



HPLC Column Hardware

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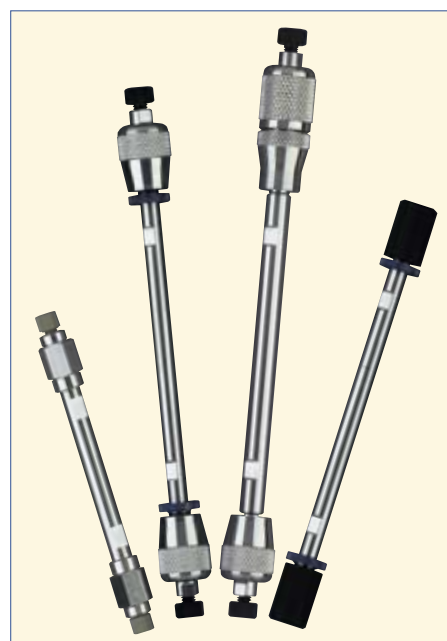
Introduction

General

During the last 30 years, liquid chromatography has become the most important analytical technique in the pharmaceutical industry. To meet the rigorous demands on the design and dimensions of columns by customers, the range of YMC products has grown to include an extensive range of capillary, microbore and analytical columns as well as columns for semi-preparative and preparative separations.

Individual columns for individual needs

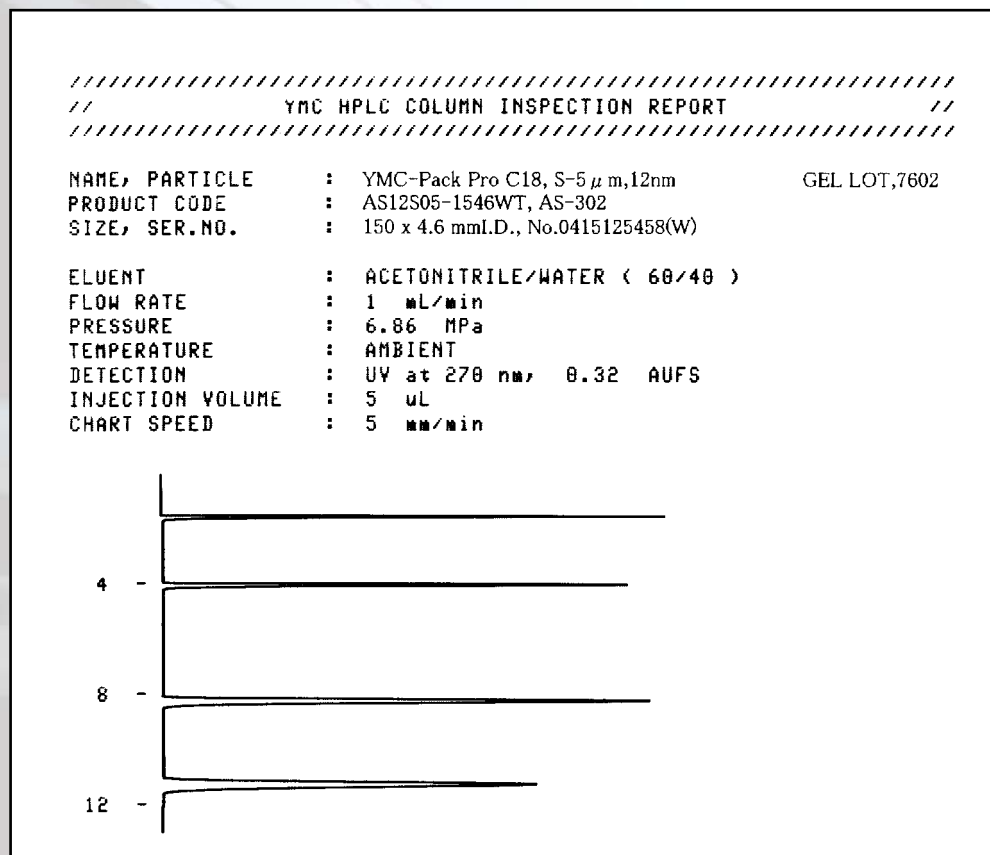
Excellent packing material, column hardware and optimised packing procedures are essential requirements for highly sophisticated HPLC separations. As a result of the continual development and long-term experience in column manufacturing, YMC HPLC columns have a worldwide reputation.



YMC offers highly sophisticated HPLC columns with inner diameters from 75 μm up to 600 mm.

