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Webinar on

LONGLIFE ®

Preparative Scale Column Hardware by Dr. Maisch HPLC

Presented by Dr. Guido Krautz

A State-of-the-Art Hardware Solution for Prep-LC

Dr. Maisch GmbH

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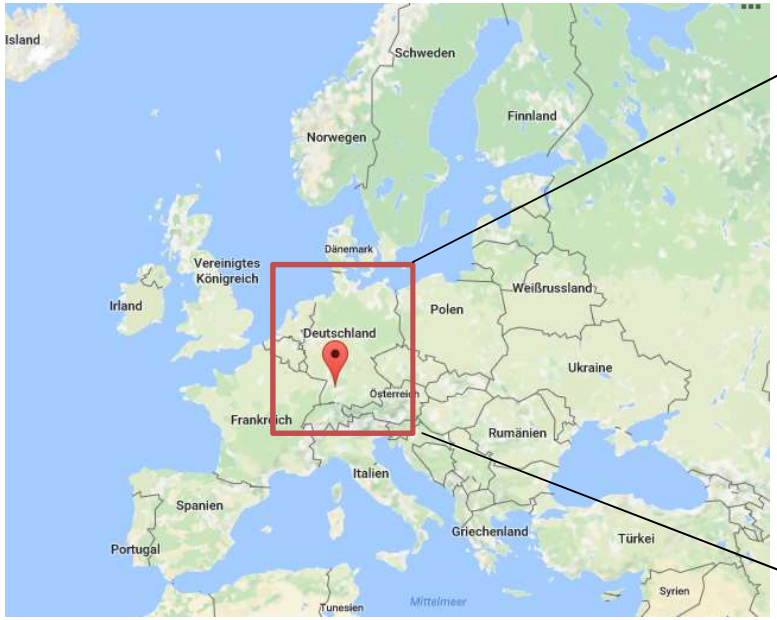
Who we are

Dr. Maisch GmbH

Any Column, Any Size, Any Media

Dr. Maisch HPLC GmbH – Located at a High-Tech Hotspot in the South of Germany



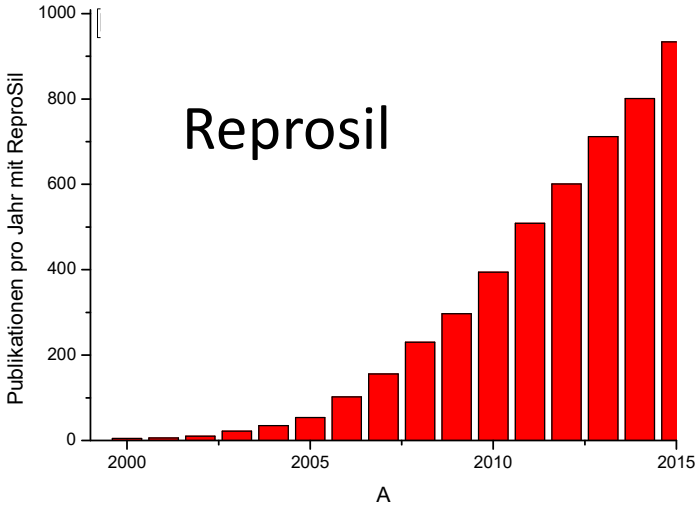
Recognition of Dr. Maisch Brands
Number of Publications

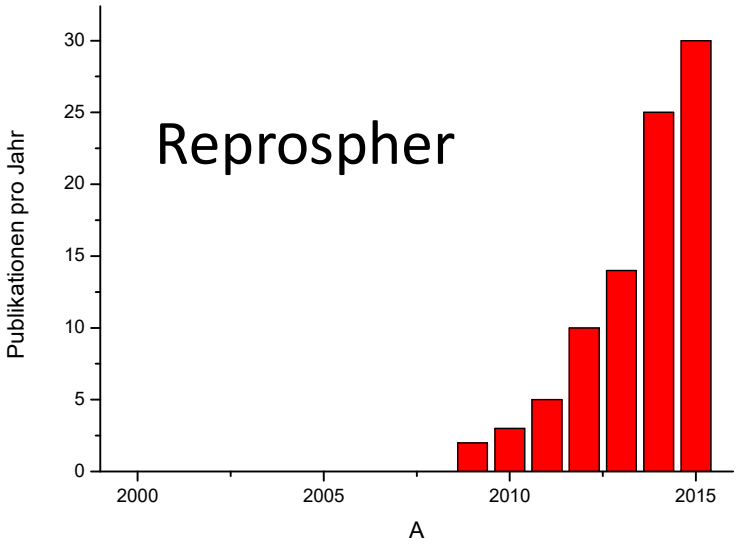
Reprosil

Launched in 1996

Reprospher

Launched in 2003





Expansion 2019/20

Purpose-Built State-of-the-Art Manufacturing Facility

with ~ 900 m²

- 300 m² for Silica Production + Modification
- 150 m² for R&D
- 450 m² for Column Packing

Dr. Maisch GmbH

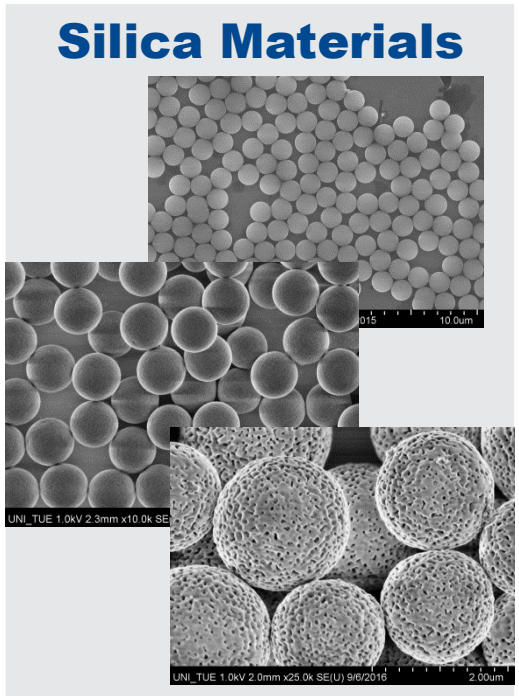
Dr. Maisch GmbH

Dr. Maisch HPLC: Relying on Local Excellence to Serve International Markets

We control the full value chain from bare silica production through surface modification, hardware manufacturing and column packing.

