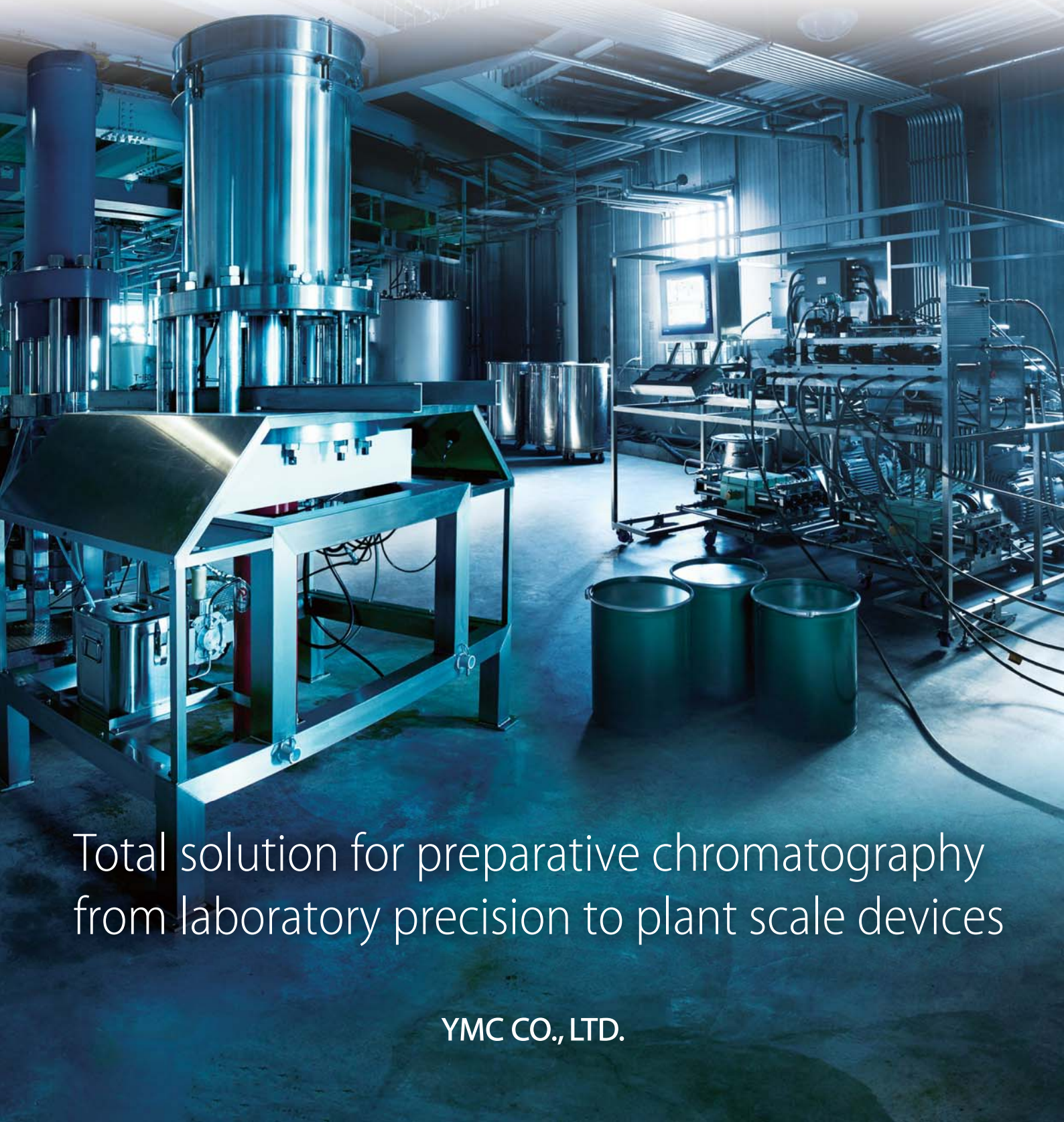
YMC

# PREPARATIVE CHROMATOGRAPHY

## PRODUCT LINEUP



Total solution for preparative chromatography
from laboratory precision to plant scale devices

YMC CO., LTD.

# Lead to the Future with YMC's Separation and Purification Technology

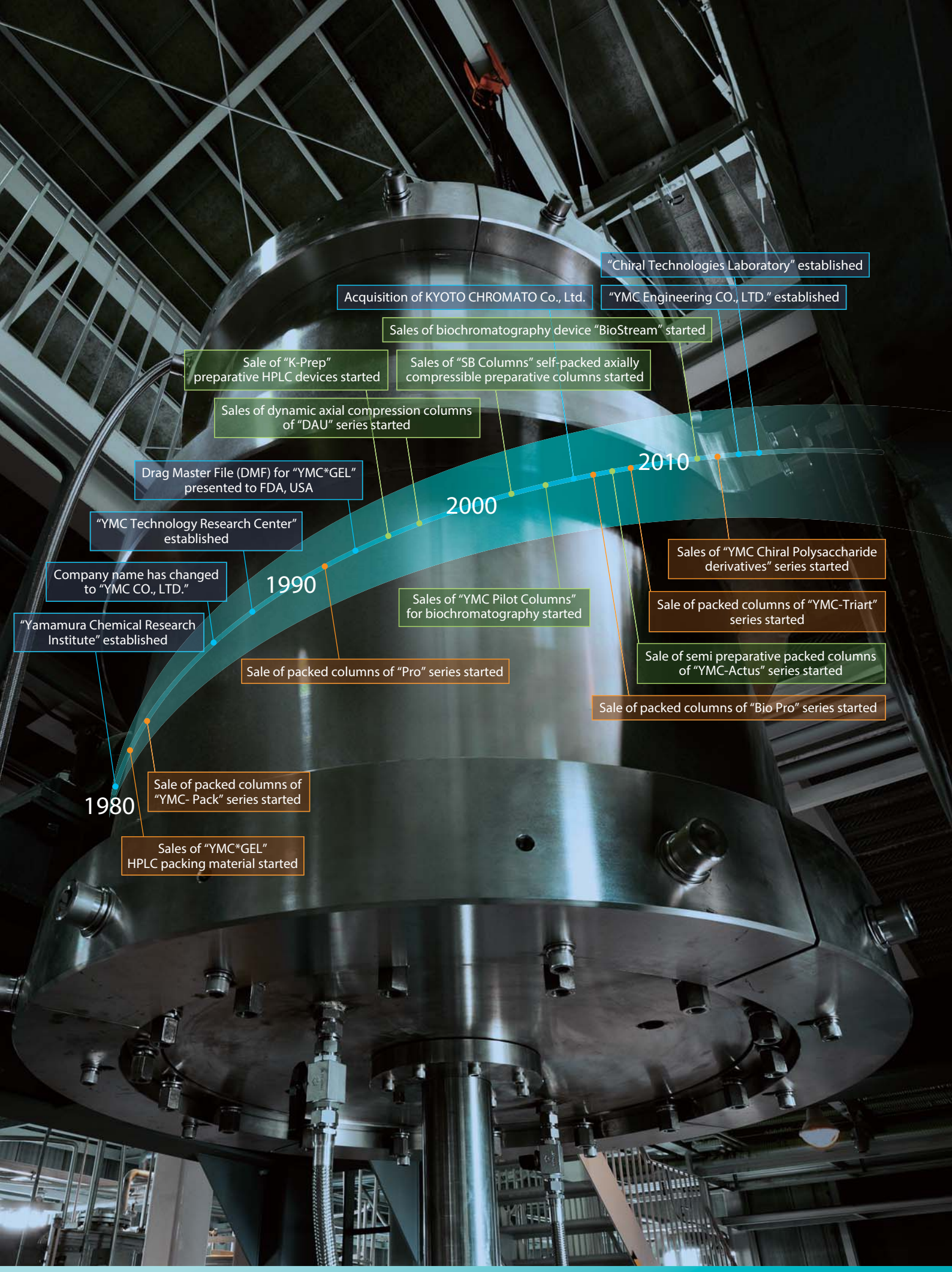
Preparative chromatography is an essential part of the scientist's toolkit for obtaining highly purified chemical substances. In order to use preparative chromatography effectively, there are many variables to consider when developing and as optimizing protocols. Since its formation in 1980, YMC CO., LTD. has been a pioneer in the field of preparative chromatography concentrating YMC efforts towards improved methods for the preparative purification of high value-added substances. YMC core competencies include detailed knowledge and resources dedicated to the development and production of high performance packing materials, columns, and packing technology. Introduction of new and innovative products has allowed YMC to enjoy a worldwide reputation as the leading supplier of technologies for the preparative chromatography marketplace.

