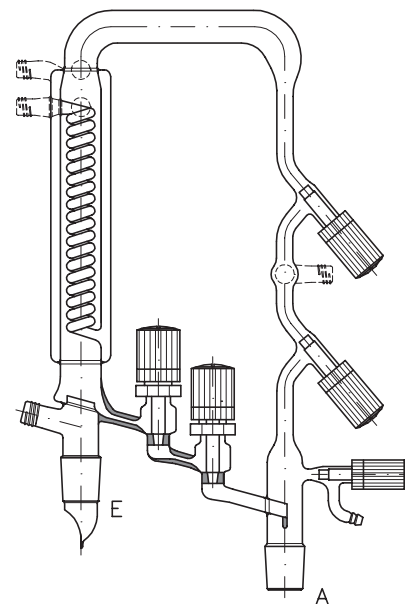


Liquid divider, with two glass needle valves

These column heads with jacketed condenser and vacuum frame are suitable for use under vacuum. They provide the facility the first spindle valve GNV 8, seen from the flow direction of the outlet, to use for control and the second one to use as locking valve GNV 8. The changing of the receiver can be carried out without loss of vacuum.

Spindle valves as locking valves (size SPV 6) and as ventilating valves (SPV 3) are used in the vacuum frame.

Inlet E	Outlet A	H	L	Catalogue No.
NS 14/23	NS 14/23	340	150	LSG 08010 60
NS 29/32	NS 14/23	340	150	LSG 08010 31
NS 29/32	NS 29/32	340	150	LSG 08010 32
S 40/25	NS 29/32	340	150	LSG 08010 34



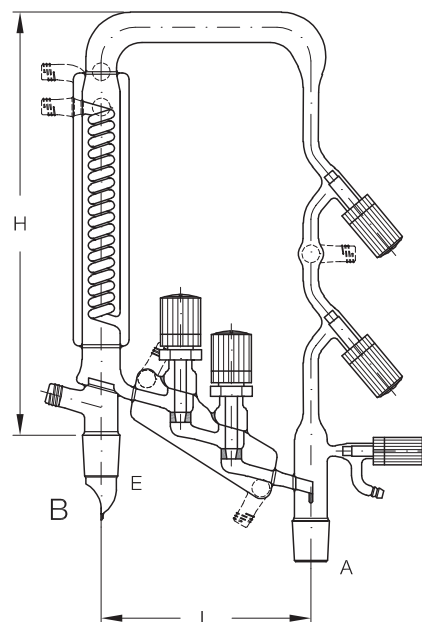
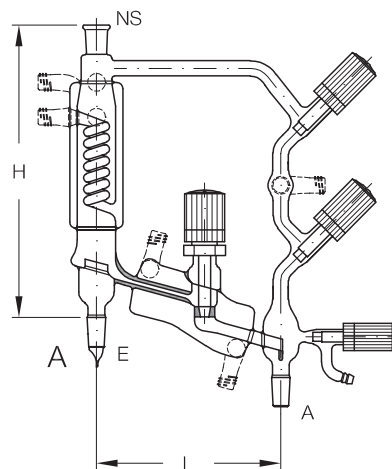
All ground joints are also available in other standard sizes, e.g. US-standard.

Liquid divider, with tempering jacket

The use of these column heads is recommended when lightly volatile or refractory substances are treated. They are fitted with a tempering jacket in the distillate drain for cooling or tempering of the distillate. Glass needle valves GNV 8 are used as control valve or additional locking valve.

Spindle valves as locking valves (size SPV 6) and as ventilating valves (SPV 3) are used in the vacuum frame.

Inlet E	Outlet A	NS	H	L	Des.	Catalogue No.
NS 14/23	NS 14/23	14/23	230	145	A	SAA 08013 01
NS 29/32	NS 14/23	-	330	165	B	LSG 08010 51
NS 29/32	NS 29/32	-	330	165	B	LSG 08010 52
S 40/25	NS 29/32	-	330	165	B	LSG 08010 54



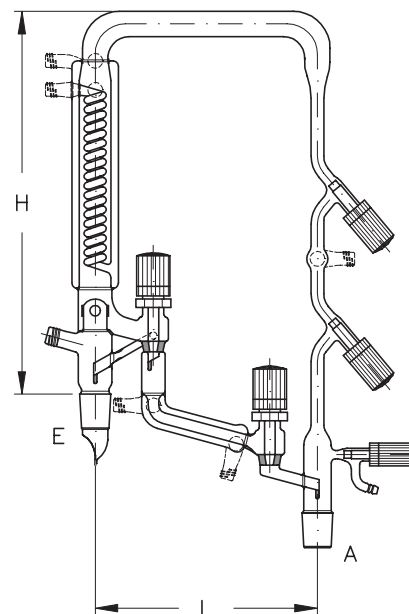
All ground joints are also available in other standard sizes, e.g. US-standard.

Liquid divider, with outlet cooling tube

In this variant, a double jacketed tube is fitted between the two glass needle valves GNV 8 for tempering the distillate. The column heads are fitted with reflux cap with holes to avoid the uncontrolled reflux of distillate.

Spindle valves as locking valves (size SPV 6) and as ventilating valves (SPV 3) are used in the vacuum frame.

Inlet E	Outlet A	H	L	Catalogue No.
NS 29/32	NS 29/32	370	210	LSG 09089 21
S 40/25	NS 29/32	420	220	LSG 09089 33



All ground joints are also available in other standard sizes, e.g. US-standard.

LIQUID DIVIDER ELECTROMAGNETIC OPERATED

We recommend the use of an electromagnetic operated liquid divider together with a timer (see chap. 10 "Measurement and control") when the reflux ratio need to be exactly and reproducibly adjusted.

In this variant, the swinging funnel with sealed counter magnet is attracted (total drain) or repelled (total reflux) from a magnet fastened outside of the column. The polarity of this magnet can be reversed with a timer. To guarantee an optimal function of the liquid divider, the time in which the funnel stays in one of its end points should not be shorter than two seconds.

Electromagnetic controlled liquid dividers are suitable for operations under vacuum and normal pressure. The distillate outlet tube with tempering jacket allows the treatment of light volatile and high melting substances. A glass needle valve GNV 8 serves as locking valve.

Spindle valves in size SPV 10 as locking valve and in size SPV 6 as ventilation valve are used in the vacuum frame.