1st Core Expertise in Silica Development

For over 20 years Dr. Maisch HPLC has been at the forefront for Stationary Phases for HPLC



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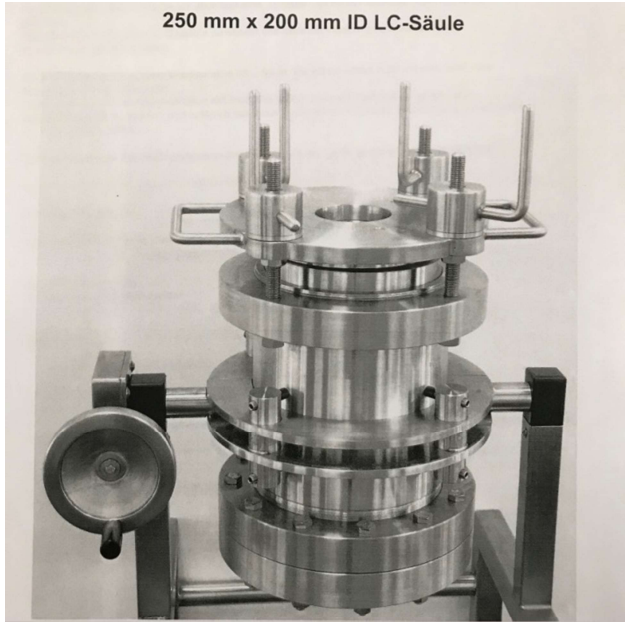
2nd Core Expertise in Column Hardware and Packing

Second core expertise is column packing in optimal hardware

- ID: from 0,05 up to 200 mm
  - 300 mm iD under R&D
- Length: From 2 mm up to 1200 mm
- Special sizes available on request



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Available Column Technologies – the Best Solution For Every Application

Cost effective high quality standard hardware and packing technology

Manually-Adjustable and Self-Adjusting Piston Technology

Patented Piston Technology
SAC and DAC mode
Outstanding analytical-like Performance
Outstanding Lifetime

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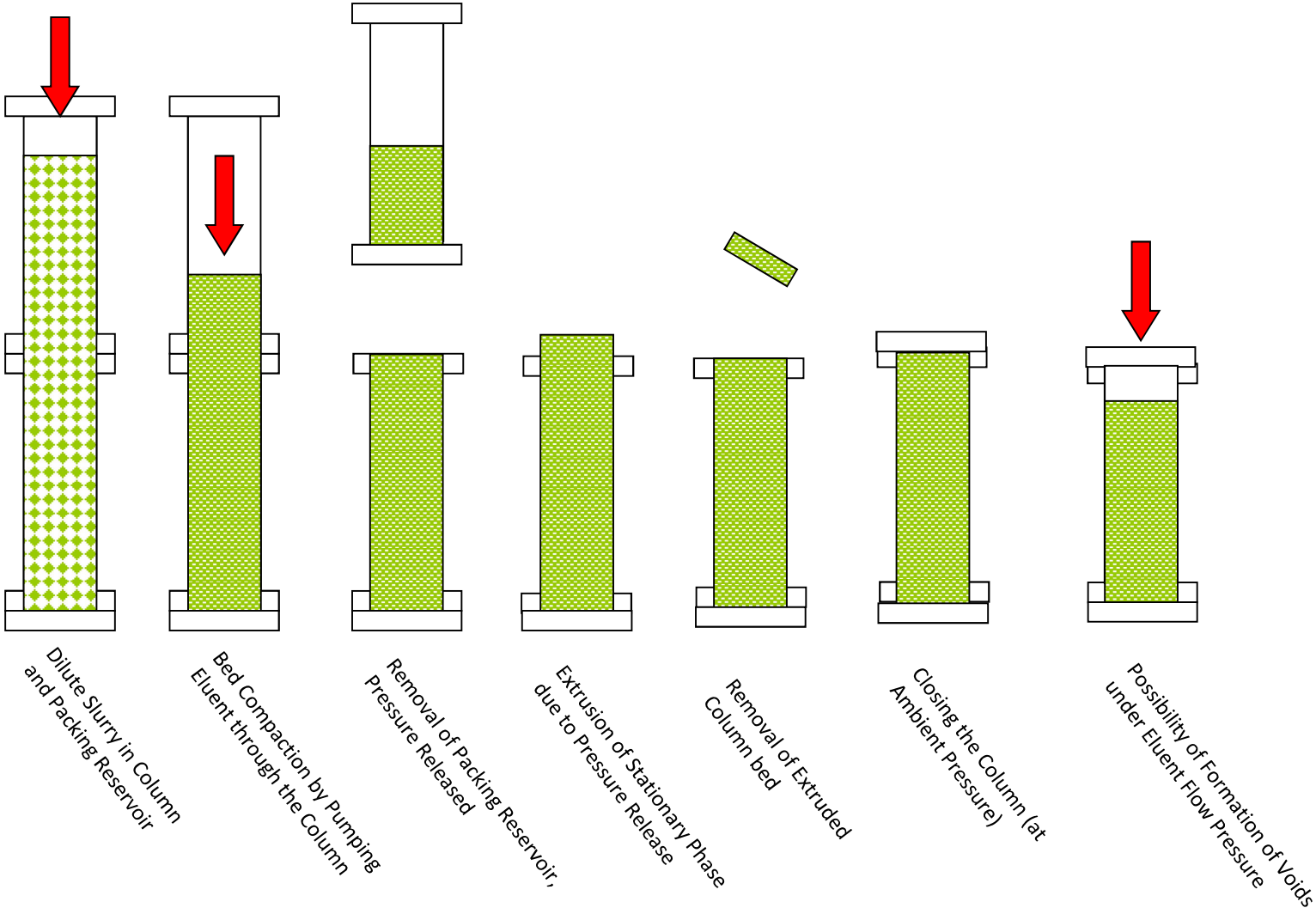
Column Packing Technologies