YMC's solid foundation of knowledge and resources help it propose the most suitable packing materials and columns from our broad of product lineup as well as offer contract services for optimization and/or execution of separation conditions for preparative purifications. YMC is confident about proposing the best separation and purification methods.

YMC is also focusing on development and manufacturing of preparative chromatography devices at its facilities in Japan and provides devices which meet customers' needs. Maintenance and service after installation are ensured.

In 2013, YMC Engineering CO., LTD. was established and YMC is committed to develop and manufacture high quality hardware, software and consumable devices that provide fast and efficient solutions at laboratory, process development, and full production scale.


## CONTENTS


"Chiral Technologies Laboratory" established
"YMC Engineering CO., LTD." established
Acquisition of KYOTO CHROMATO Co., Ltd.
Sales of biochromatography device "BioStream" started
Sale of "K-Prep" preparative HPLC devices started
Sales of "SB Columns" self-packed axially compressible preparative columns started
Sales of dynamic axial compression columns of "DAU" series started
2010
Drag Master File (DMF) for "YMC*GEL" presented to FDA, USA
2000
"YMC Technology Research Center" established
Sales of "YMC Chiral Polysaccharide derivatives" series started
Company name has changed to "YMC CO., LTD."
1990
Sales of "YMC Pilot Columns" for biochromatography started
Sale of packed columns of "YMC-Triart" series started
"Yamamura Chemical Research Institute" established
Sale of semi preparative packed columns of "YMC-Actus" series started
Sale of packed columns of "Pro" series started
Sale of packed columns of "Bio Pro" series started
Sale of packed columns of "YMC- Pack" series started
1980
Sales of "YMC*GEL" HPLC packing material started

# Lineup of Preparative Devices

## Preparative HPLC Devices

| Name | Multiple Preparative HPLC Device | Preparative HPLC Devices | | | | Explosion Proof Preparative HPLC Devices | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LC-Forte/R | K-Prep LAB | | K-Prep FC | | K-Prep EX | | | |
| Model | LC-Forte/R | K-Prep LAB100S<br>K-Prep LAB100G | K-Prep LAB300S<br>K-Prep LAB300G | K-Prep FC750S<br>K-Prep FC750G | K-Prep FC1500S<br>K-Prep FC1500G | K-Prep EX03KS<br>K-Prep EX03KG | K-Prep EX06KS<br>K-Prep EX06KG | K-Prep EX12KS<br>K-Prep EX12KG | K-Prep EX25KS<br>K-Prep EX25KG |
| Appearance |  |  | |  | |  | | | |
| Flow rate range (mL/min) | 0.1 - 50.0 | 1 - 100 | 1 - 300 | 1 - 750 | 1 - 1500 | 30 - 3000 | 60 - 6000 | 125 - 12500 | 250 - 25000 |
| Device pressure limit (MPa) | 30 | 15 | 10 | 10 | | 10 | | 10 | |
| Dimension (W×D×H) | 500 × 500 × 400 mm | 800 × 600 × 650 mm | | 700 × 750 × 1250 mm | | 1100 x 1100 x 1300 mm | Please contact us. | | |
| Control software | LC-Forte/R Software<br>Forte Separa Ⅱ (Optional) | K-Prep Software | | | | | | | |
| GMP/CSV compliance | No | Yes | Yes | Yes | | Yes | | Yes | |
| Explosion proof type | No | No | No | No | | Yes | | Yes | |
| Feature | Recycle function<br>3 wavelengths measurable at a time | Equipped with injectors for preparative separation | | Equipped with HPLC pumps to load samples | | Custom made available | | | |
| See page | 12 | 13 | | 14 | | 15 | | | |

| Name | Semi Preparative Columns | Self-Packed Axially Compressible Preparative Columns | Dynamic Axial Compression Columns | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | YMC-Actus Series | SB Columns | DAU Series | | | | | | |
| Model | Please contact us. | Please see page 19. | DAU-50-700S | DAU-100-700S | DAU-150-700 | DAU-200-700 | DAU-300-700 | DAU-450-700 | DAU-600-700 |
| Appearance |  |  |  | |  | | |  | |
| Inner diameter ($\phi$, mm) | 20, 30 | 50, 70, 100<br>150, 200, 300 | 50 | 100 | 150 | 200 | 300 | 450 | 600 |
| Column length (mm) | 50, 75, 100<br>150, 250 | 250, 500<br>1000 | 700 | 700 | 700 | 700 | 700 | 700 | 700 |
| Pressure limit (MPa) | 30 | 10 - 2 | 10 | | | | | 7 | |
| Dimension (W×D×H) | — | — | 700 x 600 x 1800 mm | 700 x 600 x 1900 mm | 810 x 830 x 2100 mm | 900 x 950 x 2200 mm | 1000 x 1050 x 2300 mm | 1500 x 1400 x 2500 mm | 1800 x 1900 x 2800 mm |
| See page | 18 | 19 | 20 | | | | | | |

## HPLC Pumps

| K Series | | | |
|---|---|---|---|
| K-100 | K-300 | K-500 | K-1000 |
|  | | | |
| 1 - 100 | 1 - 300 | 1 - 500 | 1 - 1000 |
| 15 | 10 | 10 | 10 |
| 225 × 485 × 205 mm | | 380 × 550 × 220 mm | |
| LCD panel, Microcomputer control | | | |
| No | | | |
| No | | | |
| Standalone operation | | | |
| 17 | | | |

| Name | Optional device for DAU Series |
|---|---|
| | Slurry Container |
| Model | Please contact us. |
| Appearance |  |
| Corresponding device | DAU Series |
| Tank volume (L) | 2 - 250 |
| Connection | ISO sanitary ferrule |
| Feature | Mixing and filling slurry |
| See page | 21 |

# Preparative LPLC Devices

| Name | Biochromatography Devices | | | |
|---|---|---|---|---|
| | BioStream | | | |
| Model | BSTP-800 | BSTP-03K<br>BSTS-03K | BSTS-10K | BSTS-30K |
| Appearance |  | | | |
| Flow rate range (mL/min) | 1 - 800 | 1 - 3000 | 1 - 10000 | 1 - 30000 |
| Device pressure limit (MPa) | 0.5 (Max. 0.6) | | | |
| Dimension (W×D×H) | 800 × 900 × 1360 mm | 900 × 1100 × 1800 mm | 1200 × 1200 × 1800 mm | 2000 × 1500 × 1800 mm |
| Control software | BioStream Software | | | |
| GMP/CSV compliance | Yes | | | |
| Explosion proof type | No | | | |
| Feature | Sanitary design<br>3 wavelengths measurable at a time | | | |
| See page | 8 | | | |

| Name | Biochromatography Columns | | | |
|---|---|---|---|---|
| | YMC Pilot Columns | | | |
| Model | PI100/500<br>PI100/800 | PI140/500<br>PI140/850 | PI200/500<br>PI200/850 | PI300/500<br>PI300/850 |
| Appearance |  | |  | |
| Inner diameter ($\phi$, mm) | 100 | 140 | 200 | 300 |
| Column length (mm) | 500, 800 | | 500, 800 | |
| Pressure limit (bar) | 10 | 7 | 5 | 3 |
| Dimension (W×D×H) | — | — | — | — |
| See page | 10 | | | |