Individual Column Test

All packed YMC columns are shipped with an individual Column Inspection Report, certifying column efficiency and peak symmetry.



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////////////////////////////////////
//                               YMC HPLC COLUMN INSPECTION REPORT           //
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NAME, PARTICLE : YMC-Pack Pro C18, S-5 μ m, 12nm GEL LOT, 7602
 PRODUCT CODE : AS12S05-1546WT, AS-302
 SIZE, SER.NO. : 150 x 4.6 mm I.D., No.0415125458(W)

ELUENT : ACETONITRILE/WATER (60/40)
 FLOW RATE : 1 mL/min
 PRESSURE : 6.86 MPa
 TEMPERATURE : AMBIENT
 DETECTION : UV at 270 nm, 0.32 AUFS
 INJECTION VOLUME : 5 μ L
 CHART SPEED : 5 mm/min

in order of elution;

| No(n) | SAMPLE | k' | Alpha | N | As |
|-------|-----------------|-----------------|-------|-------|------|
| 1 | URACIL | 0.05 μ g/mL | | | |
| 2 | METHYL BENZOATE | 0.5 μ L/mL | 1.6 | | |
| 3 | NAPHTHALENE | 0.18 μ g/mL | 4.34 | 2.71 | |
| 4 | BUTYL BENZOATE | 1.5 μ L/mL | 6.31 | 1.45 | |
| | | | | 17000 | 1.11 |

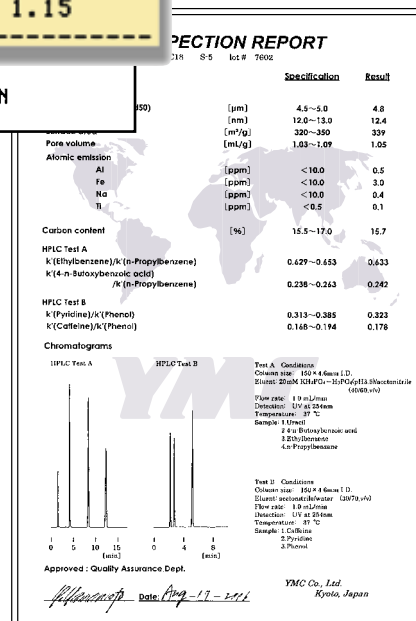
Guarantee 15000 - N - 19000 , 0.90 - As - 1.15

As, asymmetry factor at 10% Peak height
 [SYSTEM No. 102] [INSPECTED BY M.BANDO] YMC Co., Ltd., JAPAN

ProFamily: Individual Lot Inspection Report

To give our customers an insight into the strict criteria with regard to the silica base, the derivatised final product and the reproducible chromatographic behaviour, each column of the ProFamily is supplied with a lot inspection report in addition to the individual column test chromatogram. The first report illustrates the narrow window for physical parameters such as particle size distribution or surface area and the reproducibility of chemical properties. The test chromatogram illustrates the efficiency of the column with a guaranteed minimum performance of 100,000 theoretical plates per meter for 150 and 250 x 4.6 mm i.d. and an asymmetry of 0.90 to 1.15 (at 10% peak height for 5 μ m particle size).

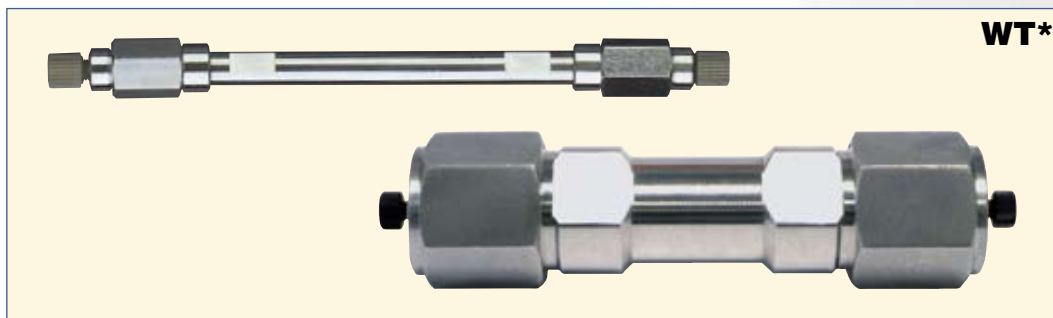
Individual Lot Test



YMC Genuine Columns

YMC analytical columns with 4.6 mm i.d., used in millions of analysis, are routinely available in lengths of 30, 50, 75, 100, 150 and 250 mm. Semi-preparative columns with inner diameters of 6, 8, 10, 20 and 30 mm are also available. With inner diameters of 10 mm and above distributor plates are inserted at the column head to ensure a homogenous distribution of the sample onto the column bed.