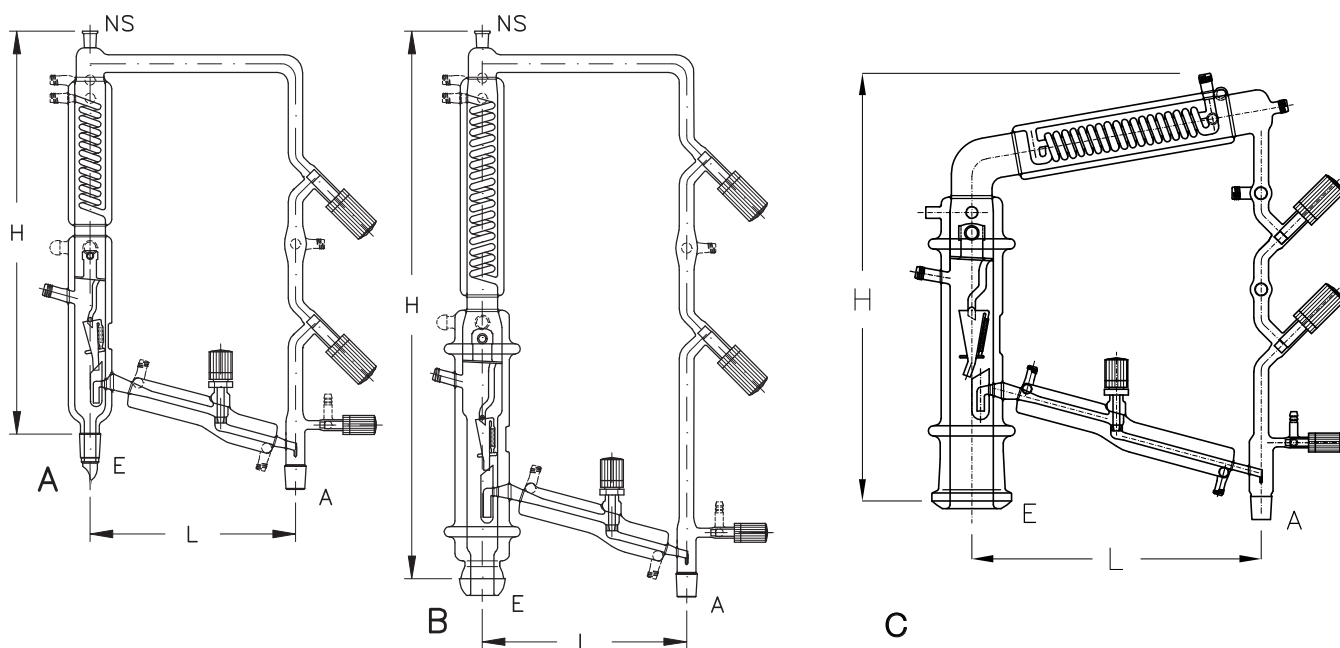
☞ Electromagnet and timer please order separately.

Measuring connections are glass threads GL 18 but on request also available with standard ground joint NS 14/23.

Cooling water connections: glass thread GL 14 complete with threaded hose connections GL 14.

Electromagnetic operated liquid divider with spherical ground joints are also available in mm-size.

Inlet E	Outlet A	NS/ GL	H	L	Throughput max. l/h	Design	Catalogue No.
NS 29/32	NS 29/32	14/23	560	280	7	A	SAA 09092 21
S 40	NS 29/32	14/23	560	280	7	A	SAA 09092 23
S 64	NS 29/32	14/23	780	280	12	B	SAA 09092 24
S 64	S 40	14/23	780	280	12	B	SAA 09092 26
KF 50	NS 29/32		440	300	7	C	SAA 09092 27
KF 80	NS 29/32		600	400	12	C	SAA 09092 28



All ground joints are also available in other standard sizes, e.g. US-standard.

ACCESSORY

Electromagnet for liquid divider

It serves in connection with the timer for the operation of the moveable born funnels from liquid dividers. Its connecting voltage is 24 VDC.

Item	Catalogue No.
Electromagnet	ESR 12145 01



Connecting cable

For connection of the electromagnet described above, available in five lengths.

Length (m)	Catalogue No.
2	ESR 12166 01
4	ESR 12166 02
6	ESR 12166 03
8	ESR 12166 04
10	ESR 12166 05



Suspension device

This suspension device is used in electromagnetic operated liquid dividers.



The electromagnet is fastened with these clamps at the liquid divider.

Size	suitable for liquid divider with catalogue no.	Catalogue No.
1	SAA 09092 21 and SAA 09092 23	SAA 09092 30
2	SAA 09092 24 and SAA 09092 26	SAA 09092 31
3	SAA 09086 01 and SAA 09086 11	SAA 09092 33



VAPOUR DIVIDER ELECTROMAGNETIC OPERATED

Vapour dividers are recommended for difficult separations as are low temperature distillation, working with light volatile substances or two-phase azeotropes to adjust exactly reproducible reflux ratios. Furthermore, they are used instead of a liquid divider when the product flow is very small and the separation of the condensate does not lead to the required accuracy.

While in the majority of the application purposes the standard design provides optimal results. For distillations of highly viscous and/or light crystallising substances, vapour dividers in special designs are used. Due to the special designed drain tube, they allow a fine tempering of the product to drain into the receiver.

In both cases, the product stream is separated with an electromagnetic operated valve GNV 8, directed either to the reflux tube or to the drain tube and condenses there. The valve is operated with a timer and an electromagnet. Is the electromagnet without supply the reflux is free. With supply the magnet sealed in the valve spindle is attracted and the drain is open.

All vapour dividers are only delivered with silver coated high vacuum insulating jacket (10^{-6} mbar), corresponding to their special tasks.

 Electromagnet and timer please order separately.

Measuring connections are glass threads GL 18 but on request also available with standard ground joint NS 14/23.

Cooling water connections: glass thread GL 14 complete with threaded hose connections GL 14.

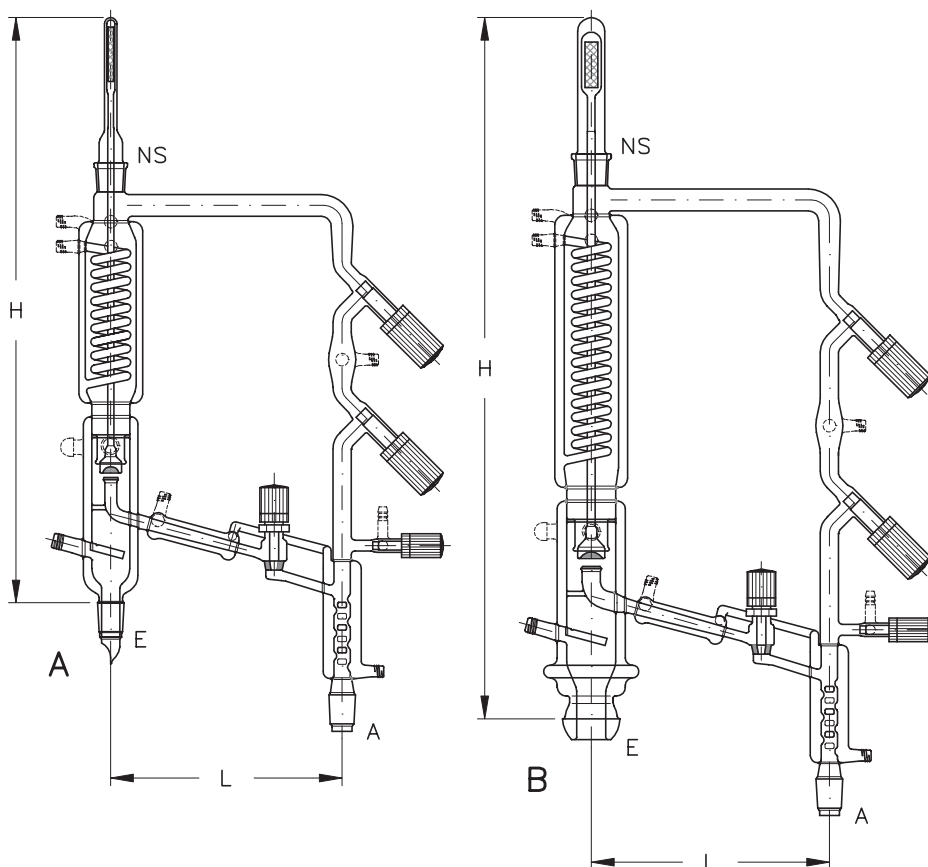
Electromagnetic operated vapour divider with spherical ground joints are also available in mm-size.

