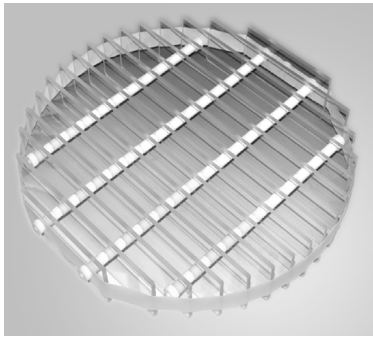


GENERAL INFORMATION

For columns and their fixtures, the separation capacity and the hydraulic properties as well as their general suitability for the respective process conditions such as chemical resistance, application (rectification, absorption/ desorption, extraction, etc.) or GMP standards are in general the most important requirements.

NORMAG offers a variety of individually adapted high-quality solutions for this that cover these issues and can be used in an optimally coordinated manner. Examples of this are displayed for typical installations and column sections in the following three images.



packing support
ACSG...



nozzle distributor
ACDN...-P

Our entire selection of standard offered prefabricated parts and components is described on the following pages. For better clarity, you will find an overview page, Table 8.1, with the selectable column components on the following page.

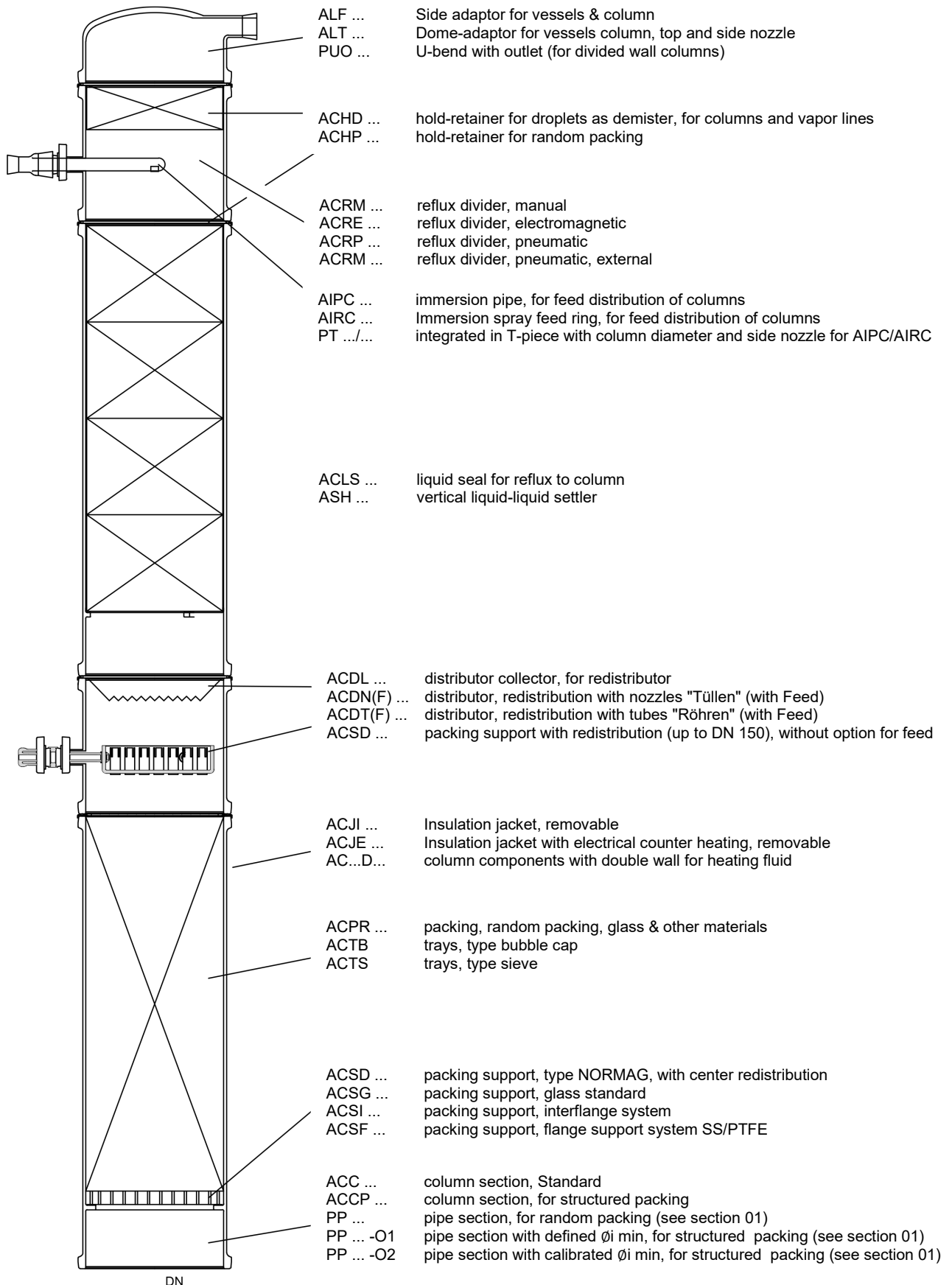
For pharmaceutical applications, GMP-compliant installations using the inert materials borosilicate 3.3 combined with FDA-certified materials such as PTFE are possible. The minimum dead space construction boasts countless pieces of apparatus, such as redistributors in standard design, which are designed so as to guarantee draining and simple and effective cleaning. These can also be adapted according to requirements. Furthermore, the use of the material borosilicate glass 3.3 avoids the buildup of deposits in areas that come into contact with the product, and it is also possible to provide components whose external design is suitable for clean room conditions.

Numerous options and special designs are available and are mentioned alongside the respective product description. Column sections and accessories made of and for other materials (steel / enamel, stainless steel, Hastelloy, etc.) are also available on request.

The permissible operating conditions as well as numerous relevant information on topics such as coatings are listed in Chapter 10 "Technical Information". This chapter must be observed in connection with the components listed here.

Upon request, and on provision of the necessary data, we would be pleased to present you with a selection of apparatus along with the calculations. To do so, please send us a completed copy of the questionnaire that can be found at the end of the chapter, or contact our experienced engineers directly.

Figure 8.1: Typical construction of a column with an overview of the possible column components



COLUMN SECTIONS

STANDARD COLUMN SECTIONS

Column sections are available in standard design ACC and in numerous special versions.

The standard variant ACC is composed of the column section itself, a support ring made of PTFE and a support grate. The elements can also be ordered individually according to the options listed below.

Column sections are available in lengths from 1,000 mm to 2,000 mm, depending on the nominal width, optionally with sockets for temperature measurement or for accommodating a re-distributor floor. The packing support and the support of the column section itself are suitable for packing with the specified minimum dimensions, the permissible load capacity of the support rings and packing supports is dimensioned for liquid densities of at least 1,800 kg / m³ when using glass fillers.

For the use of one- or two-piece structured packings, the column section can be used without packing support and thus by approx. 20% greater free cross-section; in general, column sections with a tolerated minimum inside diameter (option O1) are to be used for structured packings. Optionally, for structured packings with very high fluid loads, the column section, type ACCP described below, with specially increased free cross-section can be used.

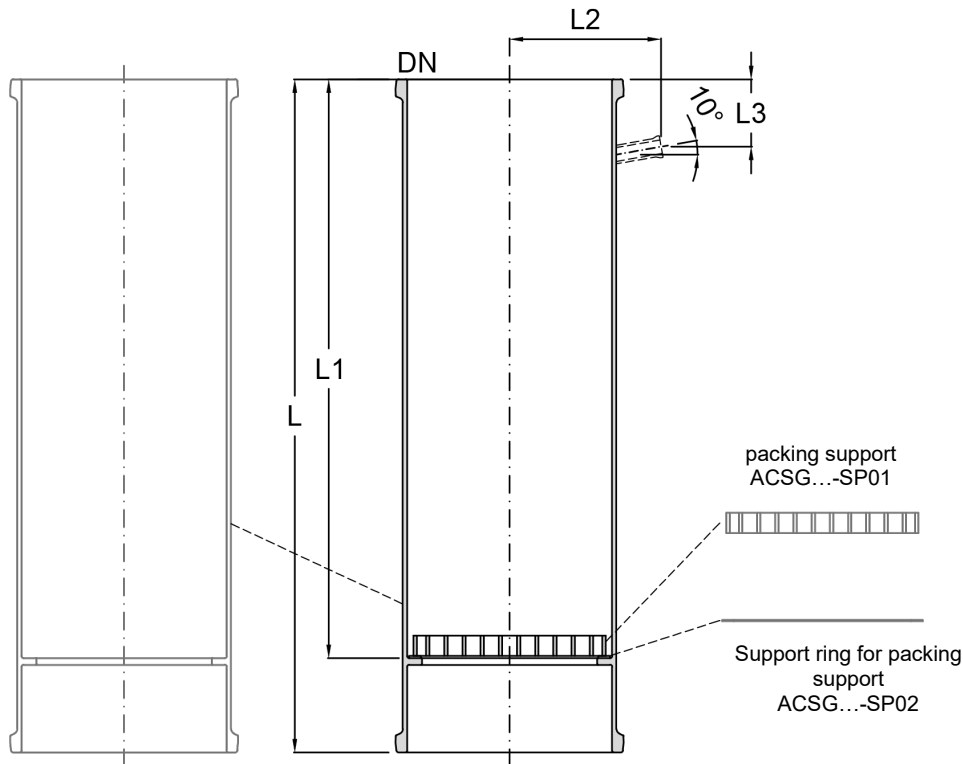
At the end of the chapter, you will find a list of available options relating to column sections. Examples are:

Description:	Item no.	Example
Column section, complete, PF system, up to DN 150:	ACC....-P	ACC 150/1500-P
Column section, complete, from DN 200:	ACC....	ACC 200/1500
Column section, complete, with temperature nozzle:	ACCT....-P	ACCT 300/1500-P
Column section, complete, with redistributor & temp. nozzles ¹⁾ :	ACCV....-P	ACCV 300/1500-P
Column section, complete, with conductive coating:	ACC....-P-C3	ACC 300/1500-P-C3
Column section, complete, with 2.1 material certificate:	ACC....-P-Z2	ACC 300/1500-P-Z2
Column section, without packing support, up to DN 150:	ACC....-P-SP01	ACC 150/1500-P-SP01
Column section, without packing support, from DN 200:	ACC....-SP01	ACC 300/1500-SP01
Column section with tolerated minimum inner diameter ²⁾ :	ACC....-P-O1-SP01	ACC 300/1500-O1-SP01
Packing support for standard column section with PTFE ring :	ACSG....	ACSG 300
Packing support for standard column section without PTFE ring :	ACSG....-SP01	ACSG 300-SP01
Support ring for standard column section, PTFE white :	ACSG....-SP02	ACSG 300-SP02

1) Distributor dimensions, type ACDN, and related accessories, see p. 8.C.20.

Positioning of the nozzle for receiving finger according to distance from upper flange specified on p.8.C.20

2) Minimum inner diameter max. 1% or 2 mm for small column diameters smaller than the nominal diameter



Column section without packing support
ACC...-P-SP01

Column section with packing support
ACC...-P

DN	DN1	L	L1	L2	L3	load capacity	rec. size packings	free cross section	Item no.
		[mm]	[mm]	[mm]	[mm]	[N]	[mm]	[%]	
80	25	1.000	855	108	150	230	8	56%	ACC 080/1000-P
80	25	1.500	1.355	108	150	230	8	56%	ACC 080/1500-P
100	25	1.000	855	122	150	350	10	64%	ACC 100/1000-P
100	25	1.500	1.355	122	150	350	10	64%	ACC 100/1500-P
150	25	1.000	855	147	150	700	15	53%	ACC 150/1000-P
150	25	1.500	1.355	147	150	700	15	53%	ACC 150/1500-P
200	25	1.000	855	172	150	1.200	20	50%	ACC 200/1000
200	25	1.500	1.355	172	150	1.200	20	50%	ACC 200/1500
200	25	2.000	1.855	172	150	1.200	20	50%	ACC 200/2000
300	25	1.000	855	221	250	2.400	25	61%	ACC 300/1000
300	25	1.500	1.355	221	250	2.400	25	61%	ACC 300/1500
300	25	2.000	1.855	221	250	2.400	25	61%	ACC 300/2000
400	25	1.500	1.345	275	250	4.100	40	52%	ACC 400/1500
400	25	2.000	1.845	275	250	4.100	40	52%	ACC 400/2000
450	25	1.500	1.300	295	250	5.200	50	52%	ACC 450/1500
450	25	2.000	1.800	295	250	5.200	50	52%	ACC 450/2000
600	25	1.500	1.300	374	250	9.100	50	60%	ACC 600/1500
600	25	2.000	1.800	374	250	9.100	50	60%	ACC 600/2000

COLUMNS FOR STRUCTURED PACKING

For one-piece structured packings up to nominal diameter 150, column sections can be designed in the ACCP design, which has a significantly increased free cross-section. The packing rests on three support points around the circumference of the column.

Structured packings made of stainless steel are arranged directly on the three-point support with low stress and low force, while, for ceramic packings, a PTFE coating of the supports is additionally provided. The specified maximum load-bearing capacity must be observed, as well as the information on the minimum inside diameter according to note 3) for standard column sections.

A packing support is not required for the specified nominal widths.

Column sections with temperature sensor, type ACCPT, have the same nozzle connection dimensions as stated under standard column sections, while for column sections with distributor, type ACCPV, more detailed dimensions are available on request. The type ACCPV can optionally also be used for feed supply, combined with redistribution, for measuring nozzles and for sampling.

At the end of the chapter, you will find a list of available options relating to column sections. Examples are:

Description:

Column section for structured packings , PF system:

Column section, PF system, with temperature nozzle:

Column section, PF system, with nozzle distributor:

PTFE sheath three-point support ring, PTFE weiß:

Item no.

ACCP....-P

ACCPT....-P

ACCPV....-P

ACCP....-SP01

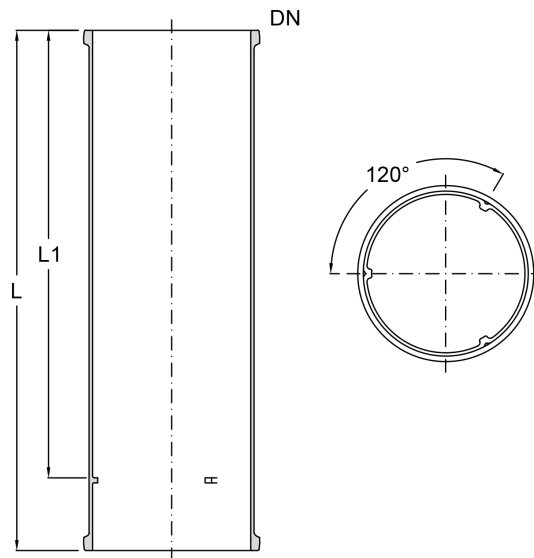
Example

ACCP 150/1500-P

ACCPT 150/1500-P

ACCPV 150/1500-P

ACCP 150-SP01



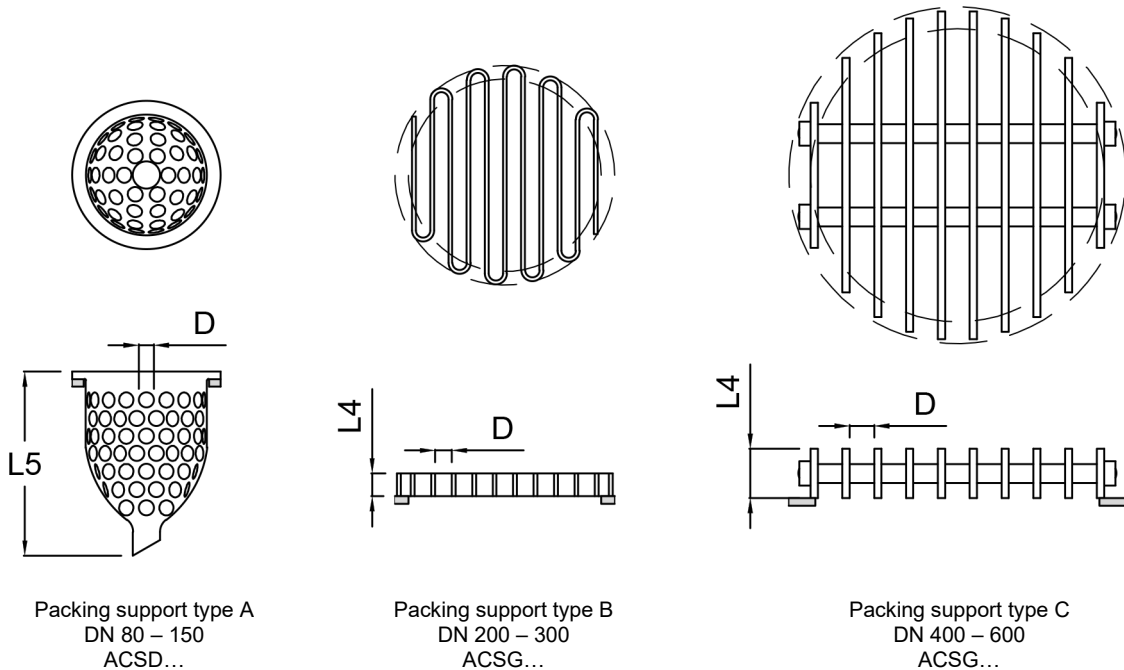
Kolumnenschuss für strukturierte Packungen
ACCP...-P

DN	DN1	L	L1	L2	L3	load capacity	free cross section	Item no.
		[mm]	[mm]	[mm]	[mm]	[N]	[%]	
80	25	1.500	1.400	108	91	230	90%	ACCP 080/1500-P
100	25	1.500	1.400	122	96	350	93%	ACCP 100/1500-P
150	25	1.500	1.400	122	96	700	95%	ACCP 150/1500-P

PACKING GRIDS, STANDARD

For the column sections, the following packing grids are used, for which there are three variants A, B and C, depending on the nominal diameter. The PTFE support ring ACSD ... -SP02 or ACSG ... -SP02 is part of the delivery.