These columns have inlet and outlet fittings of the Waters-type with the distance between the ferrule and the end of the connecting tubing (sometimes called the pilot depth) of 0.13 inch (3.3 mm) and are identified by part numbers ending with **WT**.



* Hardware Code

| mm i.d. | 30 mm length | 50 mm length | 75 mm length | 100 mm length | 150 mm length | 250 mm** length |
|---------|--------------|--------------|--------------|---------------|---------------|-----------------|
| 4.6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 6.0 | — | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8.0** | — | — | ✓ | — | — | — |
| 10.0 | — | ✓ | — | ✓ | ✓ | ✓ |
| 20.0 | — | ✓ | — | ✓ | ✓ | ✓ |
| 30.0 | — | ✓ | ✓ | ✓ | ✓ | ✓ |

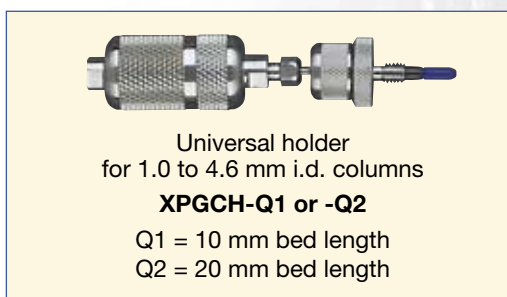
** 300 and 500 mm routinely available.

Other dimensions on request.

In order to apply guard cartridges to YMC genuine columns external guard cartridge holders are required. For 4.6 mm i.d. analytical columns, the universal holder (XPGCH-Q1/Q2) is needed.

This system guarantees a low dead volume connection between the guard cartridge and the main column irrespective of the type of column fitting used. To connect the guard cartridge holder to the column to give leak-proof connection up to 6000 psi follow the description on page 260.

This system is not only essential for 4.6 mm i.d. WT-type columns, but can be used for all analytical hardware types from 1.0 to 4.6 mm i.d.



Ultra Fast LC Columns

The latest development in YMC phase technology, YMC UltraHT Pro C18 and YMC UltraHT Hydro-sphere C18 for Fast and Ultra Fast separation required a special hardware design.



* Hardware Code

| mm i.d. | 30 mm length | 50 mm length | 75 mm length | 100 mm length | 150 mm length |
|---------|--------------|--------------|--------------|---------------|---------------|
| 2.0 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 3.0 | — | ✓ | ✓ | ✓ | ✓ |

Other dimensions on request.

YMC Microbore/Narrowbore Columns



YMC microbore and narrowbore columns have been developed for use in both routine assay applications and in speciality research situations, such as SFC, LC-GC or LC-MS.

Smaller diameter columns can provide performance comparable to that of standard 4.6 mm i.d. columns but with significantly reduced solvent consumption.

In situations where the amount of sample is limited and the mode of detection is concentration dependant, smaller bore columns provide increased response compared to standard bore columns. In practice, this translates into lower detection limits and greater sensitivity.



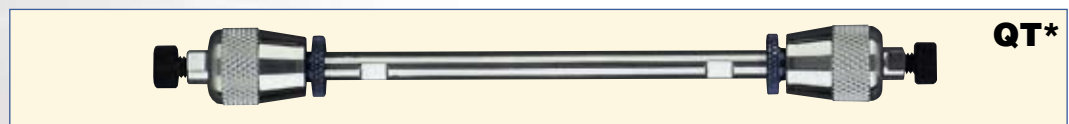
Endfitting
XPEFQT-2

The YMC cartridge column system is based on finger tight endfittings and rotating fitting ports to provide quick installation and exchange of columns without the use of any tools.

Once a complete column has been purchased, it is possible to repeatedly reuse the column endfittings over and over again. Instead of buying another complete column, it is possible to obtain just the replacement cartridge.