Standard vapour divider

This variant is available in two sizes and in different designs. Fitted with jacketed condenser in the reflux tube and product condenser in the partly jacketed drain tube. A glass needle valve GNV 8 serves as locking valve.

Spindle valves in size SPV 10 as locking valve and in size SPV 6 as ventilation valve are used in the vacuum frame.

Inlet E	Outlet A	NS	H	L	Throughput max. l/h	Design	Catalogue No.
NS 29/32	NS 29/32	29/32	650	250	8	A	SAA 09192 21
S 40	NS 29/32	29/32	650	250	8	A	SAA 09192 23
S 64	NS 29/32	34/35	800	260	12	B	SAA 09192 24
S 64	S 40	34/35	800	260	12	B	SAA 09192 26



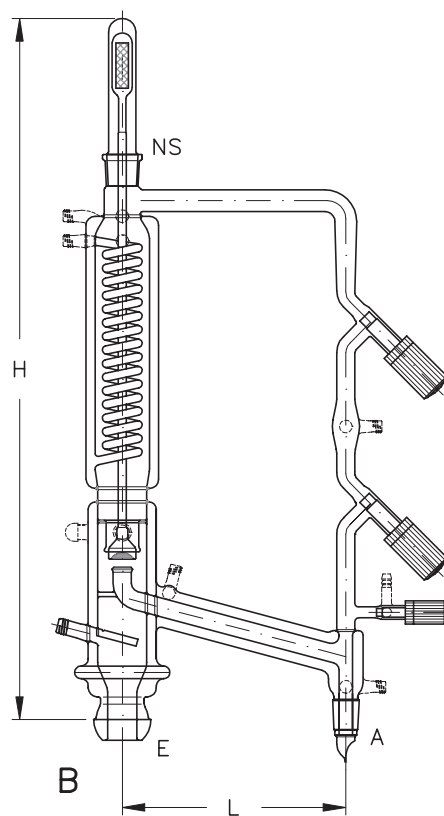
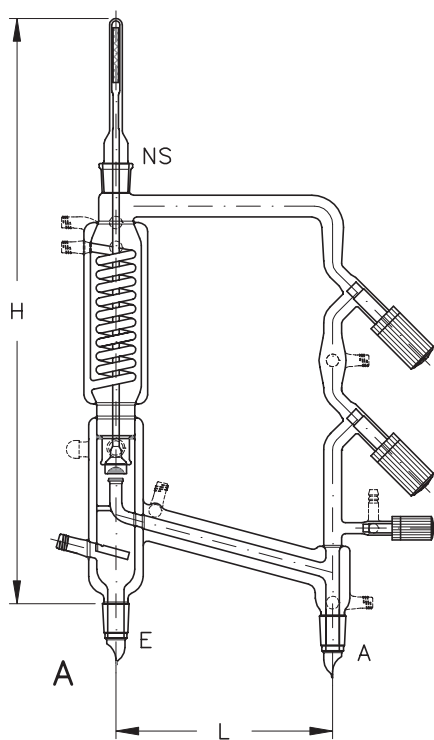
All ground joints are also available in other standard sizes, e.g. US-standard.

Special vapour divider

The drain tube of this special vapour divider has a tempering jacket over the whole length from the column to the distillate receiver. The temperature of the produced distillate can be exactly adjusted what is a feature for highly viscous or light crystallising substances. A locking valve is not necessary.

Spindle valves in size SPV 10 as locking valve and in size SPV 6 as ventilation valve are used in the vacuum frame.

Inlet E	Outlet A	NS	H	L	Throughput max. l/h	Design	Catalogue No.
NS 29/32	NS 29/32	29/32	650	240	8	A	VAB 09292 21
S 40	NS 29/32	29/32	650	240	8	A	VAB 09292 23
S 64	NS 29/32	34/35	800	245	12	B	VAB 09292 24
S 64	S 40	34/35	800	245	12	B	VAB 09292 26



All ground joints are also available in other standard sizes, e.g. US-standard.

ACCESSORY

Electromagnet for vapour divider

It serves in connection with the timer for vertical operation of the tappets of vapour dividers. Connecting voltage is 24 VDC.

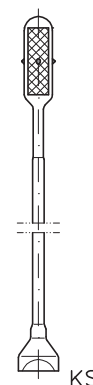
Size	suitable for vapour divider with catalogue no.	Design	Catalogue No.
1	SAA 09192 21 and SAA 09192 23	A	ESR 12146
	VAB 09292 21 and VAB 09292 23	A	ESR 12146
2	SAA 09192 24 and SAA 09192 26	B	ESR 12147
	VAB 09292 24 and VAB 09292 26	B	ESR 12147



Tappets

Both components can be delivered as spare parts for electromagnetic operated vapour divider. An exact locking of the ring is necessary.

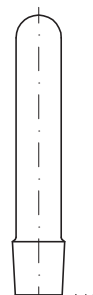
KS	suitable for vapour divider with catalogue no.	Design	Catalogue No.
18	SAA 09192 21 and SAA 09192 23	A	SAA 09192 30
	VAB 09292 21 and VAB 09292 23	A	SAA 09192 30
28	SAA 09192 24 and SAA 09192 26	B	SAA 09192 31
	VAB 09292 24 and VAB 09292 26	B	SAA 09192 31



KS

Caps, ground

NS	suitable for vapour divider with catalogue no.	Design	Catalogue No.
29/32	SAA 09192 21 and SAA 09192 23	A	SAA 09192 40
	VAB 09292 21 and VAB 09292 23	A	SAA 09192 40
34/35	SAA 09192 24 and SAA 09192 26	B	SAA 09192 41
	VAB 09292 24 and VAB 09292 26	B	SAA 09192 41



NS

Connecting cable

For the connection of the electromagnet above, available in five lengths.

Length (m)	Catalogue No.
2	ESR 12167 01
4	ESR 12167 02
6	ESR 12167 03
8	ESR 12167 04
10	ESR 12167 05



All ground joints are also available in other standard sizes, e.g. US-standard.

MICRO-LIQUID DIVIDER ACCORDING TO DR. KAMINSKY

These liquid dividers have an evacuated (10^{-6} mbar) silver coated vacuum jacket up to the lateral located descending condenser. They are especially suitable for the adjustment of precise reflux ratios in small condensate volumes. Other features are the small construction height and the jacketed measuring connection NS 10 for thermometer with installation length of 50 mm.

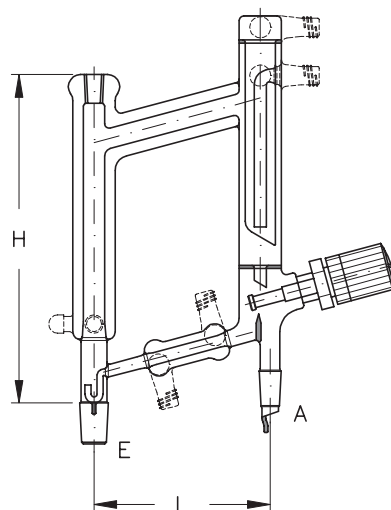
☞ These liquid dividers are available either manual operated or electromagnetic operated and in two different sizes.

