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# Preparative, Pilot & Process Columns

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## Introduction

### Columns for Preparative Chromatography

YMC is one of the very few global suppliers in the market that meet all demands in preparative scale chromatography. Our ambition is to provide chromatographic solutions for any compound from its discovery through scaling-up into production and its quality control in the lab. We therefore offer one of the world's largest portfolios of selectivities, designed to handle even the most demanding separations, as well as providing support, chromatographic tools and technical assistance.

### Production Capacity

The substantial investments into facilities and staff represent YMC's ongoing commitment towards high quality products and technical support: YMC's state-of-the-art silica production facilities allow large Lot sizes of more than 500 kg/Lot. For many years Lots of even more than 200 kg of bonded silica have become routine operations. The annual capacity of YMC's production plants amounts to double digit tons of spherical silica.

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# Preparative HPLC Columns



- direct scale up from analytical and semiprep YMC-Pack columns
- standard column diameters: 50, 70, 100, 150 and 200 mm
- standard column lengths: 250, 300, 500, 1,000 mm
- pressure rated up to 2,000 psi
- matching guard columns available



## Broad range of column dimensions

YMC-Pack preparative columns, packed with YMC\*Gels, are available in a broad variety of column sizes to accommodate virtually any preparative separation. YMC use a high-pressure slurry technique to pack all preparative columns in optional 1,000 or 2,000 psi pressure rated hardware. Standard column dimensions range from 50 to 200 mm inner diameter and 250 to 1000 mm in length. Other column sizes will be available, please request a quotation.

## Guard columns for YMC-Pack preparative columns

YMC strongly recommends the use of guard columns in order to extend column life.

Matching YMC-Pack preparative guard columns are available for all the standard column sizes in either 50, 100 or 200 mm in length, depending on the i.d..

| mm i.d. | 50 mm length | 100 mm length | 200 mm length | 250 mm length | 300 mm length | 500 mm length | 1000 mm length |
|---------|--------------|---------------|---------------|---------------|---------------|---------------|----------------|
| 50      | ✓            | ✓             | —             | ✓             | ✓             | ✓             | ✓              |
| 70      | —            | ✓             | —             | ✓             | ✓             | ✓             | ✓              |
| 100     | —            | ✓             | —             | ✓             | ✓             | ✓             | ✓              |
| 150     | —            | —             | ✓             | —             | ✓             | ✓             | ✓              |
| 200     | —            | —             | ✓             | —             | —             | ✓             | ✓              |

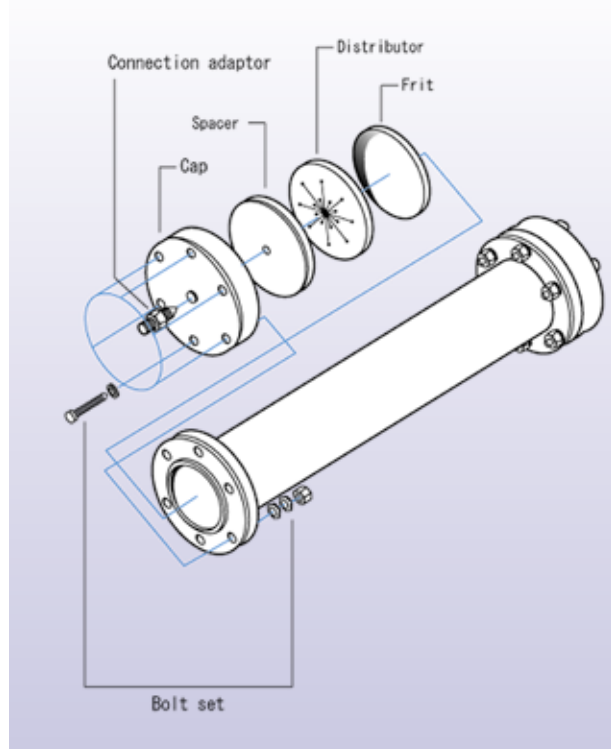
Guard columns are marked in red. Other dimensions are available. Please request a quotation.

# Preparative HPLC Columns

## Distributor-frit assembly design

The flanged stainless steel hardware of the YMC-Pack preparative columns contains a high efficient distributor-frit assembly that permits uniform distribution of sample across the entire diameter of the column bed. This allows maximum sample loading through optimised use packed bed. Similarly eluent flow is directed uniformly across the entire column diameter providing exceptional peak symmetry.

## Specification of empty flange-type column



## Quality assurance

All YMC-Pack preparative columns are subject to an individual chromatographic test and have to meet stringent specifications which ensure excellent column performance and column-to-column reproducibility.

A Column Test Report is included with each YMC-Pack preparative column specifying the theoretical plate number and asymmetry factor. All YMC-Pack columns are guaranteed to perform as shown in its Column Test Report.