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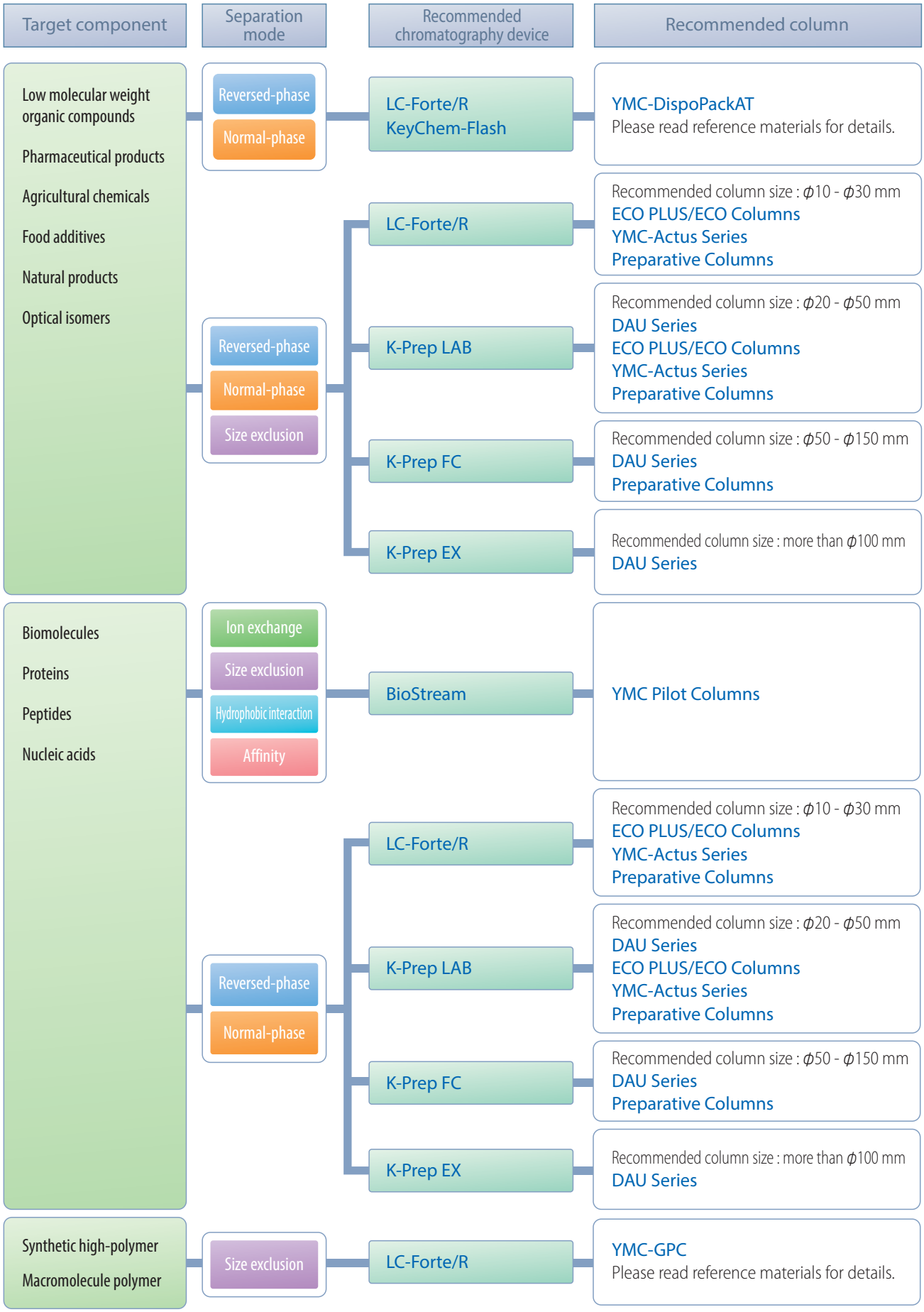
# GUIDE FOR SELECTING DEVICES



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# CHROMATOGRAPHY FOR PURIFICATION OF BIOTECHNOLOGY-BASED PHARMACEUTICALS

CONTENTS



Chromatography devices suitable for the purification of monoclonal antibodies, vaccine, protein purification, etc., as well as for large-scale GMP manufacturing are presented by YMC.
High performance ion exchange media allow us to provide total support on biotechnology-based pharmaceuticals.

# Biochromatography Devices

## BioStream

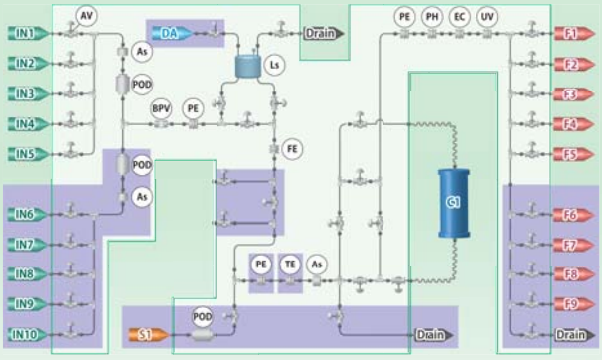
- Suitable for downstream processing for biopharmaceutical manufacturing
- Compliance with cGMP and made in Japan
- Sanitary design superior in cleaning
- Excellent operability provided by the largest 21.5-inch touch panel screen in this industry
- Low flow pumping provided by the quintuplex diaphragm pump *
- Compliance with IQ/OQ validation and CSV

* The pump for BSTP-800 is a triple diaphragm pump.

| Model | BSTP-800 | BSTP-03K | BSTS-03K | BSTS-10K | BSTS-30K |
|---|---|---|---|---|---|
| Max. flow rate (mL/min) | 800 | 3000 | 3000 | 10000 | 30000 |
| Device pressure limit (MPa) | 0.5 (Max. 0.6) | | | | |
| Ambient temperature (℃) | 5 - 30 | | | | |
| Wetted material | PFA, PTFE, Quartz, Glass, EPDM | | SUS316L, PTFE, Quartz, Glass, EPDM | | |
| Sensor | pH sensor, Conductivity sensor, Pressure sensor, Flowmeter sensor, UV sensor (3 variable-wavelengths measurable) | | | | |
| Other function | Air trap, Air sensor, Column bypass and Column switching | | | | |
| Control software | BioStream Software | | | | |
| Dimension (W×D×H) | 800 × 900 × 1360 mm | 900 × 1100 × 1800 mm | 900 × 1100 × 1800 mm | 1200 × 1200 × 1800 mm | 2000 × 1500 × 1800 mm |
| Weight (kg) | 200 | 250 | 300 | 400 | 600 |
| Utility | Single –phase 100 V (15 A) | Three-phase 200 V (20 A) | | Three-phase 200 V (30 A) | Three-phase 200 V (40 A) |
| | Instrument air, Dry air | | | | |

BSTP-800

## Flow diagram




| MARK | NAME |
|---|---|
| POD | Diaphragm Pump |
| AV | Air-operated 2way Diaphragm Valve |
| BPV | Back Pressure Valve |
| FE | Flow Sensor |
| PE | Pressure Sensor |
| EC | Electric Conductivity Meter |
| PH | pH Meter |
| UV | UV Sensor |
| TE | Thermometer |
| As | Air Switch |
| Ls | Level Switch |
| AT | Air Trap |
| IN | Inlet Port |
| DA | Air Port |
| F | Fraction Port |
| S | Sample Port |
| C | Column |

## Software

The large 21.5-inch touch panel screen provides high visibility and operability at production sites.
The operation screen has been designed for intuitive and visual operation.
Its main control screen provides operation status for control operation and monitoring information of each sensor instantly. (For more information, please refer page 16.)