Cooling water connection: Glass thread GL 14 complete with threaded hose connections GL 14.

Manual operated, micro-liquid divider

In this case, the condensate is collected below the double tube condenser and directed over a central drain on the sensor. At the end of this sensor an edge is located where the condensate is separated in reflux and drain. The sensor runs in a vacuum tight PTFE socket and is operated via a valve screwing. The adjusted reflux ratio keeps also constant at condensate fluctuations. Total reflux or total drain can also be adjusted.

Inlet E	Outlet A	H	L	Comment	Catalogue No.
NS 19/26	NS 14/23	260	110	-	SAA 09085 01
NS 29/32	NS 14/23	260	110	jacketed	SAA 09085 11

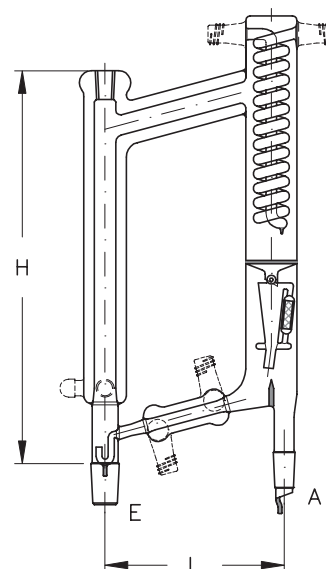


Electromagnetic operated, micro-liquid divider

In this design, the collected condensate below the coil condenser is directed over a central drain into a swinging funnel. The mode of operation of this funnel is described on page 7.14.

☞ Electromagnet and timer please order separately.

Inlet E	Outlet A	H	L	Comment	Catalogue No.
NS 19/26	NS 14/23	260	110	-	SAA 09086 01
NS 29/32	NS 14/23	260	110	jacketed	SAA 09086 11




All ground joints are also available in other standard sizes, e.g. US-standard.

HETERO-AZEOTROPE COLUMN ADAPTER

To withdrawal either the specific light or heavy phase, depending on the task, these column heads are available in two different designs. Both heads work with an added agent which is filled in the phase divider up to overflow before starting the distillation. Its special feature is that it also works on itself at density fluctuations.

The heads are set onto a column which has an evacuated (10^{-6} mbar) silver coated insulating jacket with sight strips and is fitted with a reflux condenser. During the distillation the arising vapour flows via the outer steam tube into the condenser and condenses. The distillate divides in a system of concentric tubes. One phase is led back as reflux to the column the other one is lateral drained. A tempering jacket around the divider can speed up the dividing process by heating or cooling.

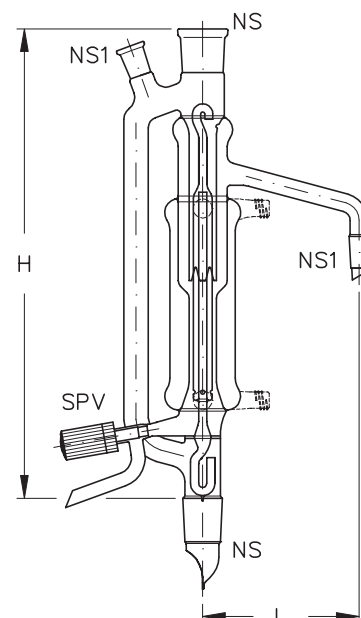
The inner dividing walls are so fitted, that they allow an automatic dividing without adjustment on the present density ratio. These devices also work trouble-free when the density ratios continuously change. The volume of the added agent keeps constant during the distillation since only the small part is brought out which is solved in the distillate. Also in steam distillations it is sufficient to give the required water volume into the boiling flask because the fluid phase is continuously in reflux. Large condensate volumes are not necessary since the azeotrope column adapter leads only the separated phase into the receiver. A small receiver flask can be used.

 Cooling water connections: Glass thread GL 14 complete with threaded hose connection GL 14

For withdrawal of the specific light phase

These column heads are suitable for density ratios from light to heavy phase of 0.60 : 1 up to 0.95 : 1.

H	L	NS	NS1	SPV	Catalogue No.
340	120	29/32	14/23	3	SAA 09096 01
455	150	45/40	14/23	6	SAA 09096 02

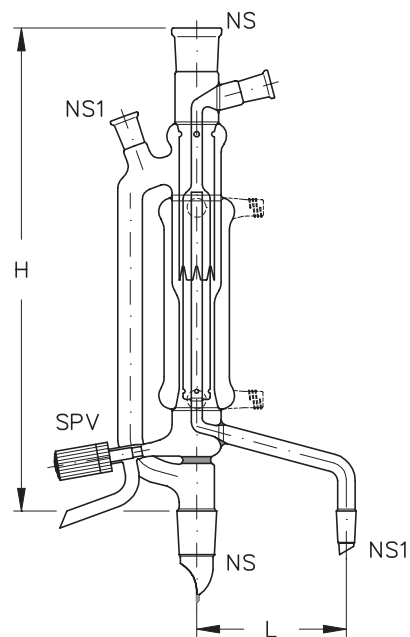


All ground joints are also available in other standard sizes, e.g. US-standard.

For withdrawal of the specific heavy phase

These column heads are suitable for density ratios from heavy to light phase of 1.60 : 1 up to 1.05 : 1.

H	L	NS	NS1	SPV	Catalogue No.
360	120	29/32	14/23	3	SAA 09097 01
475	150	45/40	14/23	6	SAA 09097 02



All ground joints are also available in other standard sizes, e.g. US-standard.

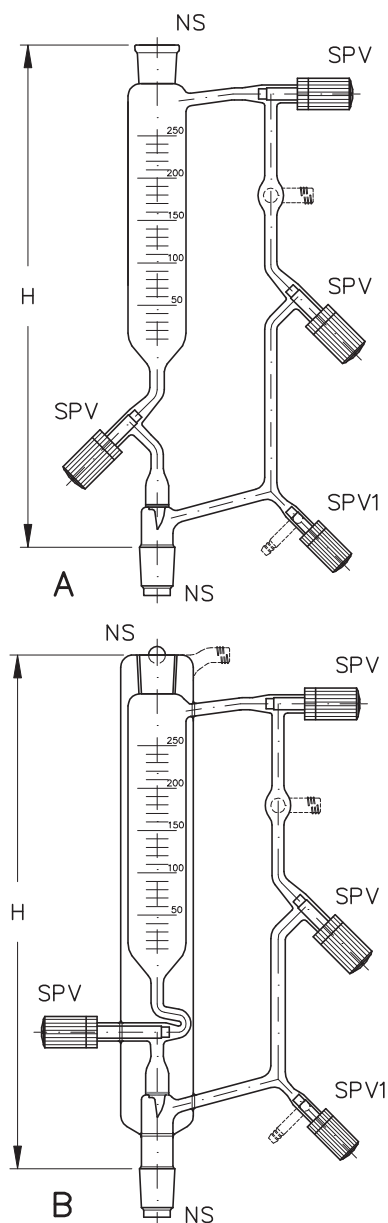
ANSCHÜTZ-THIELE-RECEIVER

The use of this special graduated receiver with vacuum frame, is recommended when the throughput is to be measured at certain time intervals in continuously working distillation columns under vacuum. A spherical or cylindrical vessel is connected afterwards.