- Fixed Bed – Packing by Solvent Flow
- Axial Compression – Packing with a Piston
  - DAC – Dynamic Axial Compression
  - SAC – Static Axial Compression

Fixed Bed Column Packing – Packing by Solvent Flow

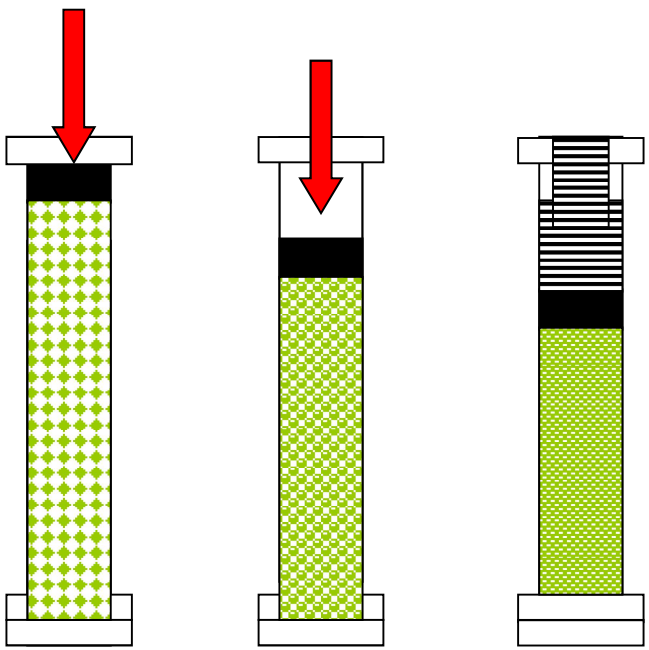


Intrinsic Problems Related to Fixed Bed Column Packing

- Need of excess media in packing reservoir
- Further loss of media after release of packing pressure
  - Less loading capacity
  - Lower efficiency
- Possibility of bed disruption upon pressure release
- Non-uniform bed packing density due to pressure drop along the column length under flow pressure packing
- Possibility of formation of voids during use
- Limited lifetime

Axial Compression – Packing with a Piston

Axial Compression overcomes these problems:



- No need of excess media or loss of media
- Mechanical pressure by the force on the piston: full pressure to the bed over the complete column length → uniform packing density
- No release of piston pressure
  - No bed disruption
  - Consistent packing density
  - No formation of voids
  - Increased column lifetime

Longlife Column Hardware

- Patented premium prep hardware
- SAC and DAC version
- Suitable for SFC
- Extremely high performance and lifetime

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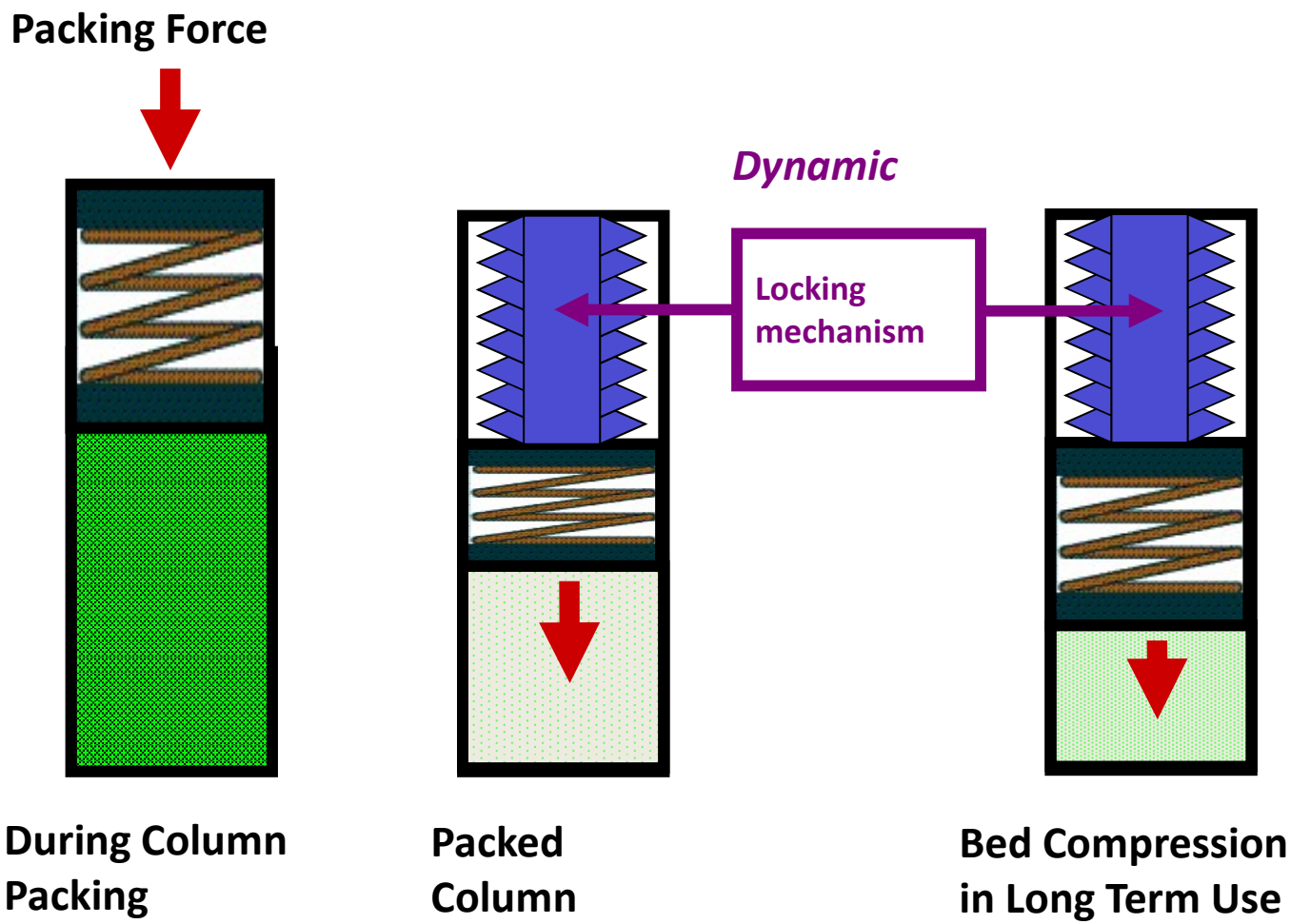
The Longlife Technology is based on the Modcol Spring Column Principle



