MODcol® Spring® Columns and MultiPacker® Instruments

The MODcol® Dynamic Axial Compression Spring® Column from Grace Davison Discovery Sciences is a product of choice for chromatographers who need high performance, robust, and long lasting columns. This highly versatile Dynamic Axial Compression (DAC) technology is self-contained in a small and portable package, providing highly advanced and flexible technology for preparative and semi-preparative chromatography columns.

MODcol® Dynamic Axial Compression Spring® columns are the only mobile DAC columns on the market. They can be used without being mounted in the Multipacker® instrument with full DAC functionality. The Spring® columns are available in 1", 2" and 4" i.d. and 2 lengths, which enable packed bed lengths from 5–30cm.

Dynamic Axial Compression has been used for many years in process chromatography to provide long lasting columns with excellent performance. This technology was developed to address the loss of efficiency and peak symmetry that can result when many samples and large amounts of mobile phase are passed through columns with fixed low-density beds. Under these conditions the initial packing of the media particles in the column bed can be disturbed, resulting in the formation of a void at the column inlet or in a channelling through the packed media bed. This compromises efficiency and peak symmetry. Such void formation can be avoided by using a DAC system that continually forces a piston against the media bed at the column inlet.

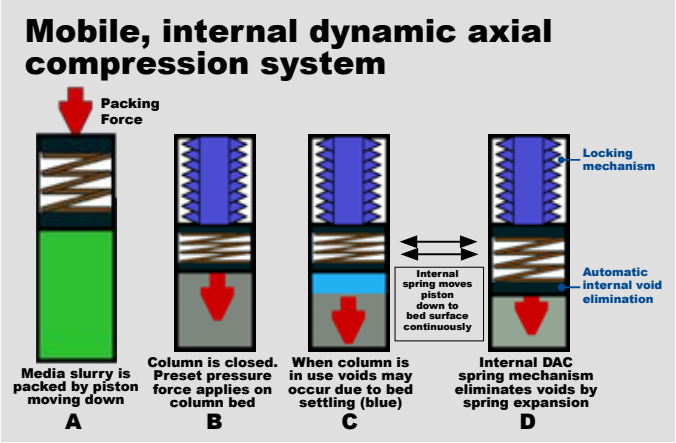
Traditional DAC systems drive the piston with a hydraulic system. The mechanical complexity of the hydraulic components can make such a solution much more expensive than traditional columns and, until recently, use of DAC systems was limited to large permanent installations or expensive preparative systems where the column is an integral part of the packing unit and can not be handled independently after the packing process is finished. For the few alternative systems available for which the column can be separated from the packing unit, the DAC principle is lost when the column is separated from the packer and reduced to static axial compression (SAC) only.

The 1" and 2" MultiPacker® Instrument is a convenient tool to self pack preparative dynamic axial compression (DAC) Spring® Columns for HPLC.

With the revolutionary Dynamic Axial Compression Spring® Columns, the advantages of the DAC technology for preparative and semi-preparative chromatography are available at an affordable cost and with an ease of use that is comparable to classical fixed bed columns.

The Spring® Column Principle

The MODcol® Dynamic Axial Compression Spring® Column technology compensates for voids formed by bed settling, extending column lifetime and improving column performance without an external power source. This patented technology uses a spring-driven compression mechanism inside the column, instead of the traditional external hydraulic system, to maintain the piston in contact with the stationary phase.



The proprietary and patented Spring® column mechanism provides a constant pressure on the packed bed. This minimizes the formation of voids by bed settling after packing. The ease of use, the gentle packing mechanism, and the permanent, constant pressure on the packed bed make it possible for a single user to pack even sensitive large pore media for protein and peptide separations with good performance.

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The mechanism in the Spring® column regulates the pressure level and compensates for the bed consolidation that is often observed under high flow conditions. The Spring® column mechanism continually forces the piston onto the media bed so that, as the volume occupied by the media gradually decreases, the piston advances to eliminate void formation before it develops.

The MODcol® Spring® column is able to maintain its performance for *thousands of injections* and thousands of hours of operation, well beyond the normal lifetime expectation for traditional columns.

The Spring® Column's reliable performance reduces uncertainties associated with premature column failure and process down-time. For those who desire to use Spring® column technology and all of its advantages, but don't want to be involved in column packing, Grace also offers prepacked Spring® columns and repack services.

MODcol® Spring® columns stand out on the market today as ready-to-use Dynamic Axial Compression Columns! If you do not need frequent repacking of your column hardware — why worry about the packing process when you can directly access a portable and effective DAC column by calling Grace or your local Grace distributor?