With spindle valves

This variant is fitted with tempering jacket in design B. Both designs are delivered with adjustable spindle valves.

Capacity (ml)	H	NS	SPV	SPV1	Design	Catalogue No.
50	300	29/32	6	3	A	SAA 09207 02
50	310	29/32	6	3	B	SAA 09208 62
100	355	29/32	6	3	A	SAA 09207 03
100	365	29/32	6	3	B	SAA 09208 63
250	415	29/32	6	3	A	SAA 09207 04
250	425	29/32	6	3	B	SAA 09208 64
500	470	29/32	6	3	A	SAA 09207 05
500	480	29/32	6	3	B	SAA 09208 65
1000	580	29/32	10	6	A	SAA 09207 06
1000	565	29/32	10	6	B	SAA 09208 66
2000	700	29/32	10	6	A	SAA 09207 07
2000	690	29/32	10	6	B	SAA 09208 67

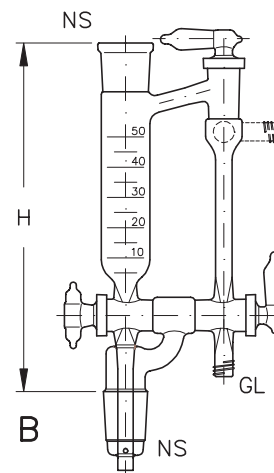
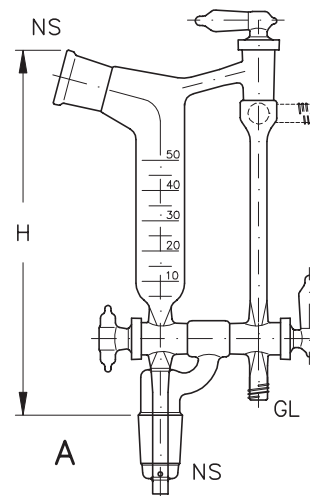


All ground joints are also available in other standard sizes, e.g. US-standard.

With standard stopcocks

This variant is available in two different designs and is fitted with standard stopcocks with bore 4 mm.

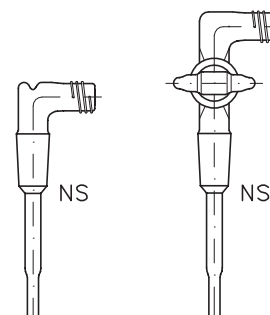
Capacity (ml)	H	NS	Stopcock	Design	Catalogue No.
50	240	29/32	4 NS	A	GSG 01094A
25	-	14/23	4 NS	A	GSG 01094B
50	230	29/32	4 NS	B	GSG 01094C
25	-	14/23	4 NS	B	GSG 01094D



All ground joints are also available in other standard sizes, e.g. US-standard.

BOILING CAPILLARIES

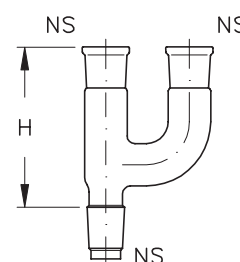
NS	Stopcock bore	Connection	Catalogue No.
10/19	-	Thread GL 14	GSG 01052
10/19	1	Olive D 8	GSG 01053
14/23	-	Thread GL 14	GSG 01057
14/23	3	Thread GL 14	GSG 01058



ADAPTER / HEADS

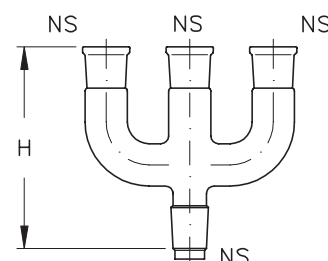
Multiple adapter, two necks

H	NS	Catalogue No.
95	14/23	GSG 01060B
125	29/32	GSG 01060A



Multiple adapter, three necks

H	NS	Catalogue No.
95	14/23	GSG 01061B
125	29/32	GSG 01061A

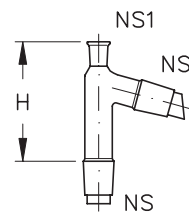


All ground joints are also available in other standard sizes, e.g. US-standard.

Distilling heads

 The temperature measuring connections are also available as GL 18 thread.

H	NS	NS1	Catalogue No.
95	14/23	14/23	GSG 01040A
110	29/32	14/23	GSG 01040

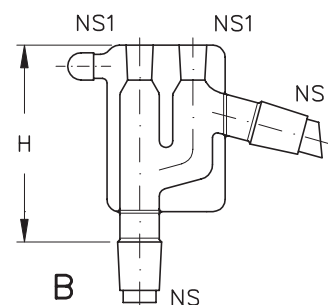
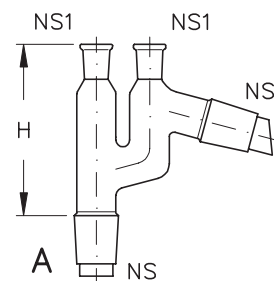


Claisen heads

Design B is fitted with a high vacuum jacket.

 The temperature measuring connections are also available as GL 18 thread.

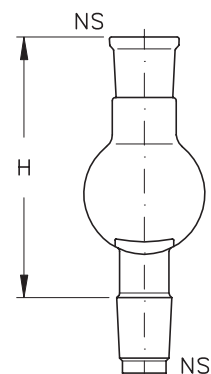
H	NS	NS1	Design	Catalogue No.
95	14/23	14/23	A	GSG 01055B
95	14/23	14/23	B	GSG 01056
110	29/32	14/23	A	GSG 01055A
110	29/32	14/23	B	GSG 01056A



Splash protection head

These heads are employed in rotation evaporators and can be used as splash protection and/or as bubble inhibitor.

H	NS	Catalogue No.
140	29/32	GSG 01054




All ground joints are also available in other standard sizes, e.g. US-standard.