BioStream is a biochromatography device and has been developed with YMC's experience and technology. This system is superior in operability, performance and quality and it achieves hygiene, speed and high purification which are required by the separation and purification of biotechnology-based pharmaceuticals.


BSTP-03K

BioStream

# Biochromatography Columns

## YMC Pilot Columns

- Biocompatible and ideal for use in purification of biotechnology-based pharmaceuticals such as proteins and peptides, etc.
- Unique frit design enables reduced losses in diffusion and uniform performance
- Easy scale-up, having the same structure and operability across different column sizes
- Packing bed height easily adjustable by hand wheeled adjusters
- Compliance with IQ/OQ validation and FDA regulations
- Various options available

140mm I.D. 200mm I.D.

YMC Pilot columns are biochromatography columns designed for use in pilot and production scale. All wetted parts are made of nonmetals. Column design and care in construction avoids causing extra dead volumes and serves to allow the column to be cleaned easily . YMC Pilot columns are available in AB type, which is suitable for applications with aqueous buffer and in SR type, which are designed for applications requiring solvent resistant. YMC Pilot columns are widely used from standard normal-phase/reversed-phase chromatography to use with resins designed for biochromatography.

| Model | Inner diameter (mm) | Packing bed height (mm) | Volume (L) min | Volume (L) max | Cross-section ($cm^2$) | Pressure limit (bar) |
|---|---|---|---|---|---|---|
| PI100/500 | 100 | 50-430 | 0.39 | 3.38 | 78.5 | 10 |
| PI100/850 | 100 | 400-780 | 3.14 | 6.13 | 78.5 | 10 |
| PI140/500 | 140 | 55-420 | 0.85 | 6.47 | 154 | 7 |
| PI140/850 | 140 | 405-770 | 6.23 | 11.9 | 154 | 7 |
| PI200/500 | 200 | 70-435 | 2.20 | 13.7 | 314 | 5 |
| PI200/850 | 200 | 420-785 | 13.2 | 24.7 | 314 | 5 |
| Other sizes (more than 300mm I.D.) are available upon request. | | | | | | |

450mm I.D.

02

# PREPARATIVE HPLC DEVICES

CONTENTS



Uniform "platform software" across different preparative devices, allows seamless transit from laboratory through development to plant scale.
YMC's preparative columns are dynamic axial compression columns that afford the highest efficiency and ease of use.

# Multiple Preparative HPLC Device

## LC-Forte/R

- Preparative device designed for both High-/Low- pressure chromatography Ideal for purification in the crude stage through to the final stage
- 3 variable-wavelengths UV detector available as a standard feature
- User friendly operation provided by touch input on graphic screen
- Compact design but equipped with multiple functions such as recycling function, automatic programming function, etc.
- Easy maintenance

The Only One!
HPLC + MPLC plus

Max. flow rate 50 mL/min
Device pressure limit 30 MPa
3 variable-wavelengths 200-400 nm
Low-pressure gradient
Recycling


The world's first HPLC preparative device, LC-Forte/R, has been designed and developed so that MPLC columns and glass columns can also be used.

| | Specification |
|---|---|
| Model | LC-Forte/R |
| Flow rate range (mL/min) | 0.1 - 50.0 |
| Device pressure limit (MPa) | 30 |
| Dimension (W×D×H) | 500 × 500 × 400 mm |
| Control software | LC-Forte/R Software *Please see page 16 for details. |
| Optional | Available detectors (UV+RI, RI, etc.) |
| | Fraction collector |
| | Software for PC |


Inside the device


Tubing connections

# Preparative HPLC Devices

## K-Prep LAB

- Automatic preparative purification device usable at laboratory scale provides strong support for exploratory research.
- All-in-one device equipped with preparative injectors and fraction collectors
- Fully-automatic operation by PC
- Easy maintenance provided by superior internal structure
- Seamless scaling-up to industrial scale

### K-Prep LAB100

Max. flow rate 100 mL/min | Device pressure limit 15 MPa | UV/VIS 195-600 nm | Gradient mode selectable

### K-Prep LAB300

Max. flow rate 300 mL/min | Device pressure limit 10 MPa | UV/VIS 195-600 nm | Gradient mode selectable


LAB 100S

K-Prep LAB is an easy to use preparative HPLC member of the K-Prep series prep HPLC's developed to achieve seamless scale-up. K-Prep LAB is an easy to learn tabletop preparative system designed for usage at laboratory scale.

| Mode | LAB100S | LAB100G | LAB300S | LAB300G |
|---|---|---|---|---|
| Gradient | No | Yes | No | Yes |
| Flow rate range (mL/min) | 1 - 100 | | 1 - 300 | |
| Device pressure limit (MPa) | 15 | | 10 | |
| Fraction collector | 20-channel drip method or 5-channel switching valve method | | | |
| Sample injection | Preparative autoinjector | | | |
| Detector | UV/VIS (195 - 600 nm) | | | |
| Control / Display | Notebook computer / Programmable logic controller | | | |
| Dimension (W×D×H) | 800 × 600 × 650 mm | | | |
| Control software | K-Prep Software | | | |

Inside the device

# Preparative HPLC Devices

## K-Prep FC

- Smooth transition from laboratory scale to industrial scale
- Usable for production purpose
- All-in-one device equipped with HPLC pumps to load samples and fraction collectors
- Strong support for preparative purifications provided by fully-automatic operation by PC
- Compliance with IQ/OQ validation and CSV

### K-Prep FC750

Max. flow rate 750 mL/min | Device pressure limit 10 MPa | UV/VIS 195-600 nm | Gradient mode selectable | CSV compliance

### K-Prep FC1500

Max. flow rate 1500 mL/min | Device pressure limit 10 MPa | UV/VIS 195-600 nm | Gradient mode selectable | CSV compliance

K-Prep FC is a preparative HPLC device that allows seamless scale-up from small scale production up to industrial scaling-up processes.

| Model | FC750S | FC750G | FC1500S | FC1500G |
|---|---|---|---|---|
| Gradient | No | Yes | No | Yes |
| Flow rate range (mL/min) | 1 - 750 | | 1 - 1500 | |
| Device pressure limit (MPa) | 10 | | | |
| Fraction collector | 5-channel switching valve method | | | |
| Sample injection | HPLC pump to load samples (1 - 300 mL/min) | | | |
| Detector | UV/VIS (195 - 600 nm) | | | |
| Control / Display | Notebook computer / Programmable logic controller | | | |
| Control software | K-Prep Software | | | |
| Utility | AC100V, 0.5 MPa dry air | | | |

# Explosion Proof Preparative HPLC Devices

## K-Prep EX

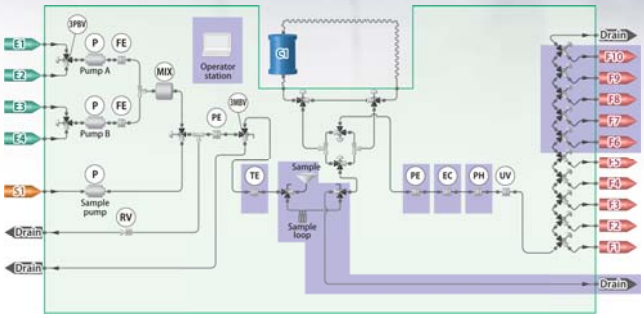
- Explosion proof device
- This explosion proof HPLC unit may be installed in a hazardous area and controlled from a safe area
- Operable at hazardous area by operation station (optional)
- Custom-made device available upon request
- Compliance with IQ/OQ validation and CSV
- Documentation maintenance feature allows for adjusting recordkeeping to meet your needs

EXPLOSION PROOF

Explosion proof | UV/VIS 195-600 nm | Gradient mode selectable | CSV compliance


K-Prep EX is an explosion proof HPLC preparative device designed for GMP manufacturing plants.