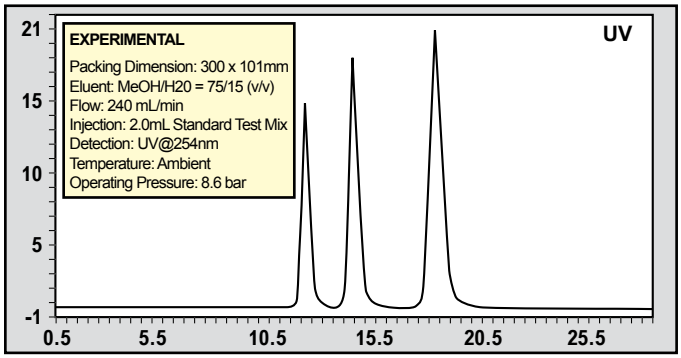
Spring® Columns offer Performance and Reproducibility

Spring® columns provide excellent efficiency, outstanding reproducibility and extended lifetimes in 25mm, 50mm and 101mm internal diameter versions. The ability to pack any bed length between 50 and 300mm and the advantages of the spring-driven DAC mechanism provide a high performance, adaptive solution for both product development and demanding process chromatography environments.

The Flexibility of the Spring® Column Design Makes It Suitable for Any Media

Spring® columns can be optimized for many stationary phases with 5µm or larger particles based on silica or polymer beads. This is made possible by a wide selection of springs having different force constants. Each is able to exercise just the right pressure for a particular type of media and flow rate. The Spring® Columns can be purchased with an integral water jacket, making them ideal for use with separations that require careful temperature control.

Efficiency Test of Vydac® 218TPB1520 Media Packed in a 101mm (4") i.d. Spring® Column



Peak Table

Signal	No.	Substance	Ret. Time	Height	Peak Area	Plate Count	Asymmetry
UV	1	Toluene	12.33min	20.33	525.94	5062	1.275
	2	Naphthalene	14.57min	25.00	826.91	4389	1.275
	3	Biphenyl	18.43min	27.77	1235.82	3914	1.294

PACKING CONDITIONS

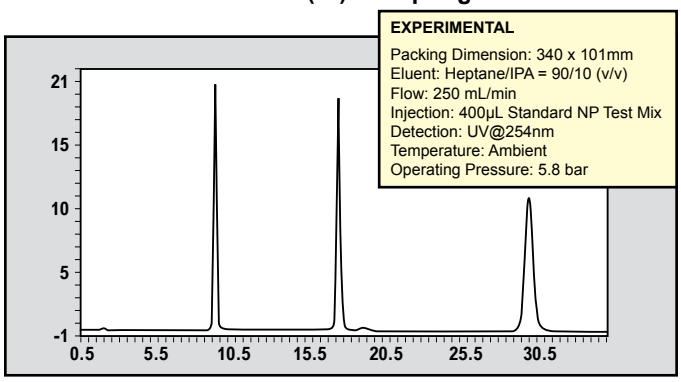
Hardware: MODcol® Spring® column, 101 x 700mm (CE)
Frit Type: 1µm/60µm Double Density (sintered metal)
Packing Device: MODcol® 4" Multipacker® instrument (Mod. 2006)
Media Type: Vydac® 218TPB1520 silica
Media Lot: E070901-1-2
Media Weight: 1300g
Slurry Solvent : 4600mL IPA/H_2O = 80/20 (v/v)
Packing Pressure: 30 bar (system : 70 bar)
Packing Speed: medium (approx. 2mm/sec)

EFFICIENCY [plates/meter]

Toluene: 16873 p/m
Naphthalene: 14630 p/m
Biphenyl: 13047 p/m

The chromatogram shows the excellent performance parameters and peak shape of a 300mm x 101mm (4") i.d. Spring® column packed with Vydac® 218TPB 1520 media. The Spring® column technique is the preferred choice to pack sensible media as well as rigid silica based separation media. Due to the smooth and gentle packing procedure you can get superior performance and longer lifetime for your columns. By having a fully mobile dynamic axial compression (DAC) column you can pack an additional column in the MP instrument while using the first one in DAC mode on a common HPLC system.

Efficiency Test of Irregular Davisil® 710N2OH (10-14µm) Media Packed in a 101mm (4") i.d. Spring® Column



Peak Table

Signal	No.	Substance	Ret. Time	Height	Peak Area	Plate Count	Asymmetry
UV	1	Toluene	9.33min	20.71	210.75	15576	1.250
	2	2-Chlorophenol	17.38min	19.43	398.86	14212	1.152
	3	4-Nitrophenol	29.81min	11.48	469.65	11569	1.119