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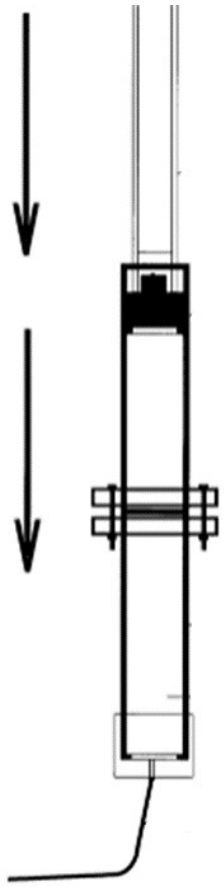
The MODcol® Spring® Column

- Compensates for Voids
- Provides a Longer Column Lifetime
- Features Convenience and Mobility
- Is Easy & Quick to Pack and Un-Pack
- Allows Maximum Efficiencies
- Enables Higher Pass Rates
- Offers Cost-Effectiveness

The Patented Longlife Principle



- A column extension (packing reservoir) is used to contain the dilute slurry
- The packing reservoir is removed after the column has been packed in order to minimise packed column‘s total hardware length
- Piston stays in the column
- Pressure is not released

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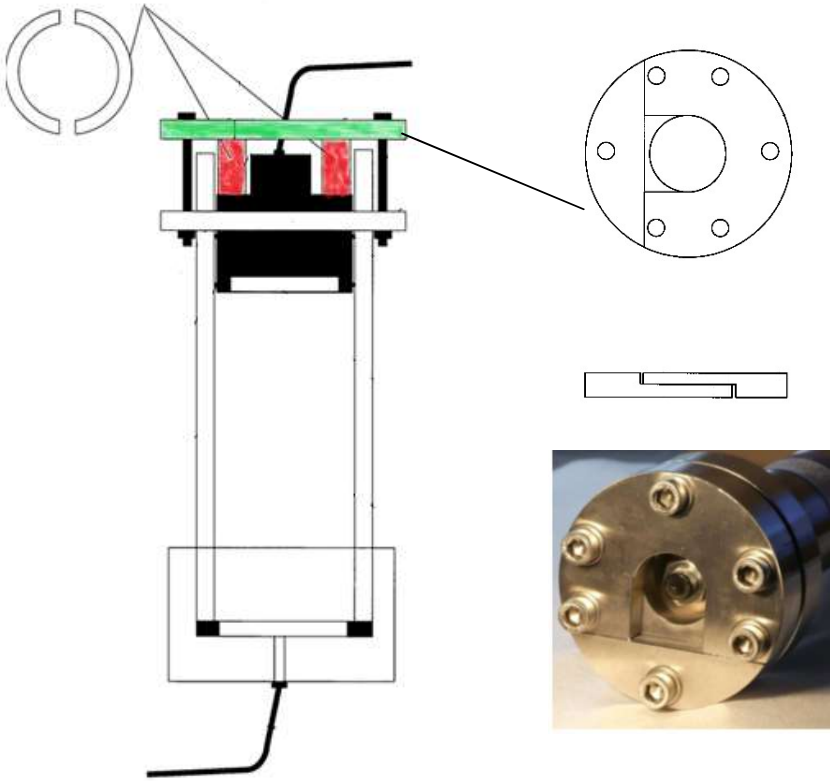
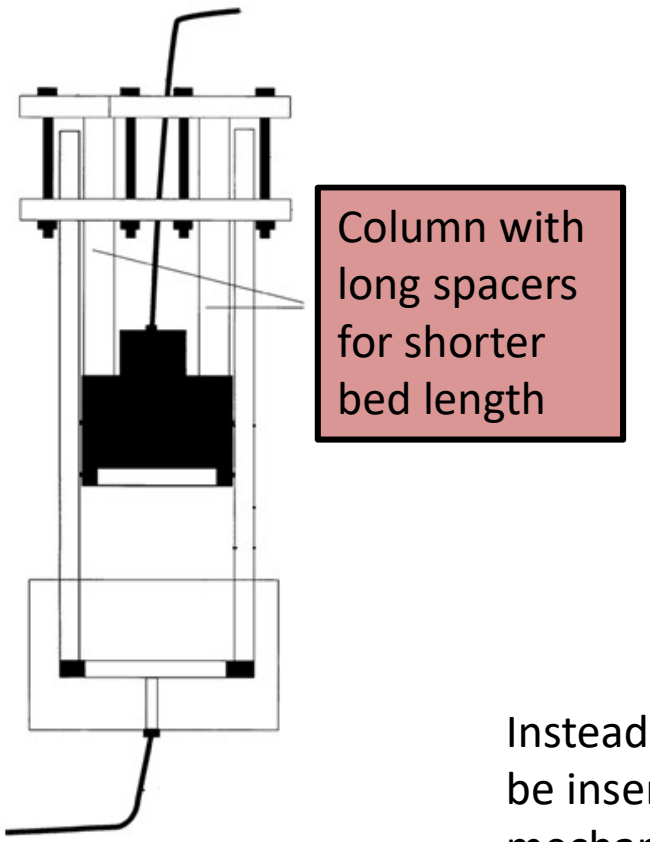
The Patented Longlife Principle

Half-tube column inserts as spacers for flexible bed length



Special design of column flange endplate to enable sideway assembly without removing the piston

The Patented Longlife Principle



Instead of static spacers, Washer Spring Units can be inserted for **Dynamic Axial Compression** mechanism

Longlife Technical Options

- ID 25, 30, 40, 50, 70 mm
- Bed Length fully flexible up to 250 mm
- Particle size from 3 µm