## Convenient scale up

Separations developed on YMC-Pack analytical or semi-preparative columns can be directly scaled up to preparative size YMC columns with pre-configured scale-up column kits. Each scale-up kit consists of one 4.6 mm i.d. scout column and one or more preparative columns packed from the very same lot of bonded phase. By excluding any variation in the packing material, this method provides the opportunity to verify analytically obtained results in semi-preparative or preparative scale. Important parameters like loadability and yield can be easily determined using a 4.6 mm i.d. scout column. Being packed with the same gel lot and therefore showing exactly identical specifications, preparative columns included in the scale-up kit allow the reproducibility of the results in larger scale to be demonstrated.

As a result, YMC scale-up kits provide the ultimate assurance that a chromatographic separation developed on YMC scout columns can be transferred to semi-preparative, pilot or production scale without method modification ... Guaranteed.

# Dynamic axial compression Columns



## For preparative liquid chromatography

Nowadays preparative liquid chromatography is the method of choice for obtaining high value products in the pharmaceutical and biotechnological industries. By means of further developments and innovations in column technology, liquid chromatography has developed over recent years into an established and economically useful process technology.

### Working Principle

In all dynamic axial compression (DAC) columns, a hydraulic jack operates a piston that moves inside the chromatographic column. The piston is used to maintain a controlled dynamic pressure on the chromatographic bed during column operation as well as being used for packing and unpacking operations. The DAC system allows fast column packing of virtually any kind of packing material and assures excellent bed stability, reproducibility and efficiency in pilot or production columns.

YMC offers two types of column design to meet our customers' specific process and site requirements:

**DAU-Columns:**  
This type of DAC chromatographic column is mounted on top of the hydraulic jack; the column bed is compressed by dynamic axial compression in the upward (DAU) direction. This assembly allows convenient packing either automatically via the slurry inlet near the bottom of the column or manually by dismantling the column top.

YMC DAU-Columns are available in two standard maximum bed lengths of 400 and 600 mm with inner diameters ranging from 50 to 600 mm and a pressure rating of 5 to 10 MPa (725 to 1450 psi). Versions with longer column beds are available on request.

### DAD-Columns:

The hydraulic jack is mounted on top of this series of chromatographic columns and pressurizes the column bed by dynamic axial compression in the downward (DAD) direction. The DAD-column can be packed automatically via the slurry inlet near the top of the column and can be easily unpacked by pushing the column bed through the lower column lid.

Due to the compact design of this assembly the maximum chromatographic bed length is limited to 300 mm. DAD-Columns are available with inner diameters ranging from 100 to 450 mm and with pressure ratings of 5 to 10 MPa (725 to 1450 psi).

Options such as designed to meet specific user requirements as well as additional features slurry vessels, slurry inlets or double jackets for heating / cooling purposes are available on request.



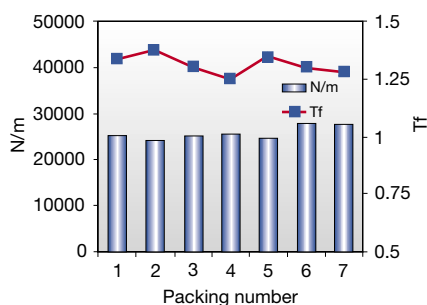
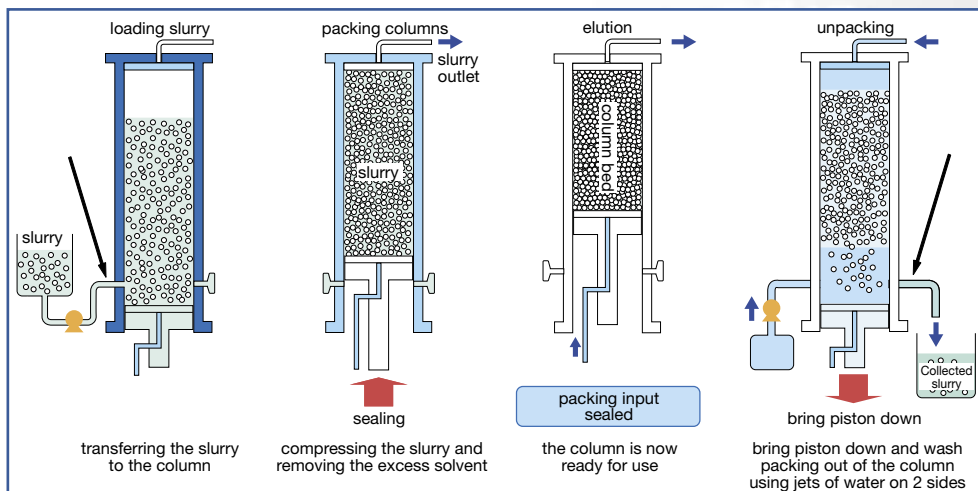
DAU 450 with slurry container