LINKS

Distilling links

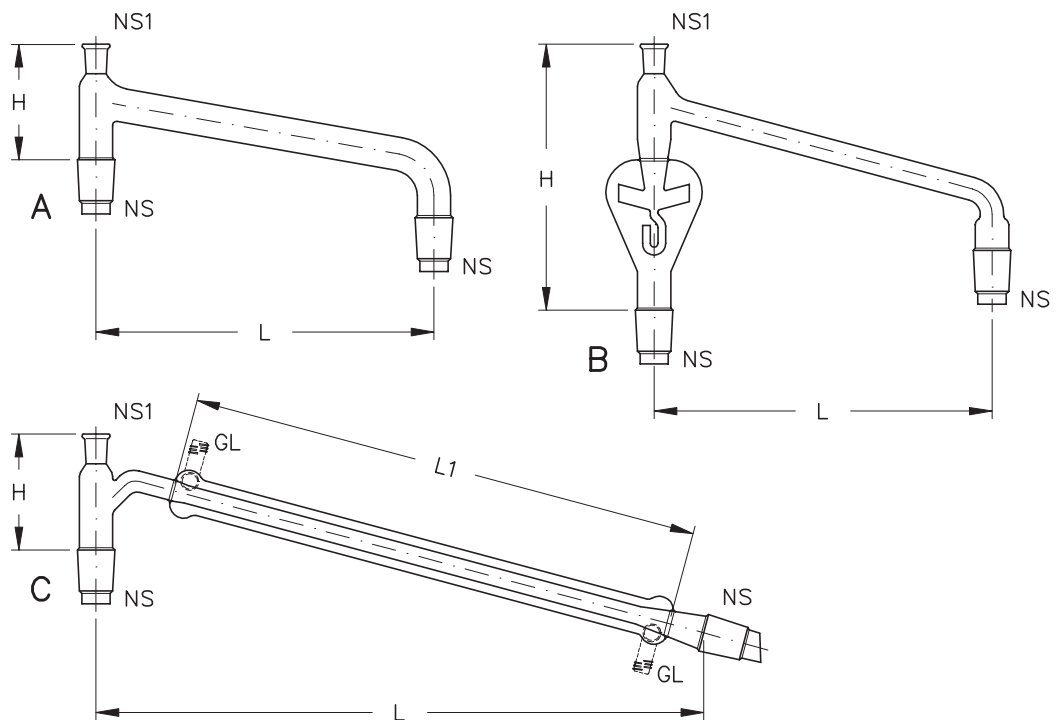
Distilling links are a special variant of connecting pieces for simple distillations. Its use is especially recommended for vacuum distillations since it reduces the number of connections.

Other jacket lengths are available on request.

 The installation length of the thermometer in distilling links is 70 mm.

The temperature measuring connections are also available as GL 18 thread.

H	L	L1	NS	NS1	GL	Des.	Catalogue No.
90	240	-	29/32	14/23	-	A	GSG 01044
160	240	-	29/32	14/23	-	B	GSG 01046
85	295	250	29/32	14/23	14	C	GSG 01077A
90	445	400	29/32	14/23	14	C	GSG 01077B



All ground joints are also available in other standard sizes, e.g. US-standard.

Claisen links

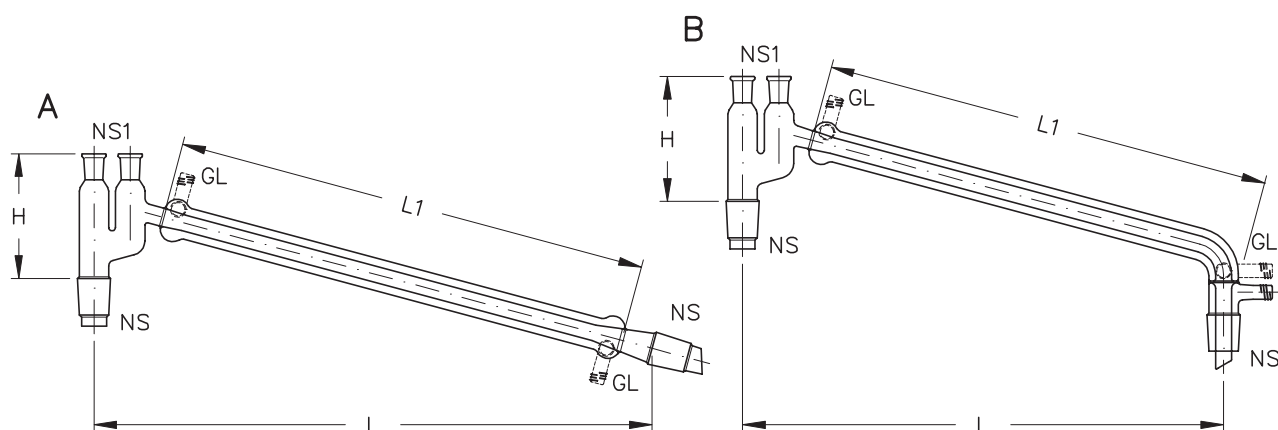
Claisen links are a special variant of connecting pieces for simple distillations. However, they are an advanced variant of the distilling links with an additional socket NS 14/23. Other jacket lengths are available on request.

☞ In design B, the length L1 is the stretched length of the tempering jacket.

The installation length of the thermometer in claisen links is 70 mm.

The temperature measuring connections are also available as GL 18 thread.

H	L	L1	NS	NS1	GL	Des.	Catalogue No.
100	310	250	29/32	14/23	14	A	GSG 01078A
110	460	400	29/32	14/23	14	A	GSG 01078B
100	170	150	14/23	14/23	14	B	LSG 11053 01
100	270	250	29/32	14/23	14	B	LSG 11053 02
100	430	400	29/32	14/23	14	B	LSG 11050



All ground joints are also available in other standard sizes, e.g. US-standard.

Short path claisen links

Claisen links, with sealed vacuum arm, are mechanically very stable. The condenser is stretched up to the dropping lip of the condensate drain joint. An optimal distillate cooling is reached and considerably increased through the inner cooling tube (the cooling efficiency of the condenser can be compared with a jacketed reflux condenser). The condensate drains without touching the joint grease. The vacuum arm is in such a way assembled that no condensate can run into the vacuum tube.

This type of link is also very suitable for light crystallising substances since the cooling temperature can be so controlled with a circulating thermostat that the condensate is kept liquid until the draining into the receiver.

Another feature of this construction is that both cooling water connections are located at the link rim and so they cannot get in touch with the heating.

Other jacket lengths are available on request.

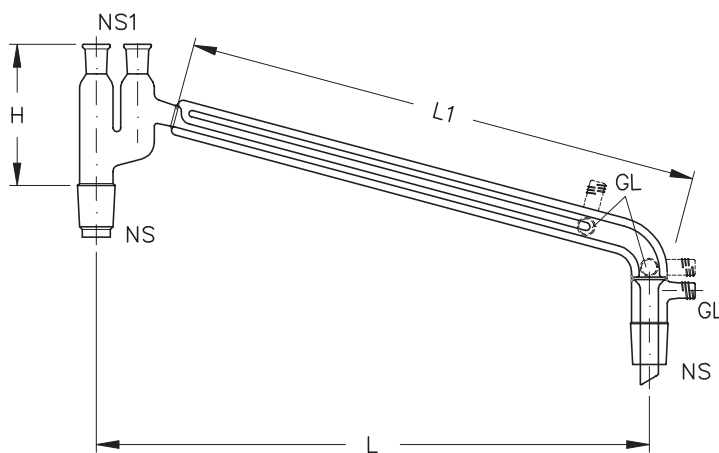
 Short path Claisen links have a double ventilation.

The length L1 is the stretched length of the tempering jacket.

The installation length of the thermometer is 70 mm.

The temperature measuring connections are also available as GL 18.

H	L	L1	NS	NS1	GL	Catalogue No.
100	235	250	29/32	14/23	14	SAA 11010
110	405	400	29/32	14/23	14	SAA 11011



All ground joints are also available in other standard sizes, e.g. US-standard.