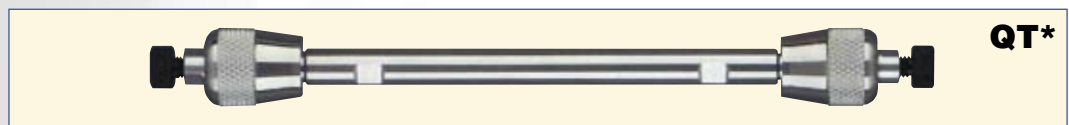
Simply unscrew the column endfittings from the exhausted column and attach to the replacement cartridge. Within seconds your system is ready to restart analysis.

These columns have inlet and outlet fittings of the Swagelok-type with the distance between the ferrule and the end of the connecting tubing (sometimes called the pilot depth) of 0.09 inch (2.3 mm) and are identified by part numbers, ending with **QT**. To obtain the replacement cartridge, part numbers end with **QC**.



Microbore column, 1.0 or 2.1 mm inner diameter

Columns with 2.1 or 1.0 mm i.d. columns have 6.5 mm o.d. barrels. These barrels are fitted with blue bushings which allow the use of the same end fittings as the 8 mm o.d. barrels of the columns with 3.0 or 4.0 mm i.d..



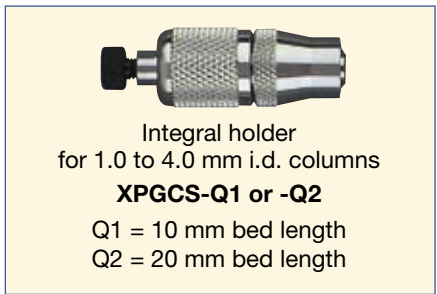
Narrowbore column, 3.0 or 4.0 mm inner diameter

* Hardware Code

| mm i.d. | 30 mm length | 50 mm length | 75 mm length | 100 mm length | 125 mm length | 150 mm length | 250 mm length |
|---------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|
| 1.0 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2.1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 3.0 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 4.0 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 4.6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Note: 4.6 mm i.d. QT-columns are not routinely available

In addition, YMC offers specific integral guard cartridge holders for 10 mm and for 20 mm length guard cartridges with 1.0; 2.1; 3.0 or 4.0 mm inner diameter. These holders are connected directly to the YMC column in place of the removable end fitting. The guard cartridges are inserted in the holder cavities without any tools. These integral guard cartridge holders will not attach to 4.6 mm i.d. -**WT** style columns.



Integral holder
for 1.0 to 4.0 mm i.d. columns
XPGCS-Q1 or -Q2
Q1 = 10 mm bed length
Q2 = 20 mm bed length

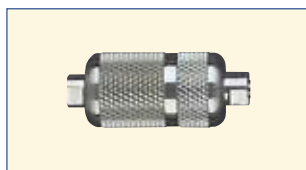
LC-MS and Capillary Columns

YMC LC-MS columns

In the most demanding LC-MS analyses, impurities that must be identified are present only in trace amounts. The chromatography column must have the highest possible efficiency to provide the most concentrated LC fraction to the MS interface for maximum sensitivity.

In order to meet the demands of mass spectroscopy detection, the highest quality hardware with the highly polished internal surfaces is required. This fast growing field of detection in liquid chromatography has led to special requirements with respect to column length and inner diameter dimensions.

YMC columns are available in a range of dimensions. However, small inner diameters are preferred, because only low flow rates are required to allow direct connection to the MS interface. Additionally, the sensitivity for smaller inner diameters is higher and only small sample amounts are necessary.



In LC-MS high throughput chromatography, ultra short analysis times are demanded. For this purpose YMC offers LC-MS cartridges with 20 mm length and 2.1, 3.0 and 4.0 mm i.d.. These cartridges meet the same high quality standards as YMC analytical columns but allow an accelerated sample throughput and rapid re-equilibration. For high efficiency, the use of 3 μm particle sizes is recommended.

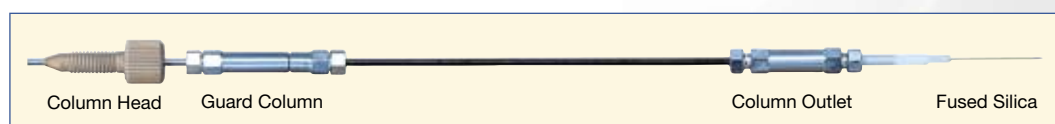


Capillary columns

The driving force behind the development of capillary chromatography typically used with LC-MS is the extremely low volumes and/or concentrations of the sample. This requires maximum sensitivity and minimal flow rates, which can only be achieved with column hardware with small inner diameters, typically from 50–800 μm .