### Flow diagram




| MARK | NAME |
|---|---|
| E | Solvent Port |
| F | Fraction Port |
| S | Sample Port |
| P | Pump |
| C | Column |
| 3PBV | Pneumatic Drive 3way Ball Valve |
| 3MBV | Manual 3way Ball Valve |
| FE | Flow Sensor |
| MIX | Mixer |
| PE | Pressure Sensor |
| TE | Thermometer |
| UV | UV/VIS Detector |
| EC | Electric Conductivity Meter |
| PH | PH Meter |
| RV | Relief Valve |

# Software (for Chromatography Devices)

## Software for K-Prep, Software for BioStream

- Software allowing seamless scale-up from laboratory scale to process scale
- User friendly, flexible and intuitive programming and operation
- Compliance with FDA 21 CFR Part 11, cGMP and CSV

FDA 21 CFR Part 11 cGMP CSV


Software for K-Prep and BioStream are the latest chromatography device control software. The software has been developed to be intuitive based on the operator's reaction to visual operation. The software enables complicated preparative purifications to be performed easily and automatically.

## Software for LC-Forte/R

- Liquid crystal touch panel allows comfortable visual touch.
- Standard features include software for displaying chromatograms on the touchscreen.
- Various functions are available such as recycling, sample injection (stacking), and automated cleaning.
- When operated in conjunction with optional external PC control software quantitative (area%) and GPC measurement may be employed.


The dedicated software for LC-Forte/R has been developed put the full power of the instrument within your grasp.

# HPLC Pumps

## K Series

- A wide range of flow rates and range allow a minimum flow rate 1/1000 of the maximum.
- Usable as a high pressure mixing gradient system by adding on a sub-pump
- Gradient and flow rate programmable provided by microcomputer control
- Max. pressure limit can be set enabling column overpressure protection.
- Plunger wash ports (optional) to prevent salt deposition and premature seal failure
- Explosion proof pumps (optional) available


K-100

K series pumps are designed for preparative chromatography employed worldwide for simple and demanding applications. K-Prep dual reciprocating plungers and the high precision servo motor enable highly-accurate pumping with less pulsation.

| Model | K-100 | K-300 | K-500 | K-1000 |
|---|---|---|---|---|
| Flow rate range (mL/min) | 1 - 100 | 1 - 300 | 1 - 500 | 1 - 1000 |
| Device pressure limit (MPa) | 15 | 10 | 10 | 5 |
| Pumping mechanism | Dual plunger linear cam driven | | | |
| Pumping method | Constant flow | | | |
| Wetted material | SUS316, Zirconia, Reinforced Teflon, PEEK | | | |
| Dimension (W×D×H) | 225 × 485 × 205 mm | | 380 × 550 × 220 mm | |

# Semi Preparative Columns

## YMC-Actus Series

- Excellent efficiency and durability
- Prepacked semi preparative columns with axial compression technology
- Available packed with silica, hybrid-silica and polymeric based derivatized chromatography media


YMC-Actus series are semi preparative HPLC columns that utilize axial compression technology for effective semi-preparative separations. The column bed is effectively compressed by attaching an end assembly newly designed for YMC-Actus series columns. Actus columns provide ideal bed densities (approx. 10% higher than conventional columns) and consistent bed uniformity.

### Various organic hybrid silica based and silica gel packing materials are available.

| Packing material | | Particle size (µm) | Pore size (nm) | C% | pH range | Features |
|---|---|---|---|---|---|---|
| **Organic hybrid silica packing materials** | | | | | | |
| YMC-Triart Series | Triart C18 | 5 | 12 | 20 | 1.0 - 12.0 | ■ Suitable as a first choice column with excellent durability<br>■ Superior peak shape<br>■ Usable over wide range of pH and temperature<br>■ Usable with 100% aqueous mobile phase |
| | Triart C8 | 5 | 12 | 17 | | ■ Compete with the versatility of C18<br>■ Usable over wide range of pH and temperature<br>■ Effective for fast analysis of compounds with low polarity or for separation of isomers |
| | Triart Phenyl | 5 | 12 | 17 | 1.0 - 10.0 | ■ Unique selectivity due to π-π interaction<br>■ Ideal for separations of aromatics compounds or compounds having long conjugated system<br>■ Excellent resolution without adsorption and tailing |
| | Triart PFP | 5 | 12 | 15 | 1.0 - 8.0 | ■ Effective for separation of polar compounds or isomers by polar interaction<br>■ Superior planar cognitive ability / steric selectivity |
| **Silica based packing materials** | | | | | | |
| Pro Series | Pro C18 | 5 | 12 | 16 | 2.0 - 8.0 | ■ Conventional ODS columns<br>■ Processed with advance end capping technology<br>■ Superior separation of basic compounds |
| | Hydrosphere C18 | 5 | 12 | 12 | | ■ Useful for separation of hydrophilic compounds<br>■ Usable with 100% aqueous mobile phase |
| | Pro C18 RS | 5 | 8 | 22 | 1.0 - 10.0 | ■ Excellent acid resistance and alkali resistance<br>■ Ideal for separation of isomers or structural analogs with low polarity<br>■ Superior separation of basic compounds |
| | Pro C8 | 5 | 12 | 10 | 2.0 - 7.5 | ■ Compete with the versatility of C18<br>■ Processed with advance end capping technology<br>■ Superior separation of basic compounds |
| YMC-Pack Series | ODS-A | 5 | 12 | 17 | 2.0 - 7.5 | ■ Conventional ODS suitable for use in from analytical to preparative separation |
| | ODS-AQ | 5 | 12 | 14 | | ■ Useful for separation of hydrophilic compounds |

Please contact us for packing materials listed other than above.

# Self-Packed Axially Compressible Preparative Columns

## SB Columns

- Superior column performance and reproducibility provided by high density packing
- Maintains great durability utilizing manual pressurization using screw bolts
- Eliminate voids (occurred by long-term usage) by re-tightening screw bolts
- Cost effective provided by self-repacking.
- Packing service (optional) available with YMC's preparative packing materials
- Column packing extender (optional) and column stand (optional) available

SB-200

SB-50

SB products are statically compressed cost effective preparative columns which enable convenient self-packing. Tightening screw bolts of the upper flange yields a compressed packing bed. Not only dry packing but also wet (slurry) packing is possible by attaching a column packing extender (optional).

| Model | SB-50 | SB-70 | SB-100 | SB-150 | SB-200 |
|---|---|---|---|---|---|
| Inner diameter ($\phi$, mm) | 50 | 70 | 100 | 150 | 200 |
| Pressure limit (MPa) | 10 | 7 | 7 | 5 | 5 |
| Column length (mm) | 250 / 500 / 1000 | | | | |
| Column bed length (mm) | 200 - 300 / 450 - 550 / 900 - 1100 | | | | |
| Optional | Column packing extender | | | | |
| | Column stand | | | | |

Please contact us for SB Columns with 300mm I.D. or larger.

# Dynamic Axial Compression Columns

## DAU Series

- Suitable for high purification in various fields such as pharmaceuticals, fine chemicals and functional foods
- Cost-effective self-packing dyanamic axial compression columns
- Optional slurry container permits automated packing procedures.
- Superior column performance, durability and reproducibility provided by usage at constant pressure
- Explosion proof type available
- Compliance with IQ/OQ validation

| Model | DAU-50 | DAU-100 | DAU-150 | DAU-200 | DAU-300 | DAU-450 | DAU-600 |
|---|---|---|---|---|---|---|---|
| Inner diameter ($\phi$, mm) | 50 | 100 | 150 | 200 | 300 | 450 | 600 |
| Pressure limit (MPa) | 10 | | | | | 7 | |
| Column length (mm) | 700 | | | | | | |
| Column bed length (mm) | 100 - 400 | | | | | | |
| Slurry container volume (L)* | 2 | 10 | 22 | 30 | 60 | 140 | 250 |

* Slurry containers are optional.