Claisen links, with sealed vacuum arm

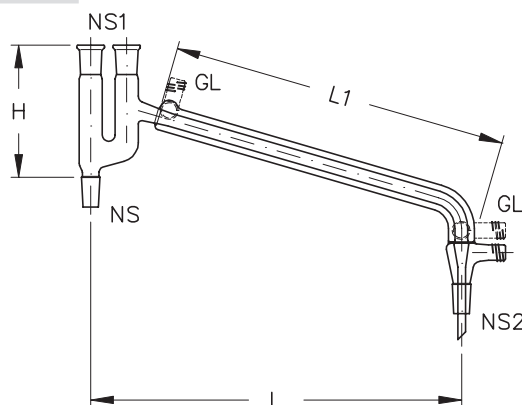
 This Claisen link suits for the manifold receiver on page 7.32.

The installation length is 70 mm.

The length L1 is the length of the tempering jacket.

The temperature measuring connections are also available with glass thread GL 18.

H	L	L1	NS	NS1	NS2	GL	Catalogue No.
100	170	150	14/23	14/23	14/23	14	LSG 11075 01
100	270	250	14/23	14/23	14/23	14	LSG 11075 02
100	170	150	19/26	14/23	14/23	14	LSG 11075A 01
100	270	250	19/26	14/23	29/32	14	LSG 11075A 02

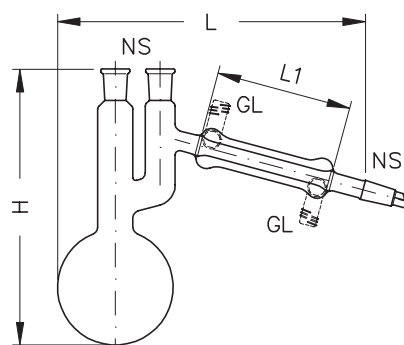


Special Claisen flasks

Our special Claisen link performed very well in vacuum distillations of high boiling liquids. The flask can be immersed up to the cooling tube connection into the heating bath. The wide neck eases considerably the vapour path.

 The temperature measuring connections are also available as GL 18 threads.

H	L	L1	NS	GL	Catalogue No.
145	175	50	14/23	14	SAA 08230 01
160	175	100	14/23	14	SAA 08230 02
180	175	250	14/23	14	SAA 08230 03



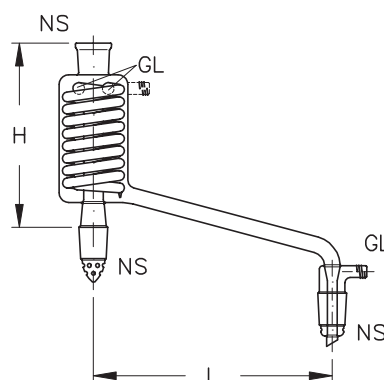
Distillation condenser

These condensers are an advanced variant of the distilling links mentioned above. They are fitted with an additional splash protection head and a descending condenser. The mounting is without a frame.

A certain fractionating can be reached through the inner tube which is filled with Raschig rings. The special assembly of the condenser coil avoids any vapour hold up and the herewith connected loss of pressure. The sealed vacuum arm provides the facility to connect a receiver flask without additional devices.

 The temperature measuring connections are also available as GL 18 thread.

H	L	NS	GL	Thermometer- installation length	Catalogue No.
160	185	14/23	14	70	SAA 08340 01
180	235	29/32	14	80	SAA 08340 02



All ground joints are also available in other standard sizes, e.g. US-standard.

Micro distillation apparatus

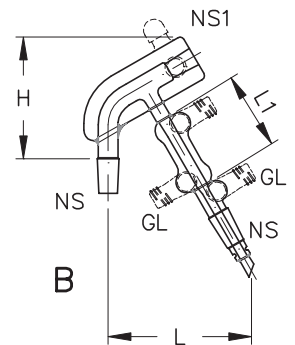
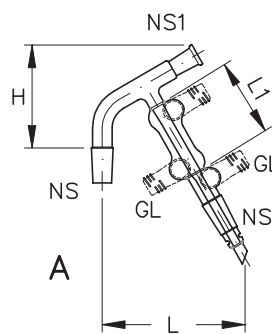
These micro distillation apparatus has a sealed vacuum connection.
The installation length of the thermometer is 50 mm.

Design B is additionally fitted with silver coated insulating jacket (10^{-6} mbar).



The temperature connections are also available with glass thread GL 18.

H	L	L1	NS	NS1	GL	Design	Catalogue No.
70	95	50	14/23	10/19	14	A	LSG 01088
85	95	50	14/23	10/19	14	B	LSG 01089

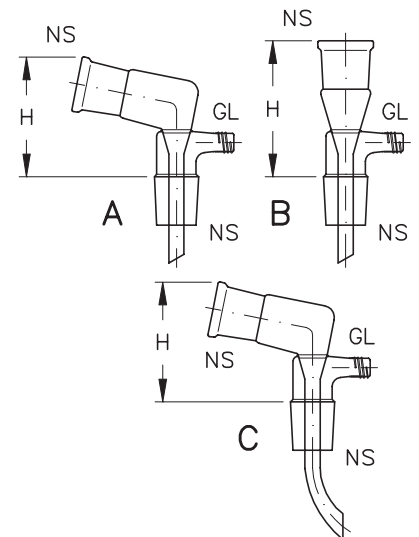


RECEIVER ADAPTER FOR VACUUM



The receiver adapter for vacuum in design C can only be used in manifold distributors in standard design. Due to the bent outlet tube, the draining fraction can be directed in one of the four receivers by turning of the receiver adapter.

H	NS	GL	Design	Catalogue No.
70	14/23	14	A	GSG 01064B
75	14/23	14	B	GSG 01064D
70	14/23	14	C	GSG 01095G
80	29/32	14	A	GSG 01064A
90	29/32	14	B	GSG 01064C
80	29/32	14	C	GSG 01095D

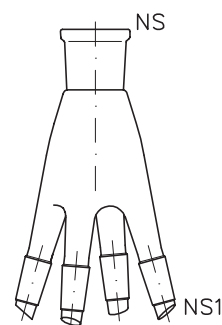


All ground joints are also available in other standard sizes, e.g. US-standard.

MANIFOLD DISTRIBUTOR

Standard design

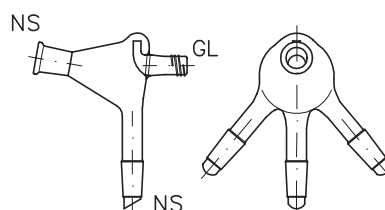
NS	NS1	Catalogue No.
14/23	14/23	GSG 01095F
29/32	14/23	GSG 01095C



Model "Konstanz"

This design can directly be fitted at a Liebig condenser with skirted cone.

NS	GL	Catalogue No.
14/23	14	GSG 01099

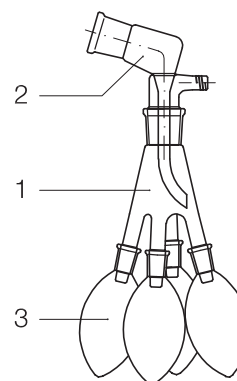


VACUUM RECEIVER ACCORDING TO BREDT

Description	Design	Catalogue No.
Vacuum Receiver acc. to Bredt (complete)	A	GSG 01095a
Vacuum Receiver acc. to Bredt (complete)	B	GSG 01095b

Delivery

Part No.	Qty.	Description	Catalogue No. Design A	Catalogue No. Design B
1	1	Manifold distributor NS 29/32 and 4 x NS 14/23	GSG 01095c	-
1	1	Manifold distributor NS 14/23 and 4 x NS 14/23	-	GSG 01095f
2	1	Receiver adapter 2 x NS 29/32 and GL 14	GSG 01095d	-
2	1	Receiver adapter 2 x NS 14/23 and GL 14	-	GSG 01095g
3	4	Receiver flask NS 14/23 - 100 ml	KOK 01022 05	-
3	4	Receiver flask NS 14/23 - 50 ml	-	KOK 01022 04



All ground joints are also available in other standard sizes, e.g. US-standard.