YMC capillary columns are available in a range of dimensions (see table below). Capillary guard cartridges are available in 300, 500 and 800 μm i.d. and 5, 10, or 20 mm length. The integral guard cartridge holder together with the “finger-tight” column head provides a dead volume-free connection throughout the entire column system.

The flow cell of the LC-MS detector can be connected easily directly to the column outlet via the fused silica capillary.



| μm i.d. | 50 mm length | 75 mm length | 100 mm length | 150 mm length | 250 mm length |
|--------------------|--------------|--------------|---------------|---------------|---------------|
| 75 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 100 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 200 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 300 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 500 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 800 | ✓ | ✓ | ✓ | ✓ | ✓ |

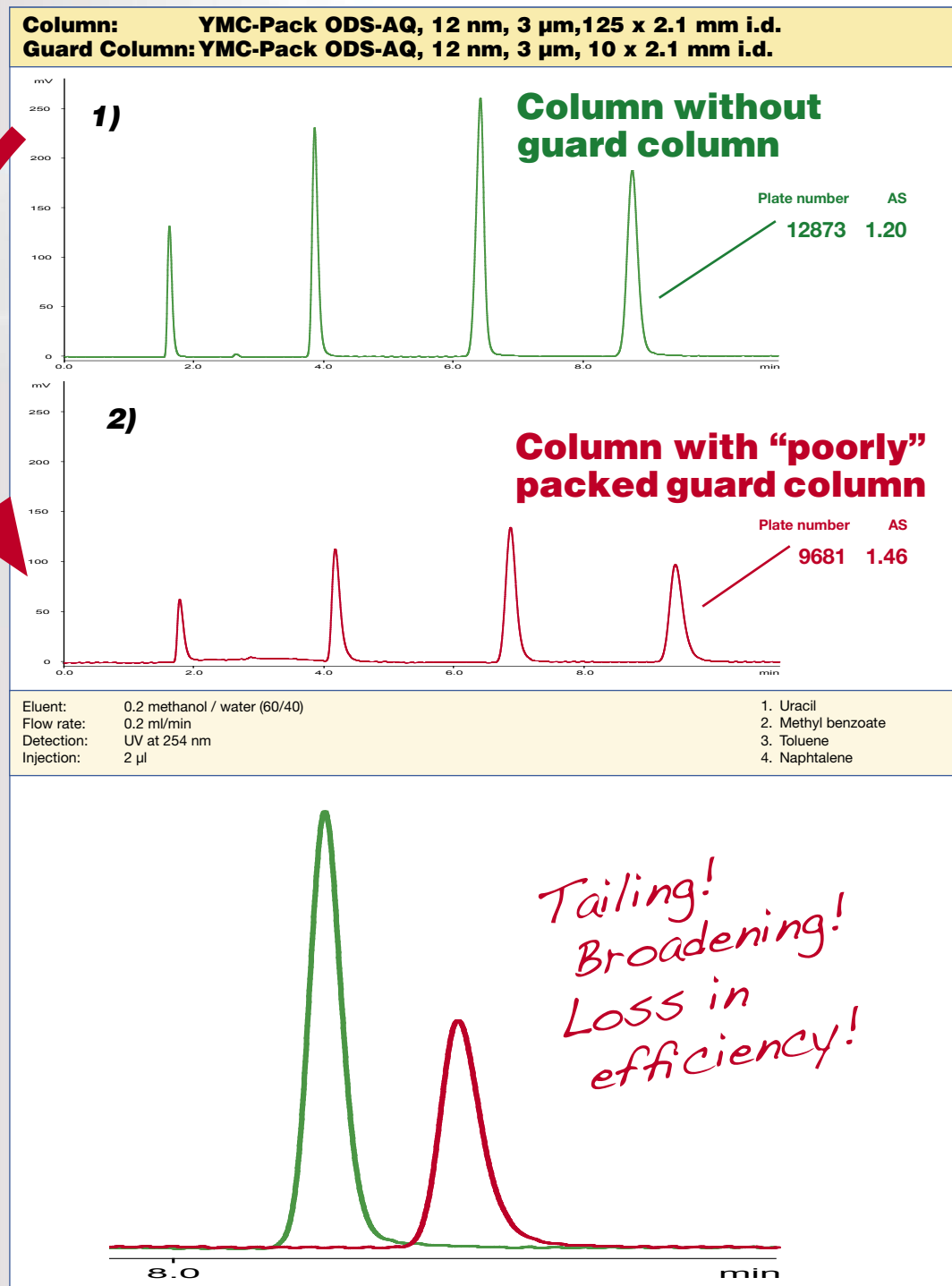
Guard Columns

General

YMC strongly recommends the use of guard cartridges to protect all chromatography columns, analytical, semipreparative and preparative scale, to extend column lifetime and to ensure unchanging performance. Guard columns should contain identical packing material and should be of the same (or only slightly lower) inner diameter as the main column.

