



PROCESS-SCALE CHROMATOGRAPHY

Bio-Rad® InPlace™ Columns

- Closed system design
- Ideal for dense media
- Adjustable height adaptor for axial compression
- Designed for multiple packing methods
- No resin loss during packing
- Low mechanical shear during media transfer
- Hoist-free operation with the Bio-Rad® MainFrame™ lifting accessory
- Complete documentation for regulatory submissions
- Adaptable diameter up to 2 m

Perform All Process Operations in a Self-Contained System to Save Buffers and Time

Bio-Rad InPlace process-scale chromatography columns are designed for industrial applications and allow contained filling, packing, unpacking, and cleaning in place. The columns have a sanitary design, variable height adaptor, inflatable seal, and special low-shear valves for safe slurry transfer.

The Bio-Rad InPlace columns have been designed so that the packing, unpacking, and cleaning-in-place features do not interfere with the bed support, distribution system, and column tube, thus allowing optimum performance during any operation. These columns are directly scalable and

retain the same general design from pilot to manufacturing scale. For instance, slurry valves can be added or removed to correlate with column diameter so that the efficiency of packing and unpacking in place is kept across the entire range of dimensions.

Bio-Rad InPlace columns are available in many standard sizes and columns can be built in any tube height up to 1,200 mm or any diameter up to 2 m. The scale and scope of a project will seldom pose a constraint. Bio-Rad InPlace columns are available with glass, stainless steel, or acrylic column tubes.



Bio-Rad InPlace column with control console.



Optimal Column Performance

An All-In-Place System

The Bio-Rad InPlace column is designed to be operated with the Bio-Rad media transfer device to enable:

- Cleaning in place of all wetted surfaces before column packing or unpacking
- Even distribution of the slurry over the column diameter during transfer
- Reslurrying in place before unpacking
- Unpacking in place
- Cleaning in place of the column
- Maintenance in place using the Bio-Rad MainFrame lifting accessory

General Handling

To pack the column, the variable height adaptor is raised to its highest position, and slurried medium is pumped through the slurry valves into the column. The low-shear

valves are specially designed to minimize damage to chromatography media during transfer. Buffer or slurry can be pumped through the slurry valves to maintain agitation, thereby reducing settling, if necessary. For optimal bed quality, the column is then axially compressed, flow packed, or packed by a combination of both. The slurry valves can be rinsed while the column is packed to prepare for unpacking.

Before the unpacking operation begins, the bed is reslurried in the upflow/downflow mode or by air sparging, while the piston is raised to its highest position. The slurry is then pumped out through the slurry valves, and when it is unloaded completely, the cleaning jets can be used to rinse the column. The powerful jets ensure that no medium or residue remains on any contact surface and help to sanitize the column.

Specifications*

Nominal internal diameter, mm**	Actual internal diameter, mm	Motorization available	Maximum pressure at 30°C, bar		
			Calibrated borosilicate glass	Stainless steel 316L***	Acrylic***
180	180 ± 2	Yes	5.2	6.0	6.0
200	200 ± 2	Yes	4.7	6.0	6.0
250	250 ± 2	Yes	3.8	6.0	6.0
300	296 ± 2	Yes	3.6	6.0	6.0
350	350 ± 2	Yes	—	6.0	6.0
400	400 ± 2	Yes	—	6.0	6.0
450	446 ± 2	Yes	2.4	6.0	6.0
500	500 ± 2	Yes	—	6.0	6.0
600	596.5 ± 2	Yes	—	6.0	6.0
700	700 ± 2	Yes	—	3.0	3.0
800	800 ± 2	Yes	—	3.0	3.0
1,000	1,000 ± 3	Yes	—	3.0	3.0
1,200	1,200 ± 3	Yes	—	3.0	3.0
1,300	1,300 ± 3	Yes	—	3.0	3.0
1,400	1,400 ± 3	Yes	—	3.0	3.0

* Standard tube heights available: 600 and 900 mm.

** Columns with internal diameters >1,400 mm are available on request.

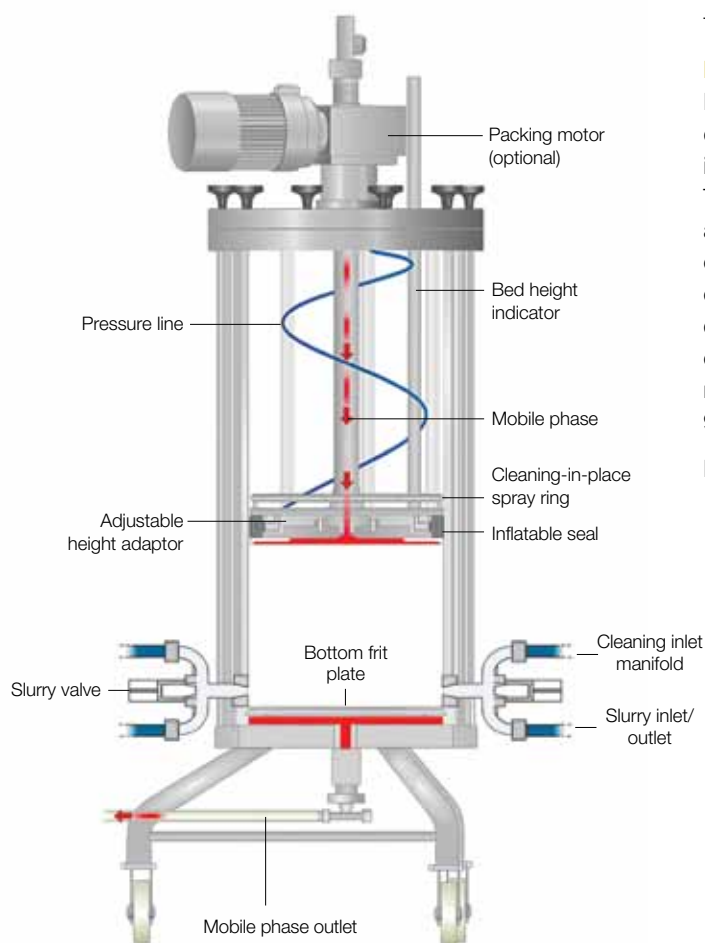
***Higher pressure rating can be quoted on request.