The DAU series are an automatic self-packing type of dynamic axial compression column that allows for an easy, cost-effective refill of packing material that results in a column bed yielding superior durability and reproducibility. The DAU series are available in columns for laboratory, pilot, and industrial scale.

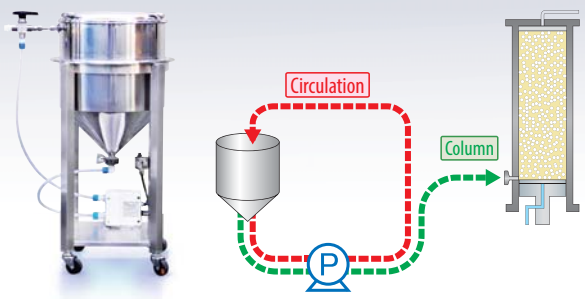
DAU-300
H2300mm

DAU-450
H2500mm

DAU-600
H2800mm

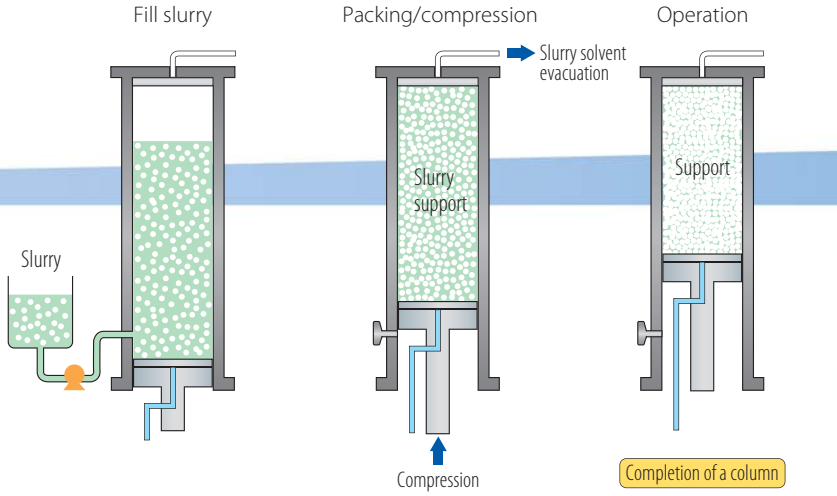
## Slurry Container (Optional)

The slurry container provides excellent distribution of packing material and allows for a "homogeneous" slurry that can be automatically loaded into the DAU column by simply switching a valve. Throughout the operation from slurry preparation to filling slurry, safety and hygiene can be achieved.



# DAU Series: Ease of Use and Outstanding Column Performance in a Single System

## Packing Procedure




Fill packing material through slurry pump.

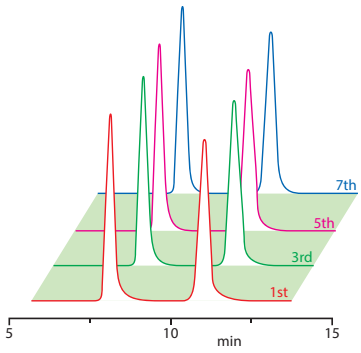
Compress the column and push out extra slurry solvent.

Perform chromatography.

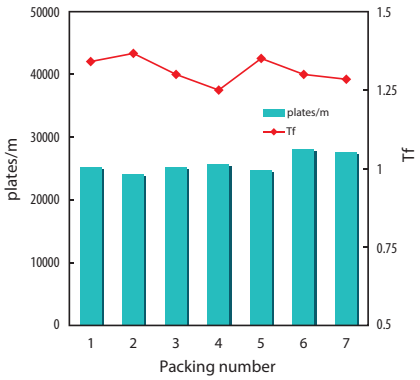
## Column Performance

The data on the right hand side shows repacking data obtained by using a 50mmI.D. DAU column(DAU-50).
After 7 times repacking, plates/m and Tf are still as good as the initial state.

*Change in chromatogram*

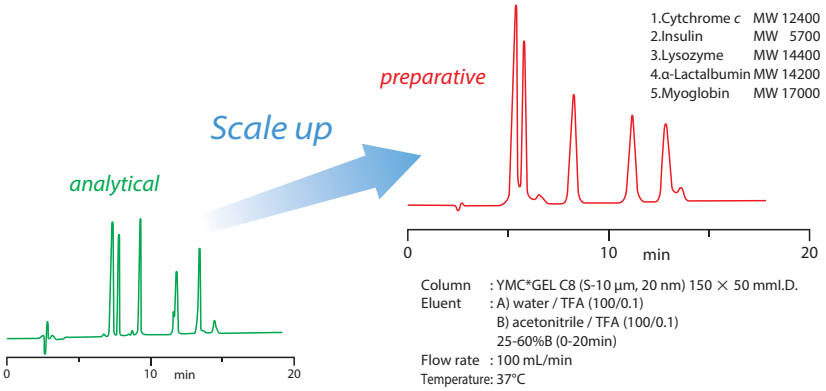



*Change in column performance*




## Seamless Scale-up

The chromatograms on the right hand side are a scale-up example from an analytical 4.6mmI.D. column to a 50mmI.D. DAU column. This indicates that the very similar separation pattern of analytical scale is also reproducible at the preparative scale.




Column : YMC-Pack C8 (S-5 µm, 20 nm) 150 × 4.6 mmI.D.
Flow rate : 0.8 mL/min

Column : YMC*GEL C8 (S-10 µm, 20 nm) 150 × 50 mmI.D.
Eluent : A) water / TFA (100/0.1)
B) acetonitrile / TFA (100/0.1)
25-60%B (0-20min)
Flow rate : 100 mL/min
Temperature: 37°C
Detection : UV at 220 nm

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# INFORMATION & SUPPORTS

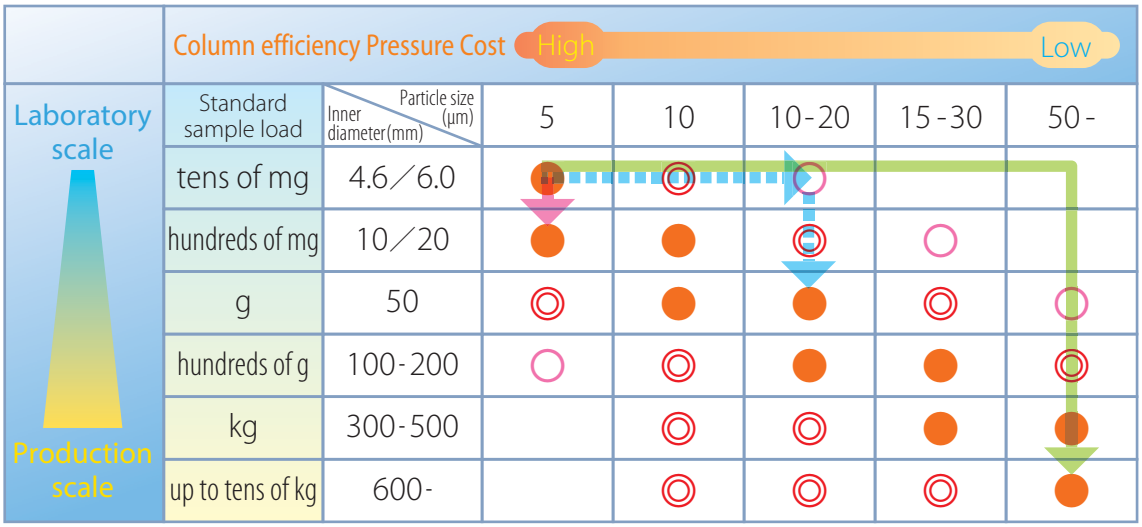
CONTENTS



All of YMC's chromatography products are manufactured under strict control by YMC's quality management system. YMC provides universal services and supports through the domestic and overseas network of the YMC group.