Information on the free cross sections of the grids (this is reduced in the columns by the support ring to the free cross sections stated there) and their load carrying capacity with uniformly applied load and on the minimum size of the packings to be used, see the following table.



DN	Typ	n ¹⁾	L4	D	L5	load capacity		rec. size packing	A _{free}	Item no.
						[N]	load ²⁾ dry wet			
			[mm]	[mm]	[mm]	[N]	[N/m] [N/m]	[mm]	[%]	
80	A	110	5	7,5	115	230	31 36	8	100%	ACSD 080
100	A	110	5	9,5	135	350	42 49	10	100%	ACSD 100
150	A	160	5	12	155	700	68 85	15	100%	ACSD 150
200	B	9	30	17	-	1.200	86 117	20	78%	ACSG 200
300	B	10	30	22	-	2.400	187 257	25	82%	ACSG 300
400	C	8	65	33	-	4.100	197 321	40	77%	ACSG 400
450	C	10	65	33	-	5.200	218 375	40	77%	ACSG 450
600	C	14	90	33	-	9.100	388 666	40	77%	ACSG 600

1.) Number of bore holes (type A) or number of bridges (type B, C)

2.) Actual loading of the packing support when using Raschig glass minimum diameter packing in dry condition and with 10% wetting with liquid at 1,000 kg / m³.

COLUMNS WITH INTERMEDIATE FLANGE PACKING SUPPORT

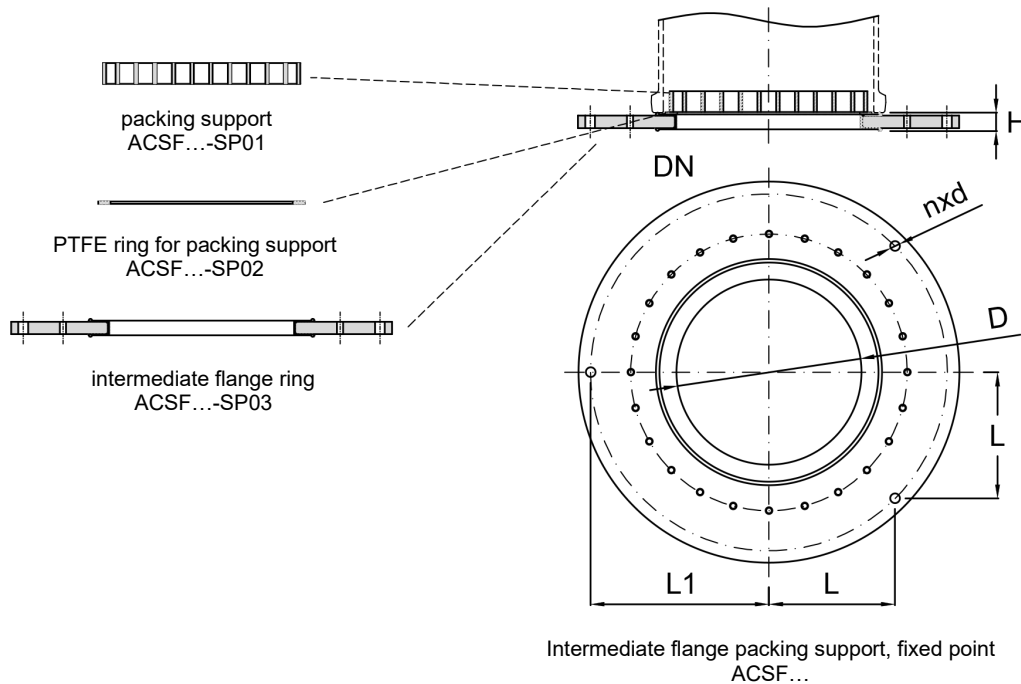
As an alternative to the standard column sections, standard pipe sections, type PP, can also be used for the construction of columns. In addition to this, an intermediate packing support is then to be used for receiving the filling bodies or packings.

The intermediate packing support is available as a pure intermediate flange, type ACSF (dimensions and specification on request), and as a support ring with fixed point support of the column, type ACSF .

The mounting of type ACSF on the structure can be made analogously to chapter 9.12 for lower support rings.

Description:

Description:	Item no.	Example
Pipe section, PF system, for random packing:	PP....-P	PP 150/1500-P
Pipe section, PF system, for random packing, with temp. nozzle:	PPT....-P	PPT 150/1500-P
Pipe section, PF system, with $\varnothing_{i\ min}$ for structured packing:	PP....-P-O1	PP 150/1500-P-O1
Pipe section, PF system, with $\varnothing_{i\ min}$, with temp. nozzle:	PPT....-P-O1	PPT 150/1500-P-O1
Intermediate flange packing support, fixed point, complete:	ACSF....	ACSF 300
Intermediate flange packing support, fixed point, PF system:	ACSF....-SP03	ACSF 300-SP03



DN1	Typ	H	D [mm]	nxd [mm]	L [mm]	L1 [mm]	Item no.
80	A	15	62	3 x Ø9	80	125	ACSF 080-P
100	A	15	76	3 x Ø11	95	135	ACSF 100-P
150	A	15	118	3 x Ø11	125	165	ACSF 150-P
200	B	25	168	3 x Ø11	155	190	ACSF 200
300	B	25	267	3 x Ø14	200	245	ACSF 300
400	C	25	357	3 x Ø14	275	298	ACSF 400
450	C	25	380	3 x Ø14	300	340	ACSF 450
600	C	35	520	3 x Ø18	375	400	ACSF 600

RANDOM PACKINGS, STRUCTURED PACKINGS AND TRAYS FOR COLUMNS

RANDOM PACKINGS

For many column applications, random packings are used that cost-effectively cover a wide range of applications. Especially for corrosion-resistant applications, Raschig rings made of glass are used, which are hydrophilic and can therefore be used very well, especially also for aqueous systems

The permissible height of the bed is limited by the load-carrying capacity of the support rings of column sections, see information in the table on the packing support.



In addition to the Raschig rings made of glass listed here, we also supply random packing made of other materials, geometries and dimensions, depending on the application. We would be glad to prepare their selection and the design of the columns for you; some options are listed below.

Description:	Item no.	Example
Raschig rings, lime glass:	ACPR ...-O20	ACPR 25-O20
Raschig rings with internal structure, glass:	ACPR ...-O21	ACPR 25-O21
Pall rings, stainless steel:	ACPR ...-O31	ACPR 25-O31
Pall rings, PVDF:	ACPR ...-O32	ACPR 25-O32
Pall rings, PP:	ACPR ...-O33	ACPR 25-O33
Intalox saddles, ceramics:	ACPR ...-O41	ACPR 25-O41

D x L	type	spec. weight dry [kg/m ³]	spec. surface		free volume [%]	Item no.	
			1) [m ² /m ³]	2) [m ² /m ³]		Raschig, Boro 3.3 Standard	w. intern. structure
8 x 8	A	620	630	-	70%	ACPR 08	-
10 x 10	A	540	581	-	75%	ACPR 10	-
15 x 15	A	390	392	-	82%	ACPR 15	-
20 x 20	A	280	262	390	87%	ACPR 20	ACPR 20-O21
25 x 25	A	270	184	270	87%	ACPR 25	ACPR 25-O21
30 x 30	A	200	131	200	87%	ACPR 30	ACPR 30-O21
40 x 40	A	160	93	150	92%	ACPR 40	ACPR 40-O21
50 x 50	A	140	83	140	93%	ACPR 50	ACPR 50-O21

Specific surface 1) as standard and 2) with internal structure

COLUMNS WITH BUBBLE CAPS OR SIEVE TRAYS

Tray columns are commonly used in thermal column separation processes where good separation efficiency and throughput is required with simultaneous high gas loading area or hold-up. Tray columns are available in two different versions, namely with bubble caps and sieve trays.

As materials, either a stainless steel version or a corrosion-resistant version made of the material combination borosilicate glass 3.3, PTFE, tantalum and SiC can be selected.

The column sections each consist of borosilicate glass 3.3 with defined inner diameter of the type PP ...-P-O1 or with calibrated inner diameter of the type PP ...-P-O2. A special PTFE lip seal seals the respective column bottom towards the column. Spacer rods are used with the appropriate distance from the ground and also allow a complete drawing or inserting of the tray package. The bottom tray is designed as an intermediate flange and fixes the position at the column section. Optionally, the intermediate tray can be designed with support points as a fixed point of the columns. Dimensions for the connection points of the support and the additional construction height of the intermediate plate can be found in this chapter for the article ACSF with corresponding connection dimensions.