— Not available.

Variable Height Adaptor and Optional Packing Motor

Bio-Rad InPlace columns use a variable height adaptor with an adjustable central screw mechanism. This design fits any column diameter from pilot to manufacturing scale. The adaptor allows either axial compression or flow packing, or a combination of both, while the central screw mechanism allows simple yet precise adjustment of the bed height.

Bio-Rad offers optional packing motors for all column diameters. A motor is strongly recommended for column diameters >180 mm. The use of a Bio-Rad packing motor allows automatic movement (upward and downward) of the adaptor and controllable speed axial compression packing, which makes packing reproducible, easier, and faster.



Schematic drawing of Bio-Rad InPlace column*.

* US patent #7,718,058.

Flow Distribution System

The adaptor and bottom endpiece of Bio-Rad InPlace columns comprise a unique flow distribution system that enhances packing and operational performance.

The standard filter is stainless steel with 20 µm nominal porosity for uniform flow and minimal product retention. The distributor plate directs the flow across the filter quickly and evenly. This combination of distributor plate and filter ensures optimal, uniform flow distribution across the bed and through the column at any flow rate.

Inflatable Seal

The design of the Bio-Rad InPlace adaptor seal provides added security against leakage and inefficient packing by ensuring uniform pressure throughout the seal. All columns have a pressure line through which the seal can be inflated with compressed gas (air or nitrogen). If preferred, a liquid pump can be installed so that inert fluids can be used for inflation instead of gas.

Regulatory Support and Quality Assurance

Bio-Rad's manufacturing procedures mandate full documentation of each step and every component in compliance with U.S. and European regulations. The original documentation and one electronic copy are included with each column. Bio-Rad maintains controlled copies. Bio-Rad InPlace chromatography columns are manufactured in compliance with engineering standards for pressure vessels, and each column comes with CE certification. The Bio-Rad manufacturing facility is certified according to ISO 9001:2008 standards.

Manufacturing files for each project include:

- Engineering drawings
- Material traceability
- Weld report and welder qualifications
- Cleaning, electropolishing, and passivation certificates
- User manual and maintenance instructions
- Spare parts list
- Documentation for equipment from other vendors
- Factory acceptance test (FAT)

InPlace Control Console

The Bio-Rad InPlace control console simplifies column operations by using preprogrammed methods for column filling, packing, unpacking, and cleaning to ensure reproducibility, reduce operator hands-on time, and eliminate operator variances.

The packing motor is controlled by the variable frequency drive of the control console and ensures precise packing speed and bed-height adjustment at each step of the procedure.

User-friendly Software

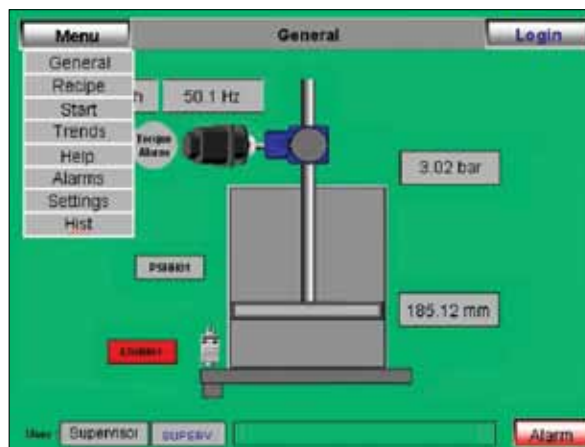
Methods can be programmed and saved by setting the settled bed-height of the media, the speed of the adjustable height adaptor, and by programming the compression-factor, which is characteristic for each type of chromatography media. The software ensures that parameters of all available chromatography media can be programmed.

Packing the column by axial compression, flow, or a combination of both is supported in the menus of the software.

For more information about the InPlace control console, request bulletin 6042.

Benefits of the Control Console

- A user-friendly touch screen interface
- Preprogrammed methods in automatic mode for time savings and reproducible packing results
- Choice of programming media transfer in syringe mode or by using the media transfer device
- Easy-to-use preprogrammed piston height adjustment
- A safety system for automatic shutoff when reaching preset pressure limits, piston positions, linear speed (in cm/hr), or torque
- Recognition and control of up to 3 different column diameters in ranges of up to 400 mm or >450 mm
- Software that is U.S. FDA 21 CFR Part 11 compliant
- Data accessibility through ethernet connections
- Onboard maintenance and inspection guide with easy-to-follow, step-by-step instructions



Software controller main screen.



**Bio-Rad
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