  - Can only be packed by Dr. Maisch
  - DAC and SAC versions available
  - HPLC and SFC versions available
  - Packing service of non-Dr. Maisch brands
  - Repacking service (incl. different bed lengths)

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Chiral Reprosil Media

Reprosil Chiral-MIA 5 µm
250 mm L x 30 mm ID

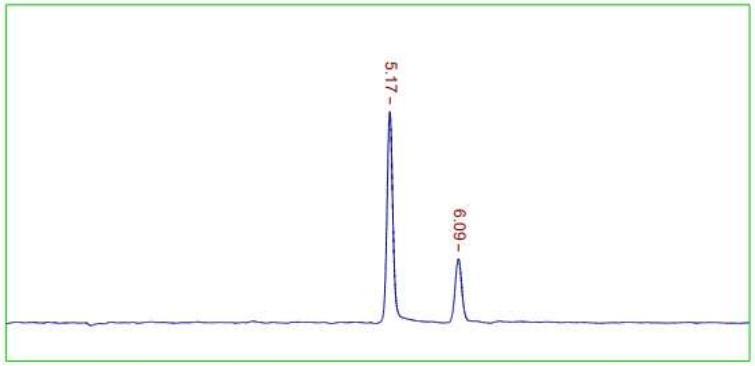
Quality Assurance Chromatogram

DESCRIPTION
Column Serial Number: 20090411330
Packing Material: ReproSil Chiral-MIA, 5 µm
Length: 250 mm ID: 30 mm
Shipping Solvent: Mobile Phase
Maximum Pressure: 130 bar

Part Number: r65.mia.s2530
Hardware Type: Longlife SFC
Packing Lot No: 0002
Frit: 2 µm
pH Range: 2.0 - 8.0

TEST CONDITIONS
Mobile Phase: Heptan/IPA 85/15
Flow Rate: 30 ml/min
Detector: UV @ 229 nm

Temperature: Ambient
Pressure: 34 bar
Sensitivity: 0.5 mV



Peak	RT (min)	Capacity Factor	Symmetry (@ 10%)	Plates	Efficiency Plates / m	red. Plate Hight (h)
1	5.17	0.00	1.1	21386	85544	2.3
2	6.09	0.18	1.0	21540	86160	2.3

ca. 86,000 N/m

sample: TSO

Reprosil Chiral NR, 8 µm
260 mm L x 50 mm ID

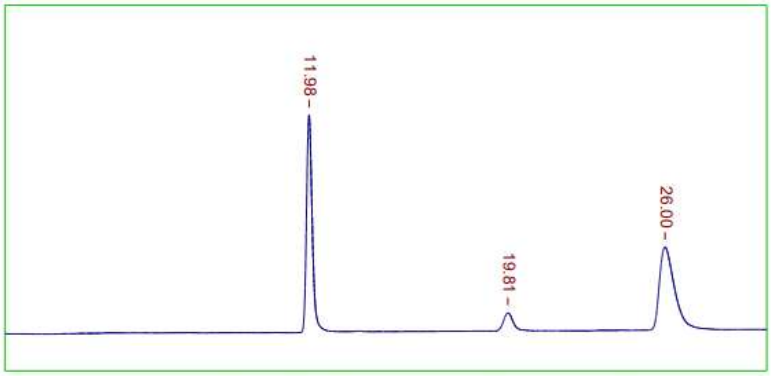
Quality Assurance Chromatogram

DESCRIPTION
Column Serial Number: 18013009385
Packing Material: Reprosil Chiral-NR, 8 µm
Length: 260 mm ID: 50 mm
Shipping Solvent: Mobile Phase
Maximum Pressure: 250 bar

Part Number: r18.nr.lfd2550
Hardware Type: LFD
Packing Lot No: 5164
Frit: 2 µm
pH Range: 2.0 - 8.0

TEST CONDITIONS
Mobile Phase: Heptane/IPA 85/15
Flow Rate: 60 ml/min
Detector: UV @ 254 nm

Temperature: Ambient
Pressure: 12 bar
Sensitivity: -0.6 mV



	RT (min)	Capacity Factor	Symmetry (@ 10%)	Plates	Efficiency Plates / m	red. Plate Height (h)
1	11.98	0.00	1.2	14346	55175	2.3
2	19.81	0.65	1.2	14049	54035	2.3
3	26.00	1.17	1.6	9608	36953	3.4

ca. 55,000 N/m

sample: TSO

Other Manufacturers‘ Media

Zorbax SB-AQ, 5 µm
70 mm L x 30 mm ID

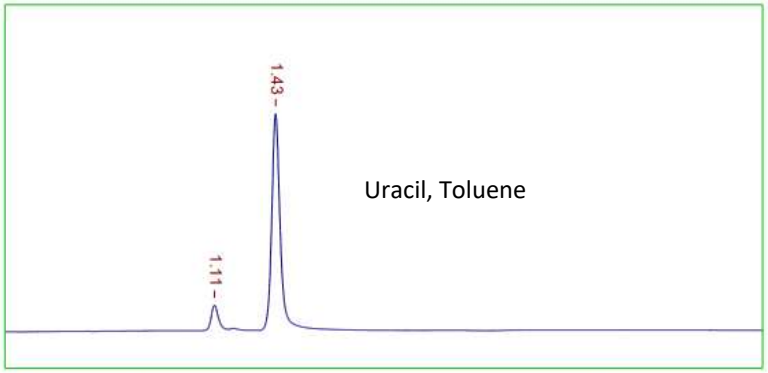
Quality Assurance Chromatogram

DESCRIPTION
Column Serial Number: 19111110522
Packing Material: Zorbax SB-AQ, 5 µm
Length: 75 mm ID: 30 mm
Shipping Solvent: Mobile Phase
Maximum Pressure: 210 bar

Part Number: x.lfc0730r
Hardware Type: LongLife SAC
Packing Lot No: B19183
Frit: 2 µm
pH Range: 2.0 - 8.0

TEST CONDITIONS
Mobile Phase: MeOH/H2O 85/15
Flow Rate: 30 ml/min
Detector: UV @ 254 nm