The NORMAG bubble caps are characterized in particular by their scale-up capability of small diameters, based on comprehensively available data from cooperations with major European chemical companies. The particular advantage is the reproducible efficiency factor, achieved by the design and the high precision, which is virtually constant over a wide load range.

Further information on the column sections with bubble caps such as, e.g., their areas of application, operating range, flooding point and pressure drop can be found on our website or can be obtained from our experts.

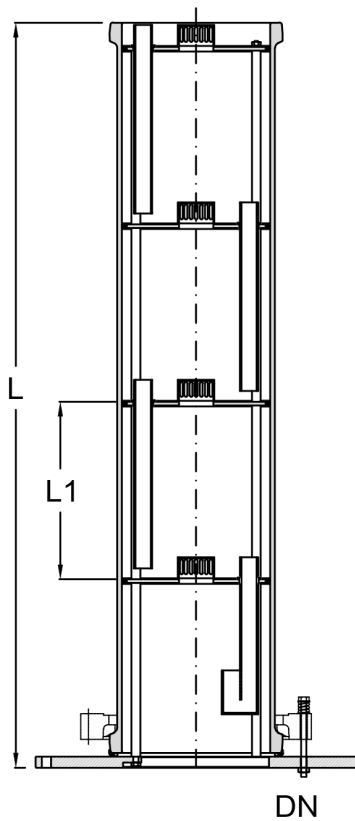
At the end of the chapter, you will find a list of available options relating to bubble caps and sieve trays. Examples are:

Description:	Item no.	Example
Bubble cap column, complete, stainless steel internals ¹⁾ :	ACTB...	ACTB 300/1000
Sieve tray column, complete, stainless steel internals ¹⁾ :	ACTS...	ACTS 300/1000
Bubble cap column, complete, corrosion resistant internals ²⁾ :	ACTB...-O3	ACTB 300/1000-O3
Sieve tray column, complete, corrosion resistant internals ²⁾ :	ACTS...-O3	ACTS 300/1000-O3
Bubble cap column, complete, with conductive coating :	ACTB...-C3	ACTB 300/1000-C3
Pipe section, with minimum inner diameter:	PP....-O1	PP 300/1000-O1
Pipe section, with inner diameter calibrated:	PP....-O2	PP 300/1000-O2

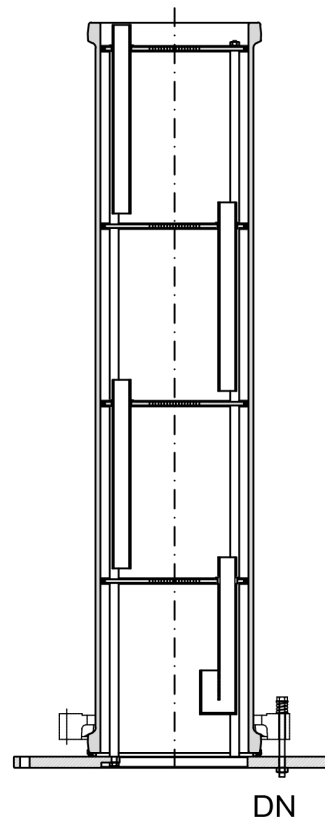
1) Stainless steel trays, 1.4571, with PTFE wall wiper. Optionally other materials on request

2) Corrosion-resistant trays made of Boro 3.3, with PTFE wall wiper and spacer bars made of glass, PTFE and tantalum.

Optionally other materials on request



Bubble cap column



Sieve tray column

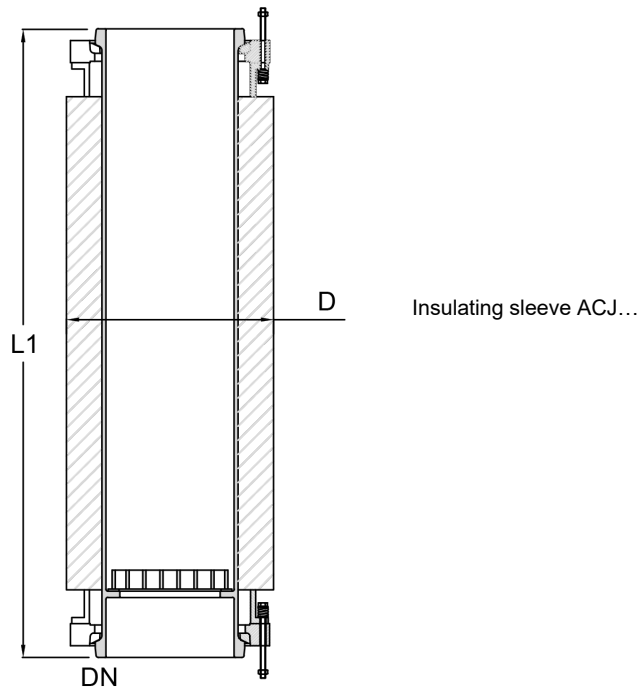
DN	L ¹⁾	H	number trays	bubble caps / holes/tray	bubble caps / holes/tray	Item no.	
	[mm]					[mm]	[-]
100	1.015	200	5	1	13 x Ø4	ACTB 100-P	ACTS 100-P
150	1.015	200	5	1	20 x Ø4	ACTB 150-P	ACTS 150-P
200	1.025	200	5	2	37 x Ø4	ACTB 200	ACTS 200
300	1.025	250	4	5	74 x Ø4	ACTB 300	ACTS 300
400	1.525	300	6	8	126 x Ø4	ACTB 400	ACTS 400
450	1.525	300	6	13	171 x Ø4	ACTB 450	ACTS 450
600	1.535	375	5	24	295 x Ø4	ACTB 600	ACTS 600

INSULATING SLEEVES, WITHOUT AND WITH ELECTRIC HEATING

For the column sections, it can be necessary - in order to minimize heat loss - especially at higher operating temperatures, in the lower vacuum range and for smaller diameters, to provide additional thermal insulation of the glass section, which basically is well insulating by itself.

For this purpose, there are insulating sleeves, type ACJI, which can be easily attached via Velcro fasteners and removed again and thus allow a view into the column section even during operation. An additional mounting option on the backing flange above ensures vertical fixation.

To further avoid heat loss insulating sleeves can be used with glass side electrical heating and temperature sensor. A separate control system controls the heater so that the temperature difference between the sheath and the product side is zero and thus no more heat losses occur.



Description:

Insulating sleeve , column section length 1.000 mm:

Item no.

ACJI...

Example

ACJI 300/1000

Insulating sleeve with electric heating, 1.000 mm ¹⁾:

ACJE...

ACJE 300/1000

Insulating sleeve with electric heating, 1.000 mm, ATEX T3-T6 ^{1,2)}:

ACJE...-O4

ACJE 300/1000-O4

DN	L [mm]	Q [W]	Item no. unheated	Item no. electrically heated ^{1,2)}
100	1.000	150	ACJI 100/1000-P	ACJE 100/1000-P
150	1.000	200	ACJI 150/1000-P	ACJE 150/1000-P
200	1.000	300	ACJI 200/1000	ACJE 200/1000
300	1.000	500	ACJI 300/1000	ACJE 300/1000
400	1.500	750	ACJI 400/1500	ACJE 400/1500
450	1.500	800	ACJI 450/1500	ACJE 450/1500
600	1.500	1.000	ACJI 600/1500	ACJE 600/1500

1) with double pt100 and 3 m length of mains / sensor cable, 230V, 50 Hz, 3-phase, protection class IP 64,

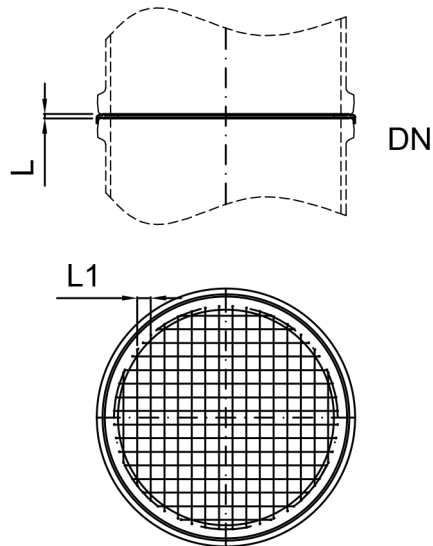
2) for ATEX applications intrinsically safe version, ATEX EX II 2G Ex e II T3 for EX zone 1 and 2,

PACKING RETAINER

Packing retainers are used above packed beds in order to protect reflux dividers or condensers against damage caused by spillage in the event of a fault. They consist of a PTFE sealing ring covered by tantalum wire.

Packing retainers are clamped directly into the connection and at the same time assume the function of a ring seal.

Use of the packing retainers as packing supports is not permitted.



Packing retainer ACHP ...