# General Guidance for Selection of Suitable Columns

## Overview of Optimization Methods for Scale-up




●: Most appropriate ◎: Appropriate ○: According to the purpose

The analytical conditions established using the analytical column are scaled up to the intended preparative scale in the direction shown by the arrow.

When more than one mode is available for the separation of samples, the load, resolution pressure, cost of packing materials, etc. should be considered for the selection of an appropriate separation mode.

### ①Column inner diameter

Sample load is proportional to the column cross-sectional area (under same packing material and column length). It is necessary to select a column inner diameter suitable for the sample load.

### ②Particle size

Smaller particle sizes result in higher column efficiency, however, which also result in higher prices and higher column pressure. In addition, the equipment used needs to be resistant to the pressure. When the target component and the nearest peak are very near and the highest resolution is needed, packing materials with small particle size are useful.

### ③Column length

Longer column lengths result in higher resolution and higher sample load, however the column pressure becomes larger and the separation time longer.

## Relationship between Column Inner Diameter and Flow Rate/Sample Load

| Column inner diameter (mm I.D.) | 4.6 | 10 | 20 | 50 | 100 | 200 | 500 | 1,000 |
|---|---|---|---|---|---|---|---|---|
| Cross-sectional area | 1.0 | 4.7 | 19 | 118 | 473 | 1,890 | 11,800 | 47,300 |
| Flow rate (mL/min) | 0.5 | 2.4 | 9.5 | 60 | 235 | 950 | 6,000 (6L) | 24,000 (24L) |
| | 1.0 | 4.7 | 19 | 120 | 470 | 1,900 | 12,000 (12L) | 47,000 (47L) |
| Sample load (mg) | 5 | 25 | 100 | 600 | 2,500 | 10,000 | 60,000 (60g) | 240,000 (240g) |

Flow rate equation : $F' = F \times (Dc'/Dc)^2$

F : Analytical column flow rate (mL/min)
F' : Preparative column flow rate (mL/min)
Dc : Analytical column inner diameter (mm)
Dc' : Preparative column inner diameter (mm)
* Use the same equation to calculate the sample load.

When the same packing material and column length are used the preparative flow rate and sample load are proportional to the column cross-sectional area. Additionally, the resolution and column pressure experienced on the preparative column would be approximately the same as that experienced for the analytical scale separation.

# Quality Control of Self-Packed Columns

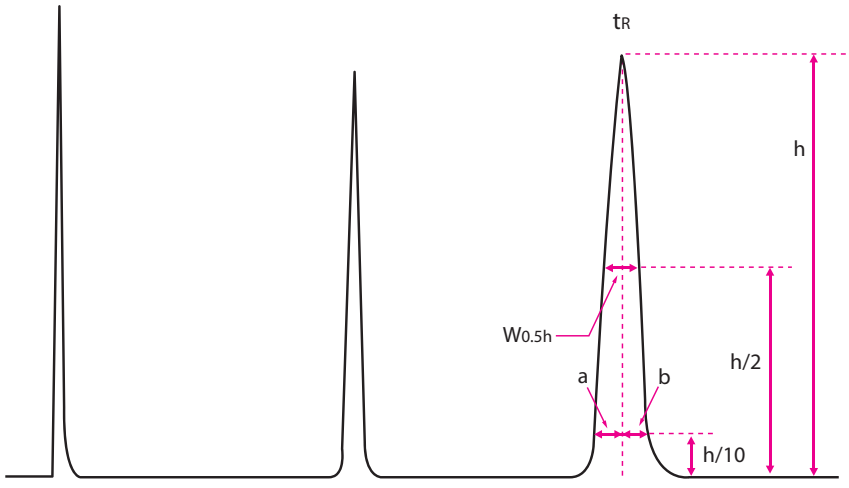
It is strongly recommended to measure the theoretical plate number (N) and the asymmetry factor (As) with standard samples after packing. By repeating this tests periodically, the quality and durability of the packing material within the preparative column can be monitored and corrective action taken, if necessary. When comparing test results over a given time period, the same compound and HPLC method conditions should be employed each time column performance is evaluated.

The theoretical plate number (N) can be calculated by below equation. The larger the value, the more densely-packed the column for a given particle size. In general, theoretical plate numbers show a higher value when peak widths are narrower for a given retention time. Longer columns and smaller packing material particle sizes tend result in higher theoretical plate numbers (N).

$$N = 5.54 \times (t_R / W_{0.5h})^2$$

The eluted peak shape is also one of the important factors to evaluate the column performance. Asymmetry factors (As) is easy to calculate with below equation. The closer to 1 the value is, the more symmetric and ideal peak shape it shows.

$$As = b / a$$




$t_R$ : Retention time
h : Peak height
$W_{0.5h}$ : Bandwidth at half-height

# GMP Support

YMC's devices have been installed at GMP manufacturing plants in many countries and YMC provides supports to all users who have needs.

## FAT (Factory Acceptance Test)

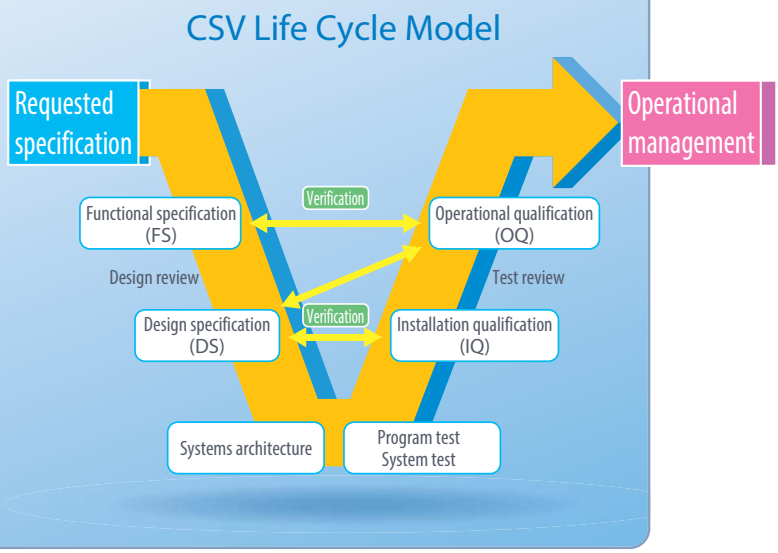
Available for all systems and components.

## IQ/OQ (Installation Qualification / Operational Qualification)

Installation qualification (IQ) and operational qualification (OQ) are available. YMC's skilled engineers perform the testing at your site and provide you with documentation.