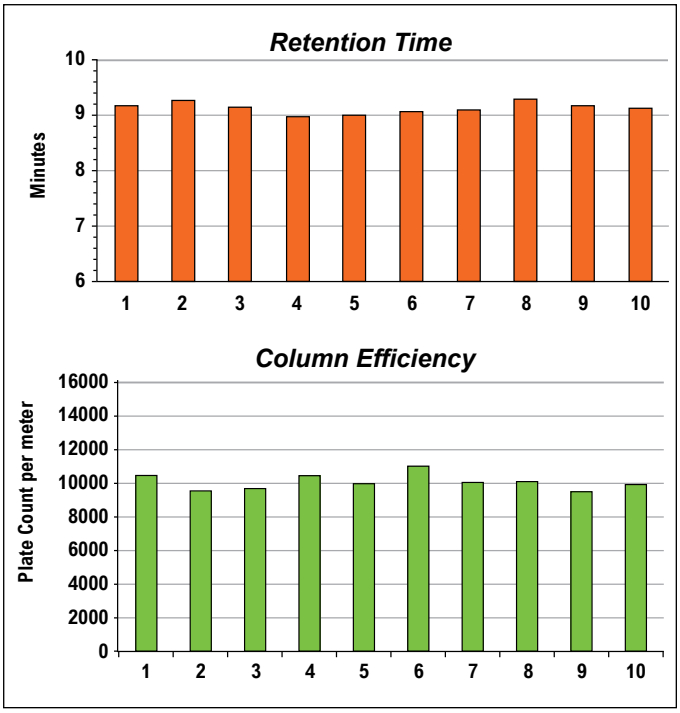
PACKING CONDITIONS

Hardware: MODcol® Spring® column, 101 x 700mm
Frit Type: 5µm Double Density
Packing Device: MODcol® 4" Multipacker® instrument (Mod. 2006)
Media Type: Davisil® 710N2OH (10-14µm) silica
Media Weight: 1315g
Slurry Solvent : 4000mL Isopropanol
Packing Pressure: 43 bar (system : 65 bar)
Packing Speed: 0.2cm/sec.

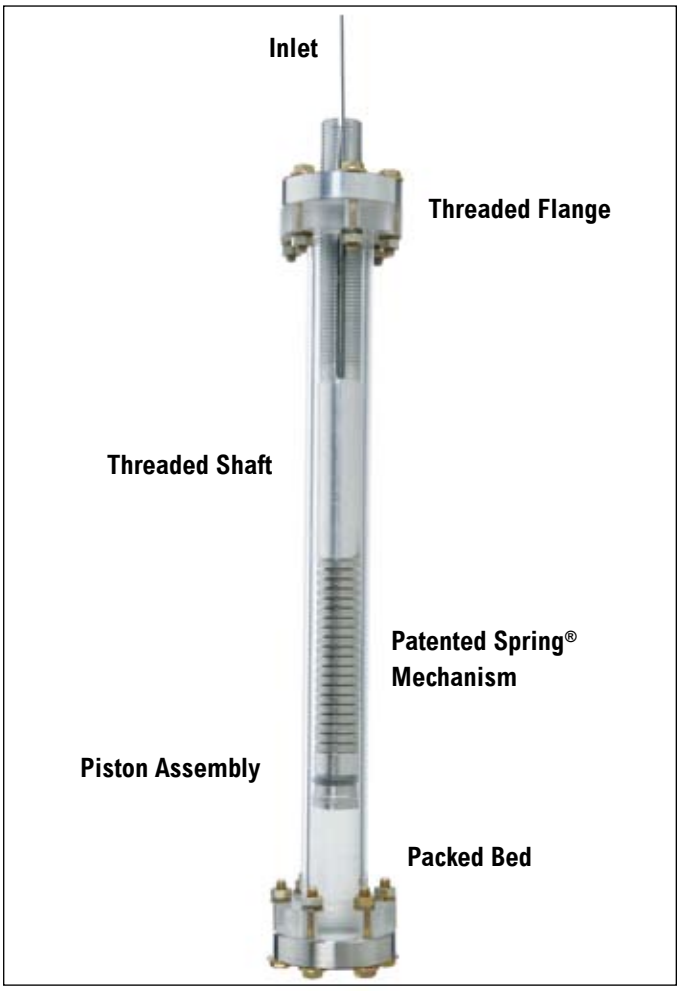
EFFICIENCY [plates/meter]

Toluene: 45812 p/m
2-Chlorophenol: 41800 p/m
4-Nitrophenol: 34027 p/m

Especially with irregular silica based separation media like Grace's Davisil® grades, the Spring® column technology shows excellent results and superior performance parameters. The chromatogram shows a separation on a 340mm x 101mm i.d. (4") Spring® column packed with irregular Davisil® 710N2OH media. With the combination of a high purity irregular silica and the unique Spring® column technology you can get separation results close to those currently achieved with spherical silicas only. An additional benefit is that you have a fully mobile column with an internal DAC mechanism up to 101mm (4") i.d. dimensions.