Description:

Packing retainer, PF system:

Packing retainer, conductive, with earthing lug, PF system:

Item no.

ACHP....-P

ACHP....-P-M2

Example

ACHP 080-P

ACHP 080-P-M2

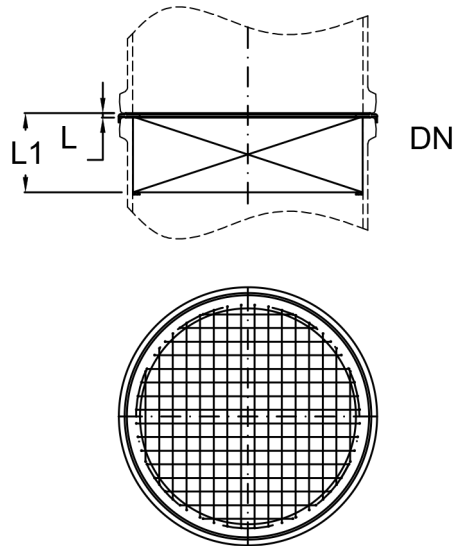
DN	L [mm]	L1 [mm]	free cross section [%]	Item no.
80	5	8	75	ACHP 080-P
100	5	10	85	ACHP 100-P
150	6	10	90	ACHP 150-P
200	6	18	90	ACHP 200
300	6	20	95	ACHP 300
400	7	20	95	ACHP 400
450	7	20	95	ACHP 450
600	7	30	95	ACHP 600

DEMISTER

Demisters are used at the top of the column above inlet pipes or reflux dividers to separate entrained drops from the downstream condenser or exhaust gas system. They consist of a PTFE sealing ring and a tantalum braided PFA / PTFE wire mesh.

Demisters are clamped directly into the connection and at the same time assume the function of a ring seal.

The ideal gas volume flow for the separation of the drops is stated in the table.



Demister ACHD ...-P

Description:

Demister, PF system:

Demister, conductive, with earthing lug, PF system:

Item no.

ACHD....-P

ACHD....-P-M2

Example

ACHD 080-P

ACHD 080-P-M2

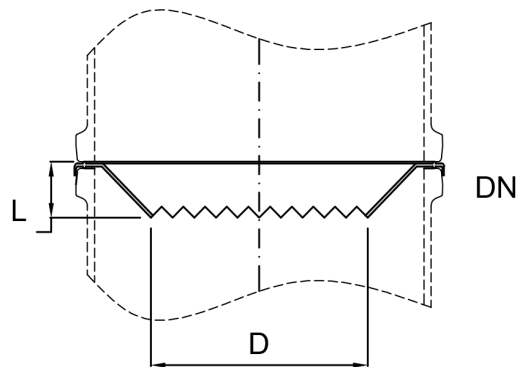
DN	L [mm]	L1 [mm]	ideal gas volume flow range [m³/h]	Item no.
80	5	55	4 – 22	ACHD 080-P
100	5	55	6 – 34	ACHD 100-P
150	6	81	13 - 76	ACHD 150-P
200	6	106	23 - 136	ACHD 200
300	6	106	51 - 305	ACHD 300
400	7	107	90 - 545	ACHD 400
450	7	107	115 - 685	ACHD 450
600	7	107	205 – 1.220	ACHD 600

GUIDE FUNNEL

Guide funnels are used in packed column sections to redirect liquid that runs down the column wall into the packing area. The distribution of liquid via the packing can be improved, for example, by a nozzle distributor as a redistributor below the guide funnel.

Guide funnels should be installed in cases of packed columns with several column sections at regular intervals, usually between two column sections.

The guide funnels are made of PTFE and at the same time take over the function of the gasket.



Leittrichter ACDL ...-P

Description:

guide funnels, PF system:

guide funnels, conductive, with earthing lug, PF system:

Item no.

ACDL...-P

ACDL...-P-M2

Example

ACDL 080-P

ACDL 080-P-M2

DN	L [mm]	D [mm]	free cross section [%]	Item no.
80	15	55	47	ACDL 080-P
100	15	70	49	ACDL 100-P
150	15	105	49	ACDL 150-P
200	25	140	49	ACDL 200
300	25	210	49	ACDL 300
400	35	280	49	ACDL 400
450	35	315	49	ACDL 450
600	35	420	49	ACDL 600

LIQUID DISTRIBUTORS

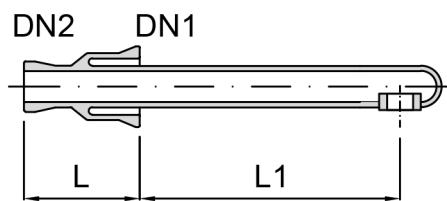
INLET PIPES, LIQUIDS

If the diameter and type of the column and the given volume flow permit a punctiform liquid feed, then inlet pipes can be used. Straight inlet pipes are used in addition to spray nozzles in extraction columns for feeding the phase to be dispersed and the continuous phase.

Wherever a punctiform deposit of the liquid on a column packing is permitted, angled inlet pipes can be used.

They are suitable for installation in reducing T-pieces (see chapter 1 "piping") or closing covers, but not for use with distributor trays.

The symbol "DN" in the tables below refers to the nominal diameter of the column component



Inlet pipe for columns, AIPC ...-P

Description:

Inlet pipe for columns, PF system:

Inlet pipe for columns, non-conductive coated:

Inlet pipe for columns, conductive coated :

Item no.

AIPC DN/DN1/DN2-P

AIPC DN/DN1/DN2-P-C1

AIPC DN/DN1/DN2-P-C3

Example

AIPC 300/040/025-P

AIPC 300/040/025-P-C1

AIPC 300/040/025-P-C3

DN	DN1	DN2	L	L1	D	Drip points/m ² [1/m ²]	V @ 1 m/s [m ³ /h]	B [m ³ /m ² h]	Item no.
			[mm]	[mm]	[mm]				
80	40	25	100	100	13,4	201	0,6	119	AIPC 080/040/025-P
100	40	25	100	125	13,4	127	0,6	77	AIPC 100/040/025-P
100	50	25	100	125	13,4	127	0,6	77	AIPC 100/050/025-P
150	40	25	100	150	13,4	57	0,6	134	AIPC 150/040/025-P
150	50	25	100	150	13,4	57	0,6	34	AIPC 150/050/025-P
200	40	25	100	175	13,4	32	0,6	19	AIPC 200/040/025-P
200	50	25	100	175	13,4	32	0,6	19	AIPC 200/050/025-P
300	40	25	100	225	13,4	14	0,6	9	AIPC 300/040/025-P
300	50	25	100	225	13,4	14	0,6	9	AIPC 300/050/025-P
400	80	40	125	300	24,0	8	1,6	13	AIPC 400/080/040-P
450	80	40	125	325	24,0	6	1,6	10	AIPC 450/080/040-P
600	150	50	200	450	37,4	3,5	3,9	13	AIPC 600/150/050-P

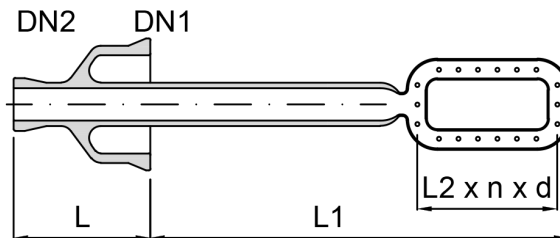
SPRAY FEED PIPES, LIQUIDS

If the column selected requires a finer first distribution of the volume flow or a higher number of drops per m² in comparison to the inlet pipe AIPC, then spray feed pipes can be used in the nominal diameter range DN 300 to DN 600. They allow an annular liquid feed.

This construction, which makes sense only with larger column diameters, ensures removal and installation of the spray feed pipe without extensive dismantling work and is installed via a standard reducing T-piece or a closing cover. Its adaptation to changing operating conditions is thereby simplified.

The spray feed pipes work within a narrow operating range around the specified volume flows. For significantly different volumetric flows or irrigation densities, the use of tube or nozzle distributors should be checked as an alternative.

The symbol "DN" in the tables below refers to the nominal diameter of the column component



Spray feed pipe AIRC ...-P

Description:

Spray feed pipe, PF system:

Spray feed pipe, non-conductive coated:

Spray feed pipe, conductive coated:

Item no.