DAU 500

# Dynamic axial compression Columns

## Packing DAU columns



Where:

N/m = plate count

Tf = tailing factor at 10% peak height

## Reproducibility of column efficiency

### Packing conditions

Packing material: YMC ODS-A 15  $\mu$ m, 12 nm  
 Weight of packing material: 250 g  
 Column: DAU 50-700  
 Column bed size: 50 mm i.d. x 200 mm  
 Packing pressure: 6.4 MPa  
 Slurry solvent: 100% methanol  
 Concentration of slurry: 35%

### HPLC conditions for column inspection

Sample: toluene + methyl benzoate  
 Flow rate: 50 ml/min  
 Temperature: ambient  
 Detection: UV at 254 nm  
 Eluent: methanol / water = 85/15

The specifications given here describe standard systems. To meet specific user needs, alternatives can be offered on demand.

| Model        | Column ID [mm] | Column length [mm] | Max. bed length [mm] | Max. bed volume [L] | System height [mm] | Max. pressure [MPa] / [psi] |
|--------------|----------------|--------------------|----------------------|---------------------|--------------------|-----------------------------|
| DAU 50-700   | 50             | 700                | 400                  | 0.8                 | 2.200              | 10 / 1450                   |
| DAU 50-1000  | 50             | 1000               | 600                  | 1.2                 | 2.800              | 10 / 1450                   |
| DAU 100-700  | 100            | 700                | 400                  | 3.1                 | 2.300              | 7 / 1015                    |
| DAU 100-1000 | 100            | 1000               | 600                  | 4.7                 | 2.900              | 7 / 1015                    |
| DAU 150-700  | 150            | 700                | 400                  | 7.1                 | 2.400              | 7 / 1015                    |
| DAU 150-1000 | 150            | 1000               | 600                  | 13.2                | 2.900              | 5 / 725                     |
| DAU 200-700  | 200            | 700                | 400                  | 12.6                | 2.400              | 7 / 1015                    |
| DAU 200-1000 | 200            | 1000               | 600                  | 18.8                | 3.000              | 5 / 725                     |
| DAU 300-700  | 300            | 700                | 400                  | 28.3                | 2.700              | 7 / 1015                    |
| DAU 300-1000 | 300            | 1000               | 600                  | 42.4                | 3.200              | 5 / 725                     |
| DAU 450-700  | 450            | 700                | 400                  | 63.3                | 3.100              | 7 / 1015                    |
| DAU 450-1000 | 450            | 1000               | 600                  | 95.4                | 3.500              | 5 / 725                     |
| DAU 500-700  | 500            | 700                | 400                  | 78.5                | 3.100              | 7 / 1015                    |
| DAU 500-1000 | 500            | 1000               | 600                  | 117.8               | 3.500              | 5 / 725                     |
| DAU 600-700  | 600            | 700                | 400                  | 113                 | 3.100              | 7 / 1015                    |
| DAU 600-1000 | 600            | 1000               | 600                  | 169.6               | 3.500              | 5 / 725                     |

Parts that make contact with the media are made of: 316 L stainless steel, PTFE, PFA Swagelok® connections.

Optional accessories (e.g. slurry container, heating/cooling casing) are available on demand.

# Pilot Columns

- **biocompatible**
- **solvent resistant version available (optional)**
- **height adjustable plunger**
- **heating/cooling jackets available (optional)**
- **custom made for each application**
- **full stainless steel versions with extended pressure ratings available**



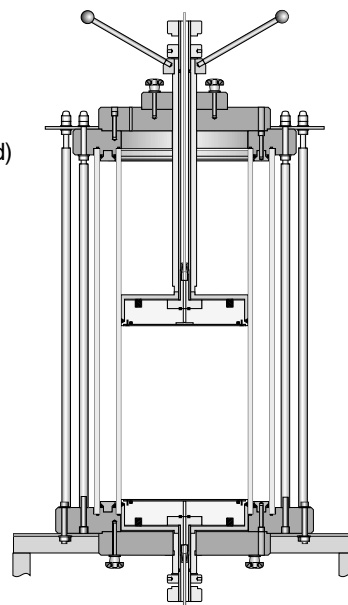
## General

Pilot columns are designed for use in pilot and production scale applications with organic solvents (version SR) or aqueous buffers (version AB), which makes them suitable for all common methods in chromatography including normal phase, reversed phase or biochromatography. High precision CNC manufacturing of plungers and distribution plates provides outstanding flow distribution which gives a linear flow distribution profile. Precise and reliable bed height adjustment is achieved by hand wheel adjusters on the plunger. A range of mounting options is available including fixed stands, wheeled trolley, or direct connections into plant.