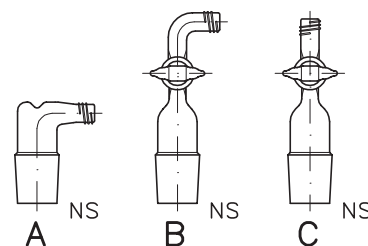
GROUND JOINTS, BENT

All bent ground joints are fitted with glass thread GL 14 but can also be delivered with olive D 11.

Design B and C are fitted with a standard stopcock with bore 3 mm.

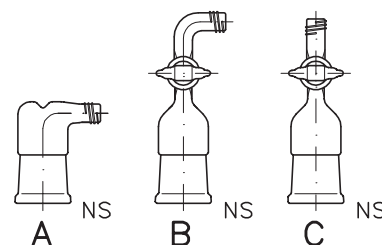
with standard ground joint cone

NS	Design	Catalogue No.
14/23	A	GSG 01080 01
29/32	A	GSG 01080 03
45/40	A	GSG 01080 04
14/23	B	GSG 01081 01
29/32	B	GSG 01081 03
45/40	B	GSG 01081 04
14/23	C	GSG 01085 01
29/32	C	GSG 01085 03
45/40	C	GSG 01085 04



with standard ground joint socket


NS	Design	Catalogue No.
14/23	A	GSG 01082 01
29/32	A	GSG 01082 03
45/40	A	GSG 01082 04
14/23	B	GSG 01083 01
29/32	B	GSG 01083 03
45/40	B	GSG 01083 04
14/23	C	GSG 01086 01
29/32	C	GSG 01086 03
45/40	C	GSG 01086 04



All ground joints are also available in other standard sizes, e.g. US-standard.

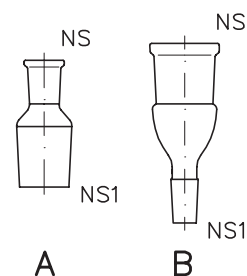
ADAPTER

These component parts are manufactured in short form, so a low construction length can be reached.

 All spherical ground joint cups at the adapters are also available in mm-size.

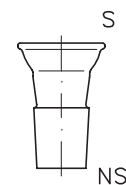
Socket / cone

NS	NS1	Design	Catalogue No.
14/23	29/32	A	GSG 01016 02
29/32	45/40	A	GSG 01016 04
29/32	60/46	A	GSG 01016 05
29/32	14/23	B	GSG 01017 02
45/40	29/32	B	GSG 01017 04
60/46	45/40	B	GSG 01017 05



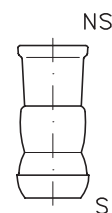
Cup / cone

S	NS	Catalogue No.
19	14/23	GSG 07010D 01
19	29/32	GSG 07010D 03
35	29/32	GSG 07010D 04
40	29/32	GSG 07010D 05
51	29/32	GSG 07010D 06
64	45/40	GSG 07010D 07



Socket / ball

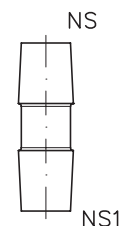
NS	S	Catalogue No.
14/23	19	GSG 07016D 01
29/32	35	GSG 07016D 03
29/32	40	GSG 07016D 04
29/32	51	GSG 07016D 05
29/32	64	GSG 07016D 06
45/40	64	GSG 07016D 07



All ground joints are also available in other standard sizes, e.g. US-standard.

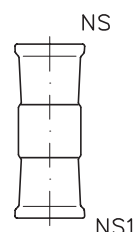
Cone / cone

NS	NS1	Catalogue No.
14/23	14/23	GSG 01015K 01
29/32	29/32	GSG 01015K 03
14/23	29/32	GSG 01015K 05



Socket / socket

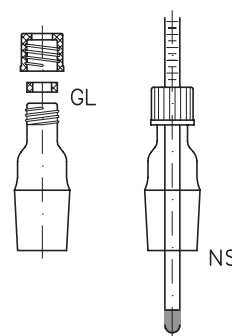
NS	NS1	Catalogue No.
14/23	14/23	GSG 01015H 01
29/32	29/32	GSG 01015H 03
14/23	29/32	GSG 01015H 05



CONNECTIONS, GROUND WITH SCREW CAP

Thermometers without ground joint and diameters from 6.8 to 12.3 mm can be assembled at apparatus with screw threads. The seal is part of delivery.

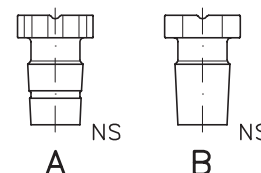
Span tolerance (mm)	Screw thread	NS	Catalogue No.
6.8 – 7.3	GL 14	14/23	VBS 01014 01
6.8 – 7.3	GL 14	19/26	VBS 01014 02
6.8 – 7.3	GL 14	29/32	VBS 01014 03
8.8 – 9.3	GL 18	29/32	VBS 01014 04
8.8 – 9.3	GL 25	29/32	VBS 01014 05
11.8 – 12.3	GL 25	29/32	VBS 01014 06



Conical ground joint hollow plugs

These hollow plugs have a flat bottom and are fitted with safety groove.

NS	Catalogue No. Design A with groove	Catalogue No. Design B without groove
7/16	-	GSG 01014 01
10/19	-	GSG 01014 02
12/21	-	GSG 01014 03
14/23	GSG 01013 04	GSG 01014 04
19/26	GSG 01013 06	GSG 01014 06
29/32	GSG 01013 08	GSG 01014 08
45/40	GSG 01013 09	GSG 01014 09




All ground joints are also available in other standard sizes, e.g. US-standard.

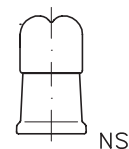
CAPS

 All spherical ground ball joints are also available in mm-size.

with conical ground joint socket

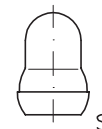
 These caps have a safety groove.

NS	Catalogue No.
14/23	GSG 01084 01
19/26	GSG 01084 02
29/32	GSG 01084 03
45/40	GSG 01084 04



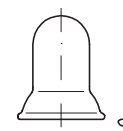
with spherical ground joint ball

S	Catalogue No.
13	GSG 07033D 01
19	GSG 07033D 02
29	GSG 07033D 03
35	GSG 07033D 04
40	GSG 07033D 05
51	GSG 07033D 06
64	GSG 07033D 07



with spherical ground joint cup

S	Catalogue No.
13	GSG 07034D 01
19	GSG 07034D 02
29	GSG 07034D 03
35	GSG 07034D 04
40	GSG 07034D 05
51	GSG 07034D 06
64	GSG 07034D 07



All ground joints are also available in other standard sizes, e.g. US-standard.