AIRC DN/DN1/DN2-P

AIRC DN/DN1/DN2-P-C1

AIRC DN/DN1/DN2-P-C3

Example

AIRC 300/100/025-P

AIRC 300/100/025-P-C1

AIRC 300/100/025-P-C3

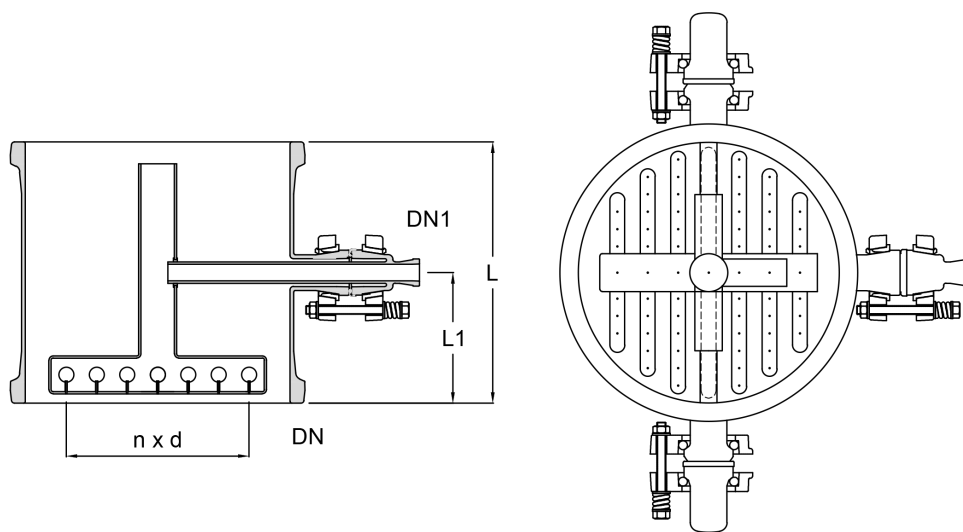
DN	DN1	DN2	L	L1	L2 x n x d1	Drip points/m ²	V ¹⁾ @ 1 m/s	B ¹⁾	Item no.
			[mm]	[mm]	[mm x mm]	[1/m ²]	[m ³ /h]	[m ³ /m ² h]	
300	100	25	150	225	100 x 30 x 3	420	0,8	11	AIRC 300/100/025-P
400	150	50	200	475	250 x 40 x 3	315	1,0	8	AIRC 400/150/050-P
450	150	50	200	500	250 x 40 x 3	252	1,0	6,5	AIRC 450/150/050-P
600	150	50	200	650	400 x 60 x 3	210	1,5	5,5	AIRC 600/150/050-P

1) For low-viscosity and solids-free liquids (<1 cP)

TUBE DISTRIBUTORS

The tube distributor is particularly suitable for a first distribution and in high vacuum applications in structured packings. Due to the retaining fluid height in the center tube depending on throughput, a particularly uniform distribution across the column cross-section results for small to medium dripping densities. In addition, it can also be used for redistribution, whereby a collector, e.g. a return flow divider type ACRM, must be mounted upstream. The tubular distributor with drilled, vertically downwardly directed holes and the jacket tube form a complete unit made of borosilicate glass 3.3. When assembling the column, a fine alignment of the distributor can additionally be carried out in order to achieve a very good liquid distribution even at low liquid loads. The slight inclination of the horizontally arranged distribution tubes ensures a good residual emptying.

On request, we supply these distributors in special design, i.e. with drip points other than those given in the table below (diameter and number of bore holes).



Tube distributor ACDT ...-P

Description:

Tube distributor, PF system:

Item no.

ACDT DN/DN1-P

Example

ACDT 450/080-P

DN	DN1	L	L1	L2	L3	DxH	nxd1	B ¹⁾	Drip points/m ²	Item no.
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[m ³ /m ² h]	[1/m ²]	
200	25	275	110	165	250	140x60	7 x 18	2-20	-	ACDT 200/025-P
300	50	300	125	220	300	230x60	19x18	2-22	-	ACDT 300/050-P
400	50	350	125	275	365	300x60	19x28	2-19	-	ACDT 400/050-P
450	80	375	135	300	390	350x65	19x28	2-17	-	ACDT 450/080-P
600	80	425	175	380	470	465x75	37x28	2-17	523	ACDT 600/080-P

1) For low-viscosity and solids-free liquids (<1 cP)

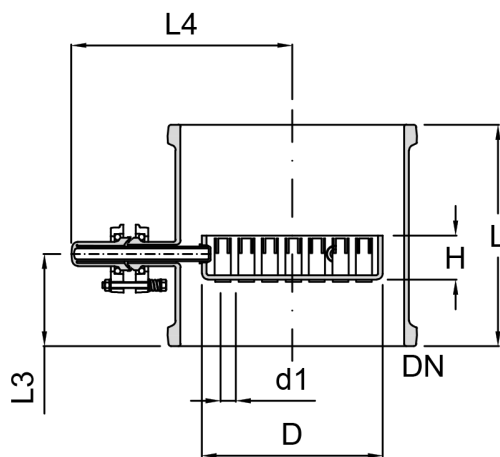
NOZZLE DISTRIBUTORS

The nozzle distributor is suitable for initial and redistribution over a wide operating range in packings.

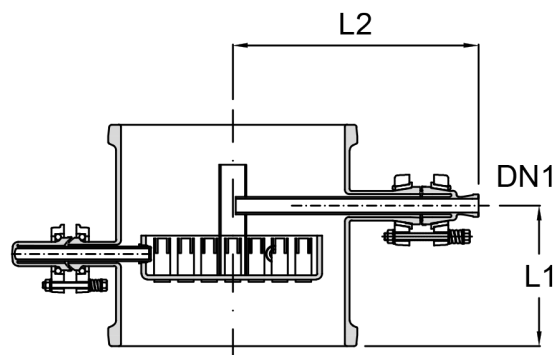
Due to the retaining fluid height on the nozzles depending on throughput, a uniform distribution across the column cross-section results along the nozzle slots. For the first distribution, type ACDNF, an additional centre pipe and inlet pipe is installed, the design has the same construction height as the redistributor, type ACDN. In both cases a collector, e.g. a guide funnel of type ACDL, has to be mounted upstream.

The nozzle distributor with vertically directed PTFE nozzles and the jacket tube form a complete unit made of borosilicate glass 3.3. with PTFE. When assembling the column, a fine alignment of the distributor can additionally be carried out over three circumferential fingers in order to achieve a very good liquid distribution even at low liquid loads.

On request, we supply these distributors in special design, e.g. with drip points other than those given in the table below.



Nozzle distributor ACDN ...-P



Nozzle distributor with feed ACDNF ...-P

Description:

Nozzle distributor , PF system:

Nozzle distributor with feed, PF system:

Item no.

ACDN DN/DN1-P

ACDNF DN/DN1-P

Example

ACDN 300/050-P

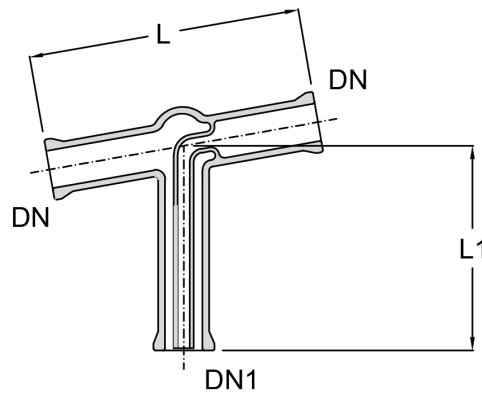
ACDNF 300/050-P

DN	DN1	L	L1	L2	L3	L4	DxH	nxd1	B ¹⁾	Drip points/m ²	Item no.
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[m ³ /m ² h]	[1/m ²]	
200	25	275	175	225	110	245	140x60	7 x18	4-45	891	ACDN 200/025-P
300	50	300	200	275	125	295	230x60	19x18	5-55	1.075	ACDN 300/050-P
400	50	350	225	300	125	355	300x60	19x28	4-60	605	ACDN 400/050-P
450	50	375	225	350	135	380	350x65	19x28	4-60	478	ACDN 450/050-P
600	50	425	325	425	175	460	465x75	37x28	4-85	523	ACDN 600/050-P

1) For low-viscosity and solids-free liquids (<1 cP)

LIQUID SEALS

In order to prevent the passage of steam through the distillate line with reflux dividers, liquid seals are required. In the standard version, the liquid seal ACLS has an inclination of 10°. For emptying the liquid divider, an outlet valve can be flanged on.



Liquid seal ACLS ...-P

Description:

Liquid seal , PF system:

Liquid seal , non-conductive coated:

Liquid seal , conductive coated:

Item no.