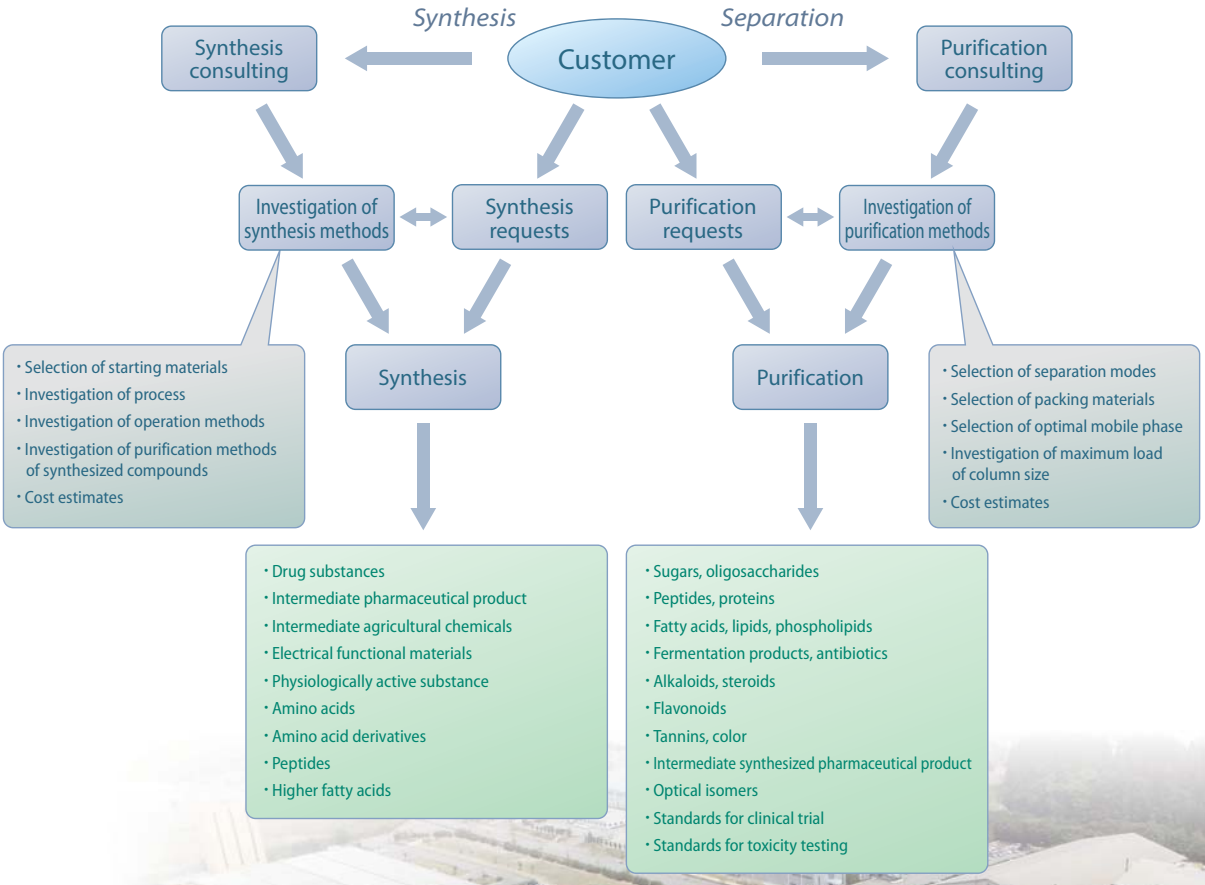
## CSV (Computer System Validation)

The software used in YMC devices comply with computer system validation (CSV). Specifications are created based on your requirements and the design review is conducted before the software is actually installed. Verification and qualification are fully conducted on the software.



# Contract Services

YMC CO., LTD. Komatsu Works has an explosion-proof facility for preparative purifications. This facility is equipped with chromatography devices with max. flow rate 20L/min, dynamic axial compression columns of various sizes up to 1000mmI.D., fraction enrichment, crystallization, vacuum filtration, vacuum drying, and freeze drying equipment. Our broad lineup of packing materials enables optimization from analytical to preparative scale and establishes the most suitable method for purification. YMC accumulated experience since 1980, and it's full portfolio of equipment are used together to bring YMC capabilities to your projects in order to give you the prompt and efficient service that your project requires for on-time high purity and cost effective experience.

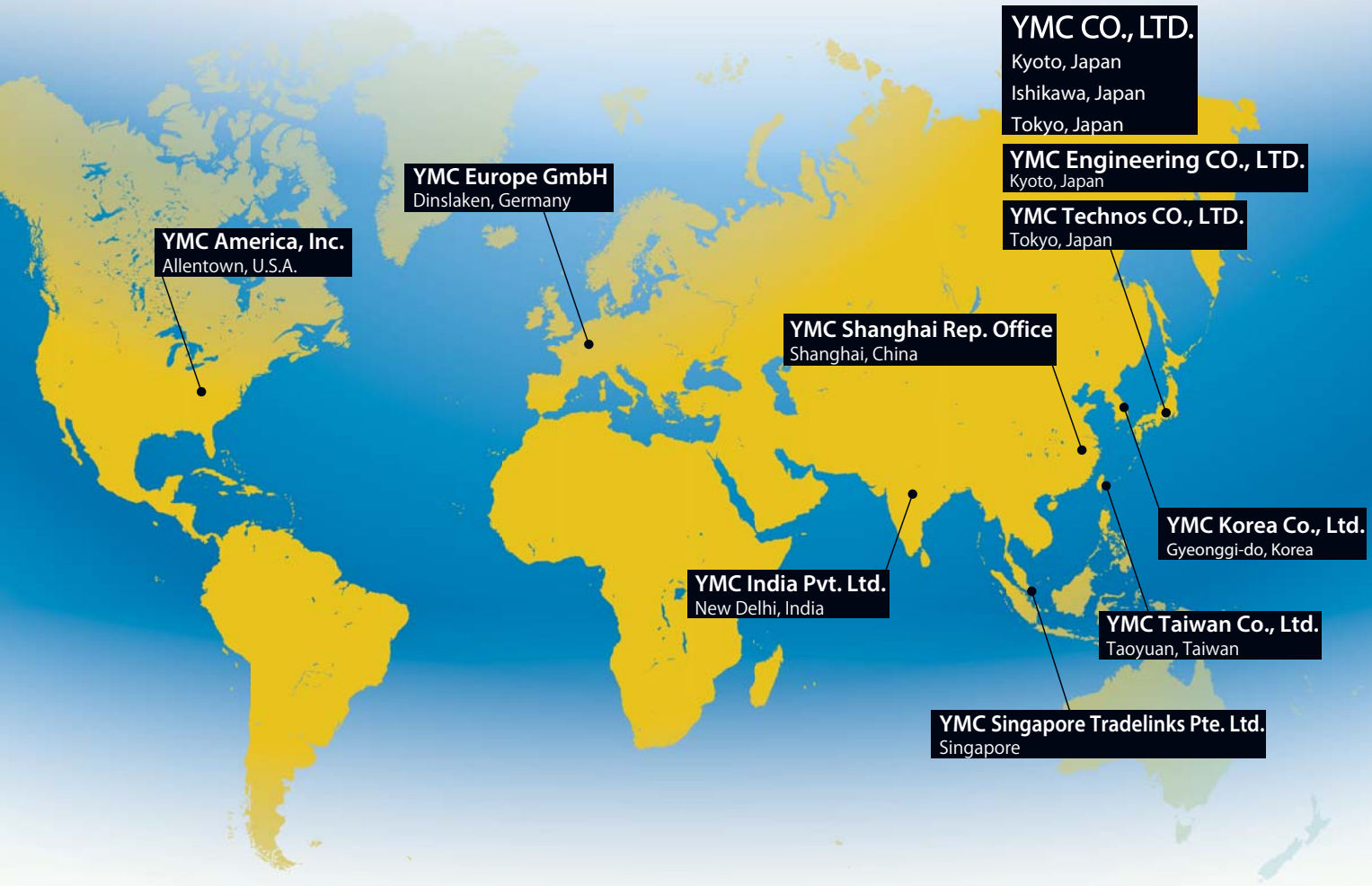



Plant scale chromatography devices (a part of the plant)

YMC CO., LTD. Komatsu Works in Ishikawa, Japan.

# Worldwide Product Supply Systems

We have secured worldwide product supply systems and service systems through the efforts of domestic and overseas branches of the YMC group. We plan to expand branches in those nations and regions where economic development and population growth are anticipated and where rapid growth of pharmaceutical services is sought.




For more information or to place an order of large-scale plant devices and preparative columns, please contact us. Please feel free to ask our specialists about products or service.

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## Worldwide Availability

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