Temperature: Ambient
Pressure: 24 bar
Sensitivity: 59.8 mV



Peak	RT (min)	Capacity Factor	Symmetry (@ 10%)	Plates	Efficiency Plates / m	red. Plate Hight (h)
1	1.11	0.00	1.3	4227	56355	3.5
2	1.43	0.29	1.1	5751	76682	2.6

ca. 76,700 N/m

Luna C18(3) 10 µm prep
250 mm L x 70 mm ID

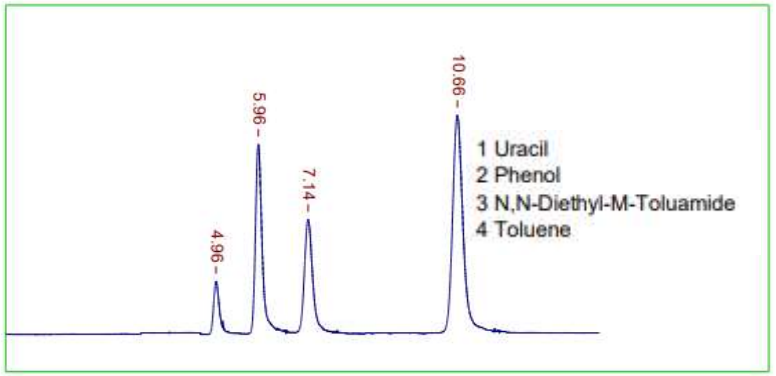
Quality Assurance Chromatogram

DESCRIPTION
Column Serial Number: 20112010770
Packing Material: Luna 100 C18(3), 10 µm
Length: 250 mm ID: 70 mm
Shipping Solvent: Mobile Phase
Maximum Pressure: 100 bar

Part Number: x.flc.s2570
Hardware Type: Longlife
Packing Lot No: 5711-0084
Frit: 2 µm
pH Range: 2.0 - 8.0

TEST CONDITIONS
Mobile Phase: MeOHe/H2O 85/15
Flow Rate: 120 ml/min
Detector: UV @ 254 nm

Temperature: Ambient
Pressure: 10 bar
Sensitivity: 1.8 mV



Peak	RT (min)	Capacity Factor	Symmetry (@ 10%)	Plates	Efficiency Plates / m	red. Plate Height (h)
1	4.96	0.00	1.3	6876	27504	3.6
2	5.96	0.20	1.3	7893	31571	3.2
3	7.14	0.44	1.2	7023	28090	3.6
4	10.66	1.15	1.2	9906	39623	2.5

ca. 39,600 N/m

Longlife - High Resolution Prep Chromatography
Core-Shell vs. 3 µm Particles

Column loadability is a function of surface area AND column efficiency.

Core-Shell Media 5 µm 120,000 N/m

surface area: 100 m2/g = 100 m2/mL

Reprosil-Pur Basic 3 µm 135,000 N/m

Surface area: 450 m2/g = 270 m2/mL
Rel. Backpressure: 5 µm particles x 2.7

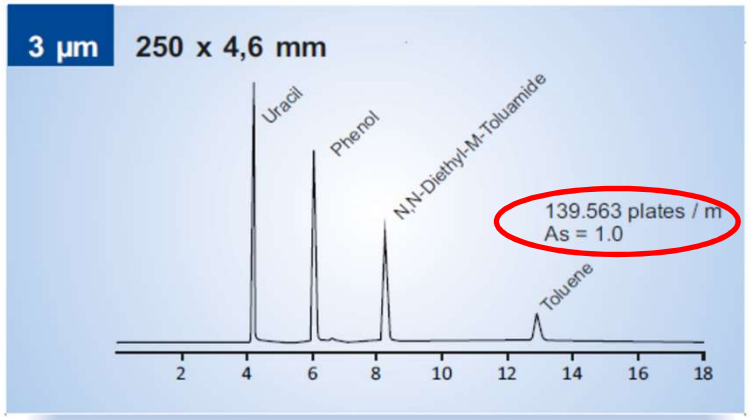
To achieve the same back pressure and surface area per column volume, column length can be reduced by a factor of 2.7

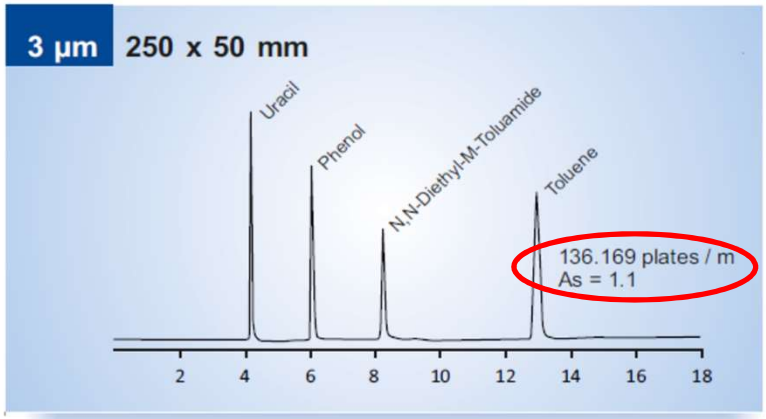
In SFC back pressure is rarely an issue.

Longlife - High Resolution Prep Chromatography
Prep Column Performance with 3 µm Particles

ReproSil-Pur Basic C18, 3 µm – Up-Scale: 4.6 mm to 50 mm ID

Packed in LongLife hardware: same performance from 4.6 to 50 mm ID





Conditions: Mobile Phase: MeOH/H20 80/20, Flow Rate: 60 ml/min @ 50 mm ID, Flow Rate: 0.5 ml/min @ 4.6 mm ID
Pressure: 197 bar, Detector: UV @ 254 nm