ACLS DN/DN1 -P

ACLS DN/DN1 -P-C1

ACLS DN/DN1 -P-C3

Example

ACLS 040/025-P

ACLS 040/025-P-C1

ACLS 040/025-P-C3

DN	DN1	L [mm]	L1 [mm]	Item no.
25	025	205	160	ACLS 025/025-P
40	025	305	315	ACLS 040/025-P

REFLUX DIVIDER

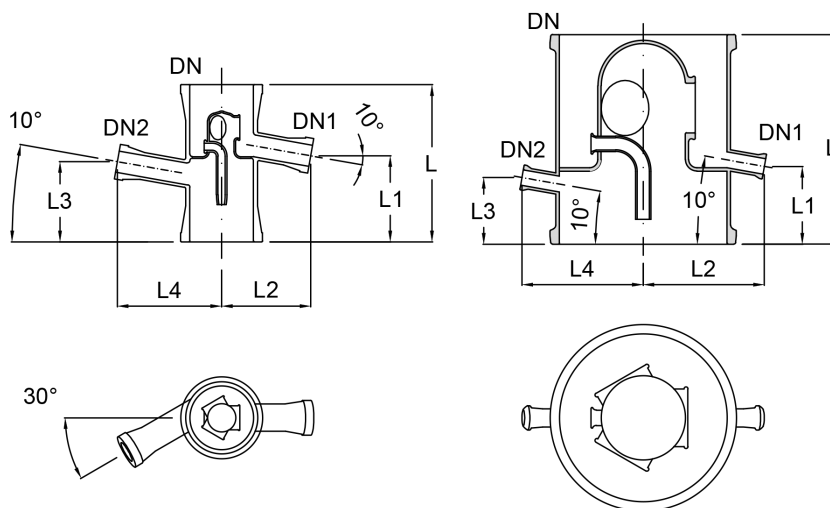
Reflux dividers are used in rectification columns and also in simple distillations to divide the resulting condensate into reflux and distillate discharge. Depending on the type, reflux dividers can be arranged in the column or in front of the condenser or outside the column or after the condenser. The mode of operation may be manual or timed to set a return flow ratio. The different types are presented below.

REFLUX DIVIDER, MANUAL

Manual reflux dividers are suitable for arrangement inside and outside of rectification columns or before or after the condenser. In the arrangement inside the column, vapors flow through large internal openings from bottom to top through the reflux divider, while distillate, separately guided from the vapors, flows from above circumferentially, is collected and flows out from the reflux divider through the nozzle DN1. If a valve is arranged at the nozzle DN1 and closed, then liquid accumulates up to the inner overflow pipe and flows downwards as a punctiform deposit into the column. By throttling or clocking the valve, the return flow ratio can be adjusted up to complete return flow.

Optionally, another nozzle DN2 is provided below the distillation tray for measurement instrumentation, e.g. temperature measurement.

In order to prevent the entry of steam into the distillate line, a liquid seal in the drain line is required for these reflux dividers.



Reflux divider, manual ACRM ...-P

Description:

Reflux divider, manual, PF system:

Reflux divider, manual, with nozzle DN 25 for temperature measure:

Item no.

ACRM....-P

ACRM....-P-O5

Example

ACRM 300-P

ACRM 300-P-O5

DN	DN1 / DN2	L [mm]	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]	A _{frei} [%]	Item no.
80	25	190	104	108	126	97	21 %	ACRM 080-P
100	25	255	134	120	121	106	27 %	ACRM 100-P
150	25	255	134	145	145	111	21 %	ACRM 150-P
200	25	380	139	169	169	111	45 %	ACRM 200-P
300	25	380	139	220	220	121	25 %	ACRM 300-P
400	25	450	163	270	270	162	40 %	ACRM 400-P
450	25	610	263	304	304	162	42 %	ACRM 450-P

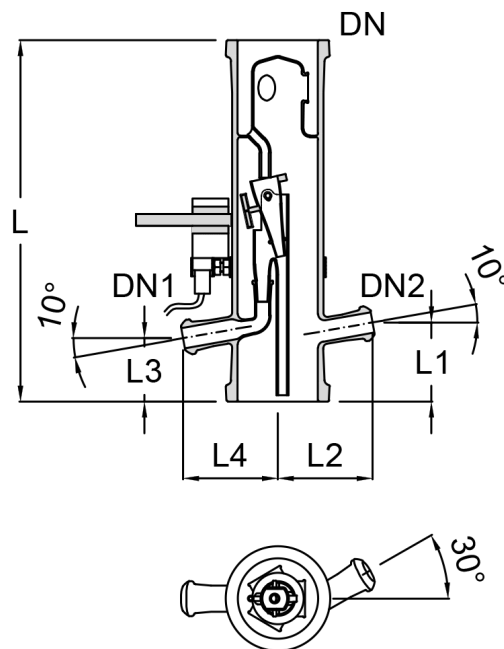
ELECTROMAGNETIC REFLUX DIVIDERS, LOCATED INSIDE

Electromagnetic reflux dividers are used for distillate distribution into return flow and removed distillate analogous to the manual reflux divider. In contrast to the manual reflux divider, a movably mounted funnel with a melted iron core is used in the electromagnetic reflux divider, the outlet of which, depending on the position, flows away in the direction of the column or distillate outlet DN1. The adjustment in one of the two positions is carried out by an external electromagnet, in which the current direction is changed in a timed manner. The timing corresponds to the set return flow ratio.

For the temperature measurement of the vapours, the nozzle DN2 is intended.

In order to prevent the entry of steam into the distillate line, a liquid seal in the drain line is always required for these reflux dividers.

The electromagnet is part of the delivery of the reflux divider, a timer can be ordered separately as an option.



Reflux divider, electromagnetic ACRE ...-P

Description:	Item no.	Example
Reflux divider, electromagnetic, PF system:	ACRE....-P	ACRE 080-P
Reflux divider, electromagnetic, Ex-proof, PF system:	ACRE....-P-O6	ACRE 080-P-O6
Reflux divider, electromagnetic, glass mantle, PF system:	ACRE....-P-SP01	ACRE 080-P-SP01
Electromagnet for reflux divider, ATEX T4 ^{1,3)} :	ACRE....-SP05	ACRE 080-SP05
Timer for reflux divider ²⁾ :	ACRE....-SP06	ACRE 080-SP06
Timer for reflux divider, ATEX T4 ^{2,3)} :	ACRE....-SP07	ACRE 080-SP07

DN	DN1	DN2	L [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Item no.
80	25	25	380	126	65	91	ACRE 080-P
100	25	25	455	118	80	101	ACRE 100-P
150	25	25	455	146	79	101	ACRE 150-P
200	25	25	475	171	78	106	ACRE 200-P
300	40	25	500	196	82	121	ACRE 300-P

- 1) Electromagnet with 5 m cable length (3x 0,75mm), 24 VDC, protection class IP 67, ambient temperature -40 - +60 °C, incl. holder for column, mounting directly on not-insulated reflux divider
- 2) Timer for non-ATEX applications, for setting return flow and distillate drain times and thus the return flow ratio, display of the timing of the return flow ratio and a temperature (pt100, 3-4 wire, not scope of supply).
Optionally with control possibility of the timing / return flow ratio according to displayed temperature.
- 3) for ATEX applications intrinsically safe version for magnet, EX II 2G Ex mb IIC T4 Gb for EX zone 1, and pressurized enclosure version for timer EX II 3GD Ex pz IIC T4 Gc for zone 2/22 (optionally available for zone 1)

REFLUX DIVIDER FOR CONDENSER OUTLETS

For dividing the distillate after the condenser, an external reflux divider can be used. The reflux divider can be made corrosion resistant in Boro 3.3 with PTFE, type ACRE or in stainless steel, type AERM.

The version made of Boro 3.3 is analogous to the previously described type.

With the stainless steel version the distillate flows from above via a guide tube to a movable funnel, which is controlled by external solenoid valves for a timed distribution into the two separate outlets. Typically, the condensate in the distillate outlet and return to the column is also separated here. In contrast to the previously described reflux dividers, there is no vapors flow here. The merely required pressure equalization is done via the inlet nozzle to the condenser. A temperature measurement is not provided as standard.

In order to prevent the entry of steam into the distillate line, a liquid seal in the return flow line is always required for these reflux dividers.

A timer can be ordered separately as an option.

Description:

Reflux divider, electromagnetic, Boro 3.3, PF system:

Reflux divider, pneumatic, stainless steel ^{1,3)}:

Timer for reflux divider²⁾:

Timer for reflux divider, ATEX T1-T4 ^{2,3)}:

Item no.

ACRE....-P

AERM....