The gentle packing mechanism and the permanent, constant pressure on the packed bed result in a higher performance of the column. Additionally this higher performance can be kept for a longer period of time. This helps reduce costs of separation.



The MODcol® Spring® column principle - a patented, internal tension mechanism provides a constant pressure onto the gel bed after packing. This makes the column mobile without losing the advantages of a DAC packing.

MultiPacker® Packing Stations for Spring® Columns

When combined with the MultiPacker® instrument, the Spring® column provides the ultimate solution for in-house column packing. The MultiPacker® Instruments allow users to pack and unpack MODcol® Spring® columns quickly, conveniently, and easily in minutes. In this way, the user is able to reconfigure the Spring® column and repack as needed to address needs in real time.

The MultiPacker® instrument and Spring® column concept is extremely versatile because the packing system is physically separated from the column and its internal DAC subsystem. This means that many columns can be packed and maintained with just one MultiPacker® instrument — and only one MultiPacker® instrument is necessary to pack both 25mm and 50mm i.d. columns or 50mm and 101mm i.d. columns.

Because of its design, the Spring® column is an economical solution and a simple calculation can show that the Spring® column, when repacked with the MultiPacker® instrument, can be less expensive than traditional columns, even when those are being repacked by the manufacturer.

Another powerful dimension to the flexibility of the MultiPacker® instrument and Spring® column combination is the ability to respond almost instantaneously to unforeseen problems. The ability to pack a column on demand provides several distinct advantages for a facility that does not already have this capability. Having control over the timing and production of LC columns is an extremely attractive feature for scientists who like to roll up their sleeves and participate in column packing. This gives the chromatographer an extremely powerful and easy-to-use tool for developing in-house solutions. The ability to respond to an unplanned situation in a matter of minutes can pay for the cost of the MultiPacker® instrument and Spring® column. The MultiPacker® instruments and Spring® columns are an ideal and flexible system for use with process development, prep and process scale purifications, and also simulated moving bed (SMB) applications.

MODcol® MultiPacker® Instruments — Safety and Ease of Use

Because it employs a pneumatic packing mechanism, the MultiPacker® instrument for 25mm and 50mm Spring® columns uses no electrical power, making it safe for work with many types of solvents and a good column for hazardous environments. This also applies to the MultiPacker® instrument for 50mm i.d. and 101mm i.d. Spring® columns, which features an air-driven hydraulic system.

Other typical hydraulic packing systems on the market do not feature the damping devices provided in the MultiPacker® instrument. Therefore, the media — especially sensitive large pore media — can suffer from pressure peaks created by the hydraulic pumps. Particle breakage results from those pressure peaks, leading to high back pressures, loss of efficiency, and poor peak shape. Also, the packing speed and the packing pressure of those traditional systems may not be controllable independently, as possible with the MultiPacker® instrument systems.

The MultiPacker® instrument for 25mm and 50mm Spring® columns can overcome this problem by using a pneumatic packing system, combined with a hydraulic damping circuit. This combination allows a very smooth packing operation without any pressure peaks, and with the packing speed being completely independent from the chosen packing pressure.

The 1" and 2" MODcol® MultiPacker® instrument is able to pack 25mm i.d. (1") and 50mm i.d. (2") Spring® columns with high performance. The packer has a high safety standard, and can be used in explosion-hazard areas. The ease of use results in reproducible column packing, nearly operator independent. This makes the MODcol® MultiPacker® instrument the ideal choice for column self packing needs in the pharmaceutical industry.

The MultiPacker® instrument for 50mm i.d. and 101mm i.d. Spring® columns can also control the packing speed independently from the packing pressure. To help avoid pressure peaks that could harm the media, this air-driven hydraulic system features a sophisticated damping circuit that allows smooth and gentle packing of nearly all available chromatography media.

The 2" and 4" MODcol® MultiPacker® instrument is able to pack 50mm i.d. (2") and 101mm i.d. (4") Spring® columns with the same principle and performance as the 1"-2" MultiPacker® instrument. Both instruments have state of the art safety features and are designed to work in modern pharmaceutical lab and production environments. They are nearly maintenance free and easy to handle with very little training required.

Both MultiPacker® instruments are easy to use, require very little training to operate, and are virtually maintenance-free. They have both been approved by the TÜV Rheinland according to the EU machinery directive, are fully CE-certified, and come with an ATEX® exclusion that states their suitability to be safely operated in explosion-hazard areas.

Preparation for column packing is simple and straightforward; the packing process itself is very simple and can typically be performed in only a few minutes. Unpacking of the hardware and the cleaning process for the parts before re-packing are also easy to do.

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