A guard cartridge of inferior quality will soon result in poor chromatographic performance with respect to peak symmetry and/or efficiency as shown below. If such an effect is observed the guard column has to be replaced.

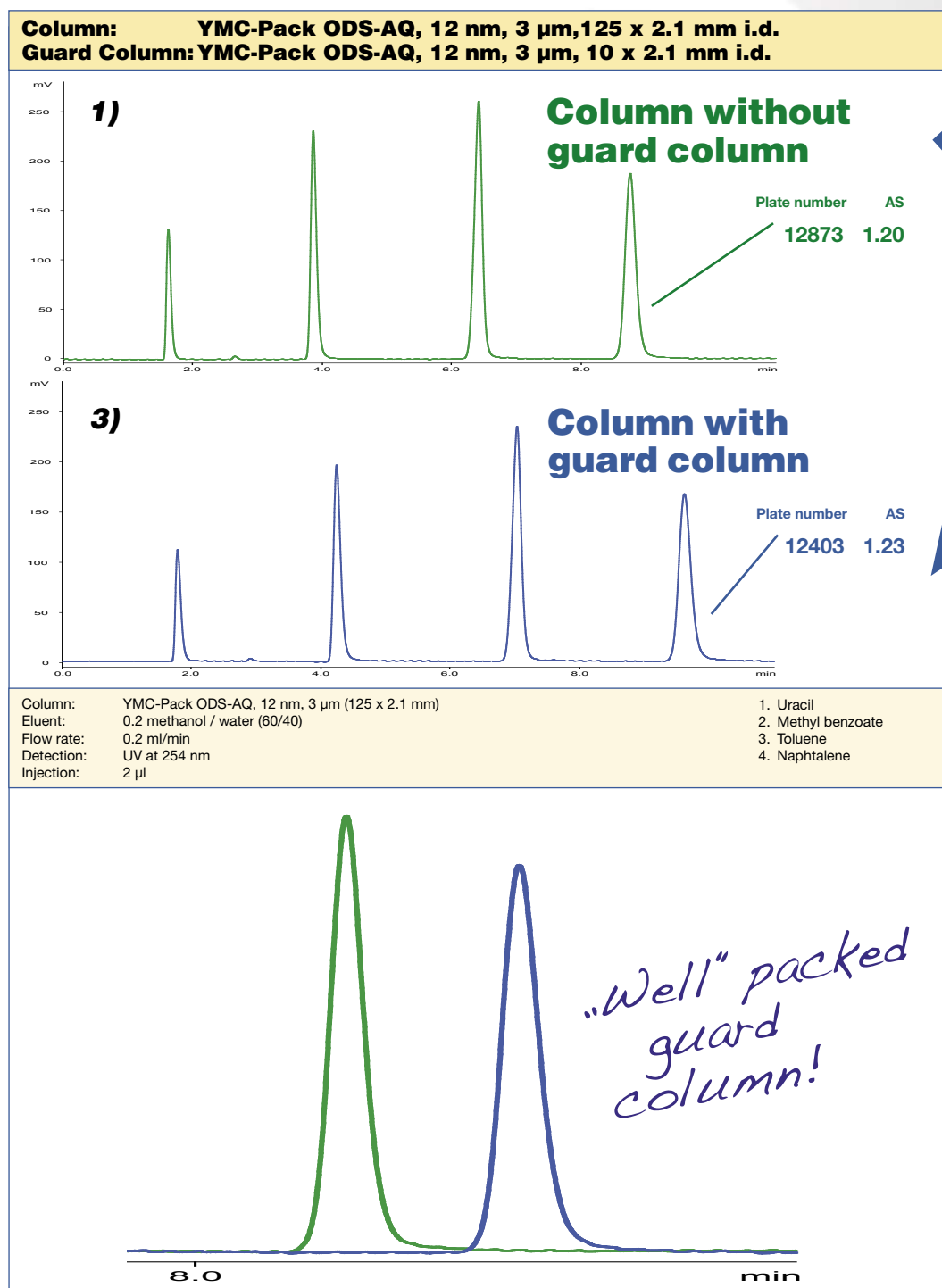
In addition to the use of guard columns, the use of inline filters to trap fines and other particles from samples and mobile phases before they damage valuable instruments and columns should be considered.