ACRE....-P-SP06

ACRE....-P-SP07

Example

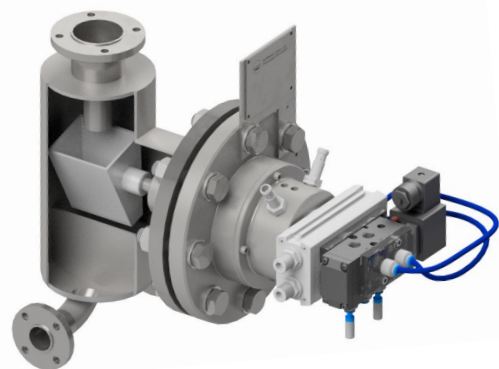
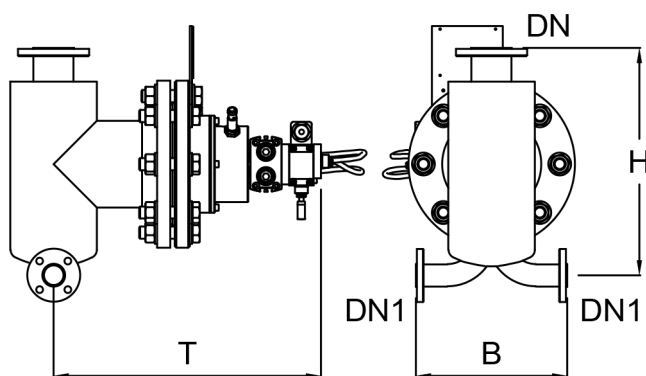
ACRE 080-P

AERM 080

ACRE 080-P-SP06

ACRE 080-P-SP07

- 1) Standard in 1.4571/1.4404, other product touching material is PTFE (details see flyer AERM on webpage)
- 2) Timer for non-ATEX applications, for setting return flow and distillate drain times and thus the return flow ratio, display of the timing of the return flow ratio and a temperature (pt100, 3-4 wire, not scope of supply).
Optionally with control possibility of the timing / return flow ratio according to displayed temperature.
- 3) for ATEX applications pressurized enclosure version for timer EX II 3GD Ex pz IIC T4 Gc for zone 2/22 (optionally available for zone 1), for the stainless steel version, please refer to the flyer AERM



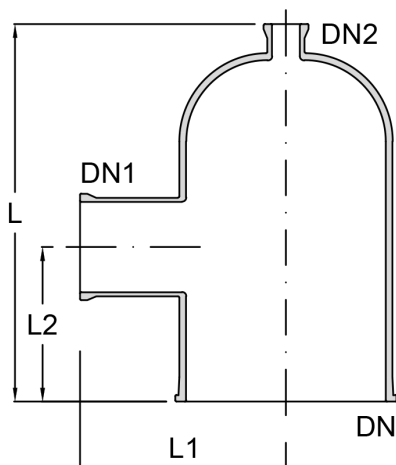
Reflux divider, pneumatic AERM ...

TYPICAL GLASS COMPONENTS FOR COLUMNS

CLOSING COVERS

Closing covers type Typ ALT have each one side and top nozzle in the standard version.

The two nozzles can be combined in different nominal diameters in order to connect inlet pipes / spray feed pipes at the top of the column, exhaust gas or measuring equipment and at the bottom of the column vapors, distillate or measuring equipment.

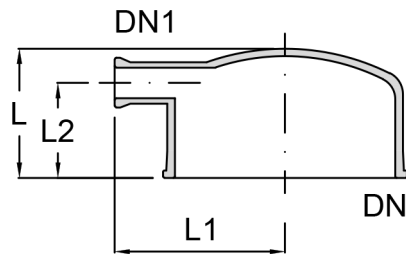


Closing cover ALT ...-P

DN	DN1	DN2	L [mm]	L1 [mm]	L2 [mm]	Item no.
80	25	40	180	110	90	ALT 080/025/040-P
80	40	25	180	110	90	ALT 080/040/025-P
100	25	50	230	125	100	ALT 100/025/050-P
100	50	25	230	125	125	ALT 100/050/025-P
150	25	50	240	150	125	ALT 150/025/050-P
150	25	80	240	150	125	ALT 150/025/080-P
150	50	25	240	150	125	ALT 150/050/025-P
150	80	25	255	165	125	ALT 150/080/025-P
200	50	50	350	175	125	ALT 200/050/050-P
200	50	80	300	175	125	ALT 200/050/080-P
200	50	100	300	175	125	ALT 200/050/100-P
200	80	50	375	200	150	ALT 200/080/050-P
200	100	50	425	225	175	ALT 200/100/050-P
300	50	100	400	225	175	ALT 300/050/100-P
300	50	150	400	225	175	ALT 300/050/150-P
300	100	50	475	275	175	ALT 300/100/050-P
300	150	50	550	300	225	ALT 300/150/050-P
400	50	150	500	300	175	ALT 400/050/150-P
400	150	50	600	325	250	ALT 400/150/050-P
450	50	150	550	325	200	ALT 450/050/150-P
450	50	200	550	325	200	ALT 450/050/200-P
450	150	50	675	375	250	ALT 450/150/050-P
450	200	50	750	350	300	ALT 450/200/050-P
600	150	50	800	450	300	ALT 600/150/050-P
600	200	80	850	425	300	ALT 600/200/080-P

FLAT COVERS

Flat covers type ALF are space-saving closures with only one side nozzle smaller nominal width as a standard. Deviating from the specifications of the permissible operating pressure in chapter 10, the flat covers of type ALF are only permitted in all nominal sizes up to an operating overpressure P_s of +0.5 barg.



Flat cover ALF ...-P

Description:

Flat cover, PF system:

Flat cover, non-conductive coated:

Flat cover, conductive coated:

Item no.

ALF DN/DN1-P

ALF DN/DN1-P-C1

ALF DN/DN1-P-C3

Example

ALF 300/050-P

ALF 300/050-P-C1

ALF 300/050-P-C3

DN	DN1	L [mm]	L1 [mm]	L2 [mm]	Item no.
150	040	155	165	110	ALF 150/040-P
150	050	165	165	125	ALF 150/050-P
200	040	175	175	125	ALF 200/040-P
200	050	175	175	125	ALF 200/050-P
300	040	185	225	125	ALF 300/040-P
300	050	185	225	125	ALF 300/050-P
400	040	235	275	150	ALF 400/040-P
400	050	235	275	150	ALF 400/050-P
450	040	275	300	150	ALF 450/040-P
450	050	275	300	150	ALF 450/050-P
600	040	325	375	175	ALF 600/040-P
600	050	325	375	175	ALF 600/050-P

OPTIONS APPARATUSES / COLUMNS

To complement the standard components, the following options can be chosen for the apparatus and column components. Each option chosen must be entered at the end of the item number. Several options can be chosen, that are typically arranged in alphabetical order. . In the following table you will find examples of item numbering, which include additional options.

Description:	Item no.	Example
Column section, complete, PF system:	ACC....-P	ACC 150/1500-P
Column section, complete, conductive coated:	ACC....-P-C3	ACC 3150/1500-P-C3
Column section, complete, conductive coated, with $\varnothing_{i \min}$:	ACC....-P-C3-O1	ACC 3150/1500-P-C3-O1
Column section, complete, conductive coated, with $\varnothing_{i \min}$, with material certificates 2.1:	ACC....-P-C3-O1-Z2	ACC 150/1500-P-C3-O1-Z2

You can choose from the following options:

OPTION C – COATING/GLASS TYPE

The standard components used are those made of borosilicate glass 3.3 without a coating. The following alternative options are possible:

- C1 = coating, non-conductive
- C2 = coating, non-conductive, for higher temperatures and chemical resistance
- C3 = coating, conductive
- C4 = amber glass
- C5 = quartz glass

OPTION F – FLANGE TYPE

The standard components used are made of borosilicate glass 3.3 with the flange type F4 (PF system).

The following flange connectors for glass structural components are also generally available:

- F1 = KF flanges, type KF../1
- F2 = KF flanges, type KF../2
- F3 = KF flanges, type KF../3
- F4 = PF flanges, type PF
- F5 = Tube connection 16 mm
- F6 = Tube connection 26 mm
- F7 = GL-thread GL 18
- F8 = GL-thread GL 25
- F9 = NS 29/32
- F10 = NS 45/40

All other combinations of the flange types F1 to F4 can be selected as options. We will be glad to check whether the other types of flange can be used with the selected component..

OPTION M – MATERIAL/PTFE DESIGN

For some components, non-standard materials can be selected.

M1 = PTFE conductive

M2 = PTFE conductive with earthing lug

M3 = stainless steel 1.4301

M4 = stainless steel 1.4571/1.4404

OPTION O – SPECIAL OPTIONS

The following special options are offered for certain structural components.

O1 = Pipes type PP or column sections type ACC(T/P/PT/PV) with continuous minimum inner diameter according to nominal width in the area off structured packings

O2 = Pipes type PP with calibrated inner diameter

O3 = Corrosion resistant design bubble cap / sieve trays columns

O4 = ATEX compliant design for insulating jackets

O5 = measurement nozzle for reflux divider

O6 = ATEX compliant design for electromagnetic reflux divider

O10 = Dimensions according to former design

O20 = Raschig rings lime glass

O21 = Raschig rings with internal structure, glass

O31 = Pall rings, stainless steel

O32 = Pall rings, PVDF

O33 = Pall rings, PP

O41 = Intalox-Saddles, ceramics

OPTION SP – REPLACEMENT PARTS

The spare parts are indicated individually for the respective items.

OPTION Z – CERTIFICATES

Standard deliveries do not come with certificates.

The following certificates can optionally be delivered with your order:

Z1 = FDA material certificate¹⁾

Z2 = Material certificate 2.1

Z3 = Certificate for Technical Guidelines on Air Quality Control (TA-Luft)

1) FDA material certificates can be delivered for product-side structural components containing PTFE.