1 Uracil
2 Phenol
3 N,N-Diethyl-M-Toluamide
4 Toluene

3 µm Media for Achiral SFC

Reprospher 100 2-EP, 3 µm
100 mm L x 50 mm ID

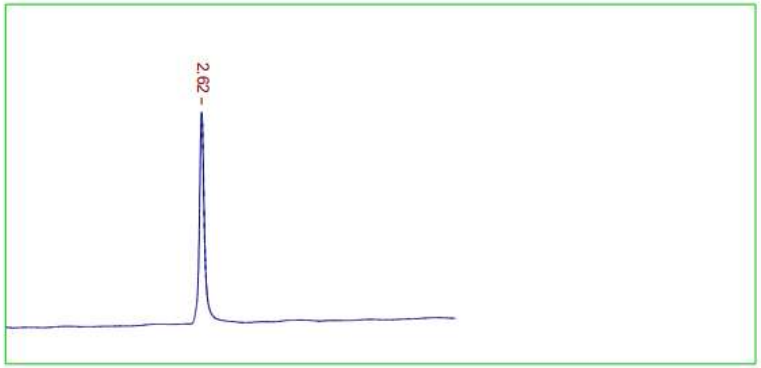
Quality Assurance Chromatogram

DESCRIPTION
Column Serial Number: 19122010576
Packing Material: Reprospher 100 2-EP, 3 µm
Length: 100 mm ID: 50 mm
Shipping Solvent: Mobile Phase
Maximum Pressure: 200 bar

Part Number: rs13.2ep.lfc1050
Hardware Type: LongLife SFC
Packing Lot No: 1973
Frit: 2 µm
pH Range: 2.0 - 8.0

TEST CONDITIONS
Mobile Phase: MeOH/H2O 85/15
Flow Rate: 60 ml/min
Detector: UV @ 254 nm

Temperature: Ambient
Pressure: 85 bar
Sensitivity: 21.1 mV



Peak	RT (min)	Capacity Factor	Symmetry (@ 10%)	Plates	Efficiency Plates / m	red. Plate Height (h)
1	2.62	0.00	1.2	9024	90244	3.7

ca. 90,000 N/m

sample: toluene

Reprospher 100 PEI, 3 µm
100 mm L x 50 mm ID

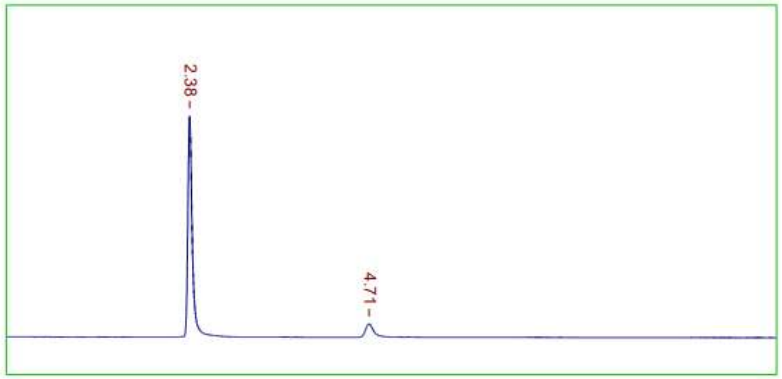
Quality Assurance Chromatogram

DESCRIPTION
Column Serial Number: 19101510509
Packing Material: Reprospher 100 PEI, 3 µm
Length: 100 mm ID: 50 mm
Shipping Solvent: Mobile Phase
Maximum Pressure: 200 bar

Part Number: rs13.pei.lfc1050
Hardware Type: LongLife SFC
Packing Lot No: 4159
Frit: 2 µm
pH Range: 2.0 - 8.0

TEST CONDITIONS
Mobile Phase: MeOH/H2O 85/15
Flow Rate: 60 ml/min
Detector: UV @ 254 nm

Temperature: Ambient
Pressure: 120 bar
Sensitivity: 58.7 mV



Peak	RT (min)	Capacity Factor	Symmetry (@ 10%)	Plates	Efficiency Plates / m	red. Plate Hight (h)
1	2.38	0.00	1.4	10008	100078	3.3
2	4.71	0.98	1.4	10593	105926	3.1

ca. 106,000 N/m

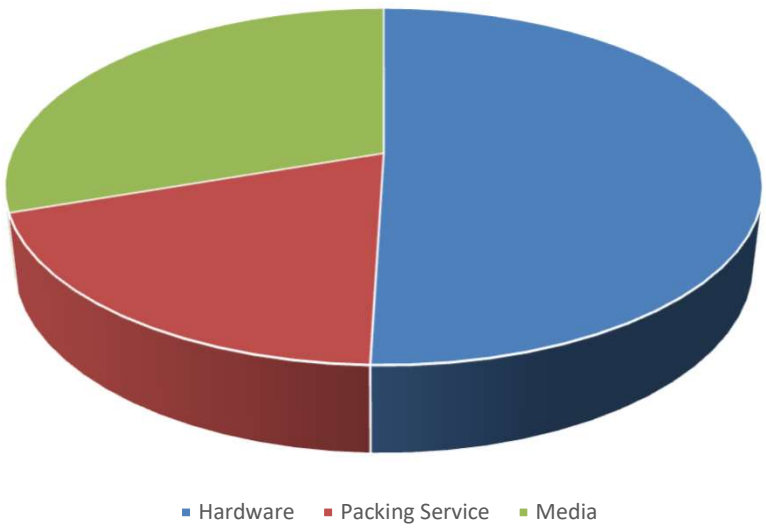
sample: toluene

Longlife: Saving With Every Column and Repacking

Often the column hardware represents a significant part of the column value:

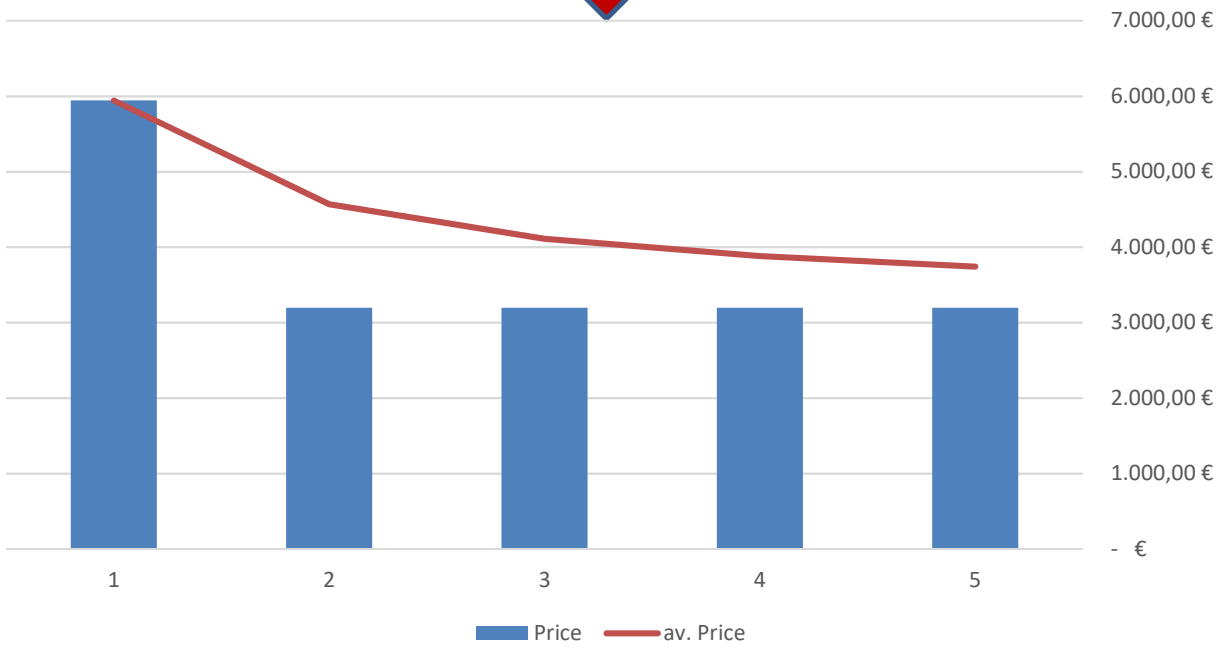
Longlife packed with Reprosil-Pur Basic-C18 10 µm; 250 x 50 mm

Hardware	3000 €
Packing Serv.	1144 €
Media	1800 €



Longlife: Saving With Every Column and Repacking

Savings from the first column and with every repacking



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Longlife: Benefits

	Longlife (Dr. Maisch)	Axia (Phenomenex)	OBD (Waters)
Packed by piston			
Flexible bed length			
DAC *and* SAC mechanism			
Packing and *repacking* service			
Available column IDs	25, 30, 40, 50, 70	21.2, 30, 50	19, 30, 50
Scalability to > 100 mm ID	Using Modcol columns / Multipacker	n.a.	n.a.

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Longlife: Summary

LongLife is available in DAC and SAC mode:
25, 30, 40, 50 and 70 mm ID

Technology:
Packing is similar to Modcol, but the reservoir and the column are separated after the packing.
The piston stays in the column.

Performance and stability are extremely high!
Column size is shorter compared to Modcol.

Can only packed at Dr. Maisch.

Option to use Modcol columns with same packing technology if interested in self-packing or for diameters > 70 mm

MODcol ® Spring Column

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Small MODcol ® Multipacker

for

25, 30, 40, 50 and 70 mm ID

Spring®Columns

- Hardware length 40 or 70 cm
- New 50 cm length for ID >/= 70 mm (bed lengths 50 – 325 mm)

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Large MODcol ® Multipacker

for

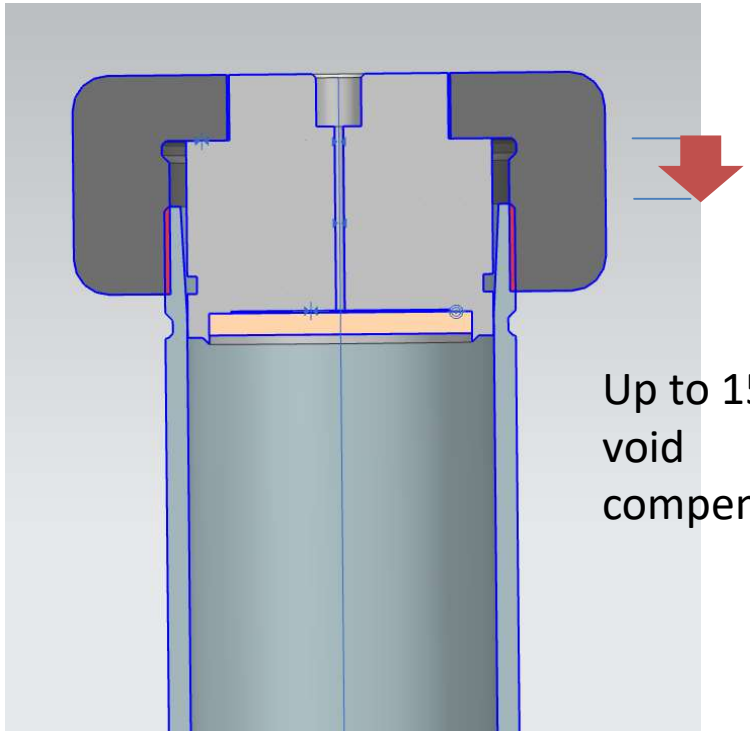
50, 70, 101 and 150 mm ID

Spring®Columns

- Hardware length 40 or 70 cm
- New 50 cm length for ID >/= 70 mm (bed lengths 50 – 325 mm)

Manually-adjustable Columns

Manual turning of the column head will re-adjust the piston and eliminate voids



Up to 15 mm of void compensation

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Manually-adjustable Columns – 200 mm ID

Piston can be adjusted manually using the 4 screws

- Dry packing
- Slurry packing
- Prepacked or self-packing
- Recently popular for medium pressure purification of cannabinoids

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Guard Columns

Cartridge System up to 30 mm ID

- Can be used for up to 50 mm columns

If the ID of the guard is smaller than the ID of the main column, the expected increase of back pressure has to be balanced out with increased particle size.

Example: 30 mm ID Cartridge for 50 mm Column

Pressure increase by ID: $50^2 / 30^2 = 2,7$
Pressure decrease by dp: $15^2 / 10^2 = 2,3$

Guard Columns

Short flanged columns for ID's ≥ 30 mm up to 200 mm ID

- Starting at 30 mm length
- Self packing possible
- Can be used for solid load

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THANK YOU

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