Guard Columns

In order to maintain the high quality of YMC packed columns, all columns are supplied, without exception, packed by YMC. Further to that, it is to be noted that all YMC guard columns are subject to individual QC testing under conditions identical to the corresponding main column. YMC does not apply batch testing to guard cartridges with reduced specification in order to maintain the high performance standards routinely provided by main columns. The influence of superior guard systems is shown below. Except for a slightly increased retention, one can observe no significant effects on the performance of the main column while using a guard column.

Most importantly, it is worth to mention that rigorous sample preparation, e.g. SPE, is always crucial to obtaining the best chromatographic results.



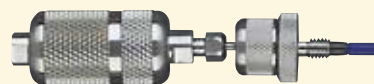
Guard Cartridge Systems



Analytical guard cartridge systems

YMC offers two different analytical guard cartridge holder systems. A universal finger tight system for all main types of column fittings with inner diameters from 1.0 to 4.6 mm i.d., and a specific integral guard cartridge holder for QT-type analytical columns only (see page 256).

The universal guard cartridge holder guarantees a low dead volume connection between the guard cartridge and the main column irrespective of the type of column fitting used. To connect the guard cartridge holder to the column for leak-proof connection up to 6000 psi follow the description below.

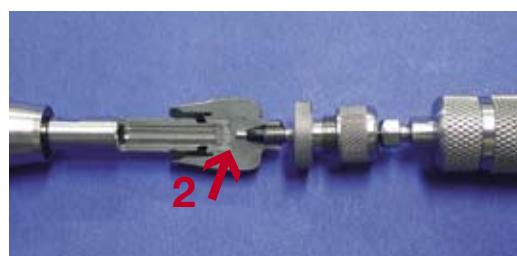


Universal holder
for 1.0 to 4.6 mm i.d. columns

XPGCH-Q1 or -Q2

Q1 = 10 mm bed length

Q2 = 20 mm bed length



- 1.) Unscrew the counternut **(1)**
- 2.) Insert the capillary into the column port and screw the knurled head screw **finger tight (2)**.
- 3.) Finally screw the counternut finger tight **(3)**.
- 4.) To insert the guard cartridge, open the cartridge holder, insert the cartridge and close again finger tight without any tool. A small slit **(4)** between the two holder parts should remain which demonstrates a perfect fit.

In addition, YMC offers specific integral guard cartridge holders for 10 mm and for 20 mm length guard cartridges with 1.0; 2.1; 3.0 or 4.0 mm inner diameter. These holders are connected directly to the YMC column in place of the removable end fitting. The guard cartridges are inserted in the holder cavities without any tools. These integral guard cartridge holders will not attach to 4.6 mm i.d. **-WT** style columns.



Integral holder
for 1.0 to 4.0 mm i.d. columns

XPGCS-Q1 or -Q2

Q1 = 10 mm bed length

Q2 = 20 mm bed length

Semiprep Guard Cartridge System

For semi-prep columns, guard cartridges and holders of 10 and 20 mm length and 8, 20 or 30 mm inner diameter are available. As the holders for these cartridges feature Valco-compatible fittings (pilot depth 0.08 inch) it is essential that fittings are made specifically for connections to the guard holder and for the inter column connector so that differences between Valco-compatible, Swagelok/Parker-compatible (pilot depth 0.09 inch) and/or Waters-compatible (pilot depth 0.13 inch) column endfittings can be accommodated. Alternatively, slipfree fittings can be used to avoid the differences in vendor specific connections.

Part numbers of Guard Column holders and cartridges

| Column i.d. | Guard Column i.d. | Guard Cartridge Holder Part-No. | |
|-------------|-------------------|---------------------------------|--------------|
| | | 10 mm length | 20 mm length |
| 8 mm | 8 mm | XPGCE08 | XPGCE08F2 |
| 10 mm | 8 mm | XPGCE08 | XPGCE08F2 |
| 20 mm | 20 mm | XPGCE20 | XPGCE20F2 |
| 30 mm | 30 mm | n/a | XPGCE30 |