All materials are in compliance with FDA regulations. Certification and full documentation is available for validation purposes. The use of borosilicate glass and a completely metal-free construction guarantees maximum hygiene standards (no unrinsed areas, no dead volumes).

## Characteristics

|                           |                                                                                                                                      |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Column body:</b>       | calibrated borosilicate glass, acrylic glass or stainless steel                                                                      |
| <b>Pressure limit:</b>    | depending on column body; 1-30 bar for glass columns, 50 bar for stainless steel columns                                             |
| <b>Temperature range:</b> | aqueous buffer version (AB): up to 40 °C<br>solvent resistant version (SR): up to 70 °C                                              |
| <b>Wetted parts:</b>      | borosilicate glass, stainless steel, PTFE or polyethylene<br>EPDM, Viton® or Kalrez® seals,<br>stainless steel or polyethylene frits |
| <b>Diameter:</b>          | 100 mm, 140 mm, 200 mm, 300 mm<br>(others on demand,<br>e.g. 450 mm, 600 mm, 800 mm)                                                 |
| <b>Lengths:</b>           | 400 mm, 750 mm (others on demand)                                                                                                    |
| <b>Connections:</b>       | stainless steel – SR version<br>or polyethylene – AB version                                                                         |



# Pilot Columns

## Applications

- gel permeation
- ion exchange
- hydrophobic interaction
- affinity
- reversed phase
- normal phase

**Areas of application:** AB Series columns are suitable for use with salts and detergents, ethanol and methanol, 6M urea, 7M guanidinium chloride, 2M NaCl and 3M ammonium sulphate.

The SR Series columns lend themselves to chromatography with silica gels and reversed phase materials as well as chiral stationary phases, which require the use of solvents such as methylene chloride, acetone, toluene, THF etc.

Flow distributor for  
PILOT glass columns



## Specifications

| Model*    | i.d.<br>[mm] | Bed height<br>[mm] | Volume |      | Cross section<br>[cm <sup>2</sup> ] | Max. pressure<br>[bar] |
|-----------|--------------|--------------------|--------|------|-------------------------------------|------------------------|
|           |              |                    | min    | max  |                                     |                        |
| PI100/400 | 100          | 100-400            | 0.78   | 3.1  | 78.5                                | 10                     |
| PI100/750 | 100          | 450-750            | 3.5    | 5.9  | 78.5                                | 10                     |
| PI140/400 | 140          | 100-400            | 1.5    | 6.1  | 154                                 | 7                      |
| PI140/750 | 140          | 450-750            | 6.9    | 11.5 | 154                                 | 7                      |
| PI200/400 | 200          | 100-400            | 3.1    | 12.5 | 314                                 | 4                      |
| PI200/750 | 200          | 450-750            | 14     | 23.5 | 314                                 | 4                      |
| PI300/400 | 300          | 100-400            | 7      | 28   | 706.5                               | 1.5                    |
| PI300/750 | 300          | 450-750            | 32     | 52   | 706.5                               | 1.5                    |

\*other models on demand, see characteristics on left page

## Components wetted by the media

| Series                    | Capillary inlet      | Frits           | Seal    | Column body | Temperature range |
|---------------------------|----------------------|-----------------|---------|-------------|-------------------|
| SR<br>(Solvent Resistant) | Stainless steel 1/4" | Stainless steel | Kalrez® | KPG glass   | 2 - 70 °C         |
| AB<br>(Aqueous Buffer)    | Polyethylene 1/4"    | Polyethylene    | EPDM    | KPG glass   | 2 - 40 °C         |

# Chromatography columns for pilot- and process scale

Glass and steel columns for aqueous-based (Version AB; Aqueous Buffer) or organic solvent applications (Version SR; Solvent Resistant).

Diameter 60 mm - 600 mm: column length according to guidelines application.

Custom made for each application and customer requirements.



Pilot column  
300 x 200 mm i.d.  
with cooling jacket,  
pivoting mount,  
with slurry tray  
for column unpacking.



Levelling guide to help you assemble the column correctly.



Notched wheels to fix a rotating column body.

# Chromatography columns for pilot- and process scale

In addition to standard versions, PILOT columns can also be adapted to the individual wishes of the user. Adaptable options include: inner diameter up to 600 mm, bed lengths up to 150 mm, the materials used, height adjustment of the piston and the mechanism of supporting the column (the stand, trolley, etc.). Please see the questionnaire on page 197 for the questions to be answered before a custom built PILOT column can be manufactured.



Column head of a stainless steel 1000 x 100 mm i.d. column, 50 bar, with swivelling column body.



600 mm i.d. column as a special reactor for coating processes. Integrated level indicators assist assembly / disassembly for maintenance purposes.



600 mm i.d. column, slurry outlet with separate tap, quadruple eluent outlet.