09

Normal-Phase Columns

Analytical columns

YMC-Pack SIL, YMC-Pack SIL-06

- High quality spherical porous silica gel
- Normal-phase separation due to surface silanol groups
- Two different pore sizes are available
- Useful for separation of compounds with similar structures

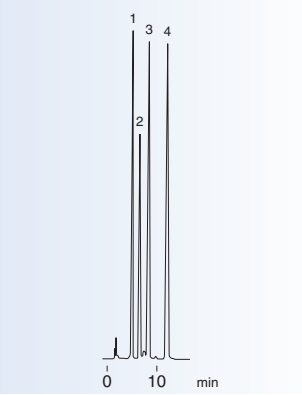
- Pore size : 60, 120 Å
- Usable pH range : 2-7.5
- USP L3

Standard normal-phase column

YMC-Pack SIL is suitable for separation of fat-soluble compounds using non-polar mobile phase and separation of positional isomers that are difficult to separate in reversed-phase mode. SIL-06 (pore size 60 Å) has greater adsorption properties than SIL (pore size 120 Å) due to its larger specific surface area, and is generally useful for separating natural products with a low molecular weight.

Application

(G910523S)



Tocopherol isomers

1. α -Tocopherol
2. β -Tocopherol
3. γ -Tocopherol
4. σ -Tocopherol

Column	: YMC-Pack SIL (5 µm, 120 Å) 150 X 4.6 mmI.D.
Eluent	: *n*-hexane/THF/acetic acid (97/3/0.25)
Flow rate	: 1.0 mL/min
Temperature	: 30°C
Detection	: UV at 295 nm

Analytical columns

YMC-Pack Diol-NP

- Silica gel bonded with dihydroxypropyl groups
- Normal-phase separation using non-polar solvents
- Useful for hydrophilic interaction chromatography (HILIC)
- Different separation characteristics from bare silica gel

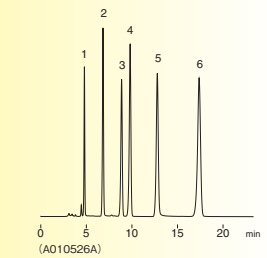
- Pore size : 60, 120 Å
- Usable pH range : 2-7.5
- USP L20

Different separation characteristics from bare silica gel

YMC-Pack Diol-NP shows retention behavior of normal-phase chromatography when it is used with low-polarity mobile phases. Hydroxyl groups on the surface of the stationary phase act as polar groups. YMC-Pack Diol-NP is as widely applicable to normal-phase separation as silica gel. It is also useful in cases where separation optimization is difficult to achieve using bare silica gel. In addition, it is available for HILIC mode separation by using organic/water mobile phases.

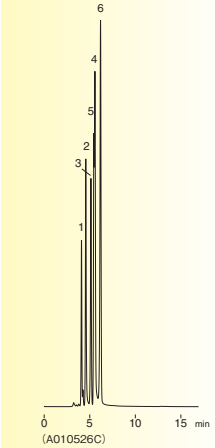
Separation characteristics of Diol-NP and SIL

YMC-Pack Diol-NP



(A010526A)

YMC-Pack SIL



(A010526C)

1. Phenol
2. Catechol
3. Resorcinol
4. Hydroquinone
5. Pyrogallol
6. Phloroglucinol

Column	: 5 µm, 120 Å 250 X 4.6 mmI.D.
Eluent	: *n*-hexane/ethanol (80/20)
Flow rate	: 1.0 mL/min
Temperature	: 30°C
Detection	: UV at 254 nm

Differences in separation characteristics of Diol-NP and SIL for separating phenols are shown on the left. Diol-NP shows longer retention and better separation than SIL in separating these compounds.

Analytical columns

YMC-Pack CN

- Silica gel chemically bonded with cyanopropyl groups
- For both normal-phase and reversed-phase modes
- Different separation characteristics from bare silica gel
- Faster column equilibration than bare silica gel

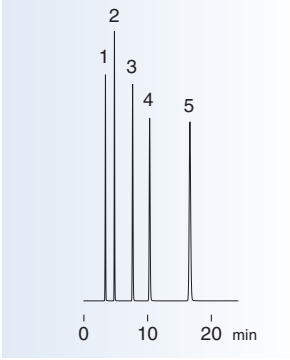
- Pore size : 120 Å
- Usable pH range : 2-7.5
- USP L10

Column can be used in both normal-phase and reversed-phase modes

YMC-Pack CN shows retention behavior of normal-phase chromatography when it is used with low-polarity mobile phases such as hexane. Since YMC-Pack CN stationary phase surface is less polar than bare silica gel, the retention times of analytes are generally shorter than with bare silica gel. YMC-Pack CN is therefore appropriate for samples having too strong retention when analyzed using bare silica gel. In contrast, YMC-Pack CN shows retention behavior of reversed-phase chromatography when it is used with high polarity mobile phase, such as methanol and water. Although separation modes are selectable according to the purpose of separation, it is preferable to use one column dedicated for one separation mode in consideration of the life of the column.

Application

(A010619A)



Nitroaniline isomers

1. Toluene
2. Nitrobenzene
3. *o*-Nitroaniline
4. *m*-Nitroaniline
5. *p*-Nitroaniline

Column	: YMC-Pack CN (5 µm, 120 Å) 250 X 4.6 mmI.D.
Eluent	: *n*-hexane/2-propanol (80/20)
Flow rate	: 1.0 mL/min
Temperature	: 30°C
Detection	: UV at 254 nm

Analytical columns

YMC-Pack PVA-Sil

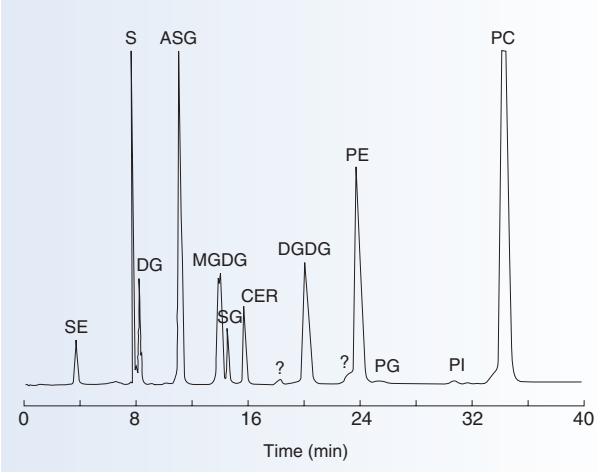
- Vinyl alcohol polymerised silica
- High stability and reproducibility

- Pore size : 120 Å
- Usable pH range : 2-9.5 (Recommended pH range : 2-7.5)
- USP L24

Polyvinyl alcohol functionalized silica

YMC-Pack PVA-Sil, bonded with a monomolecular polymer coating of vinyl alcohol (PVA), completely covers both external and internal surfaces of the silica support, protecting it against aggressive, high pH buffers and solvents. The PVA polymer shell on PVA-Sil deactivates the silica support while providing a hydrophilic surface.

Application



Potato Lipids

Column	: YMC-Pack PVA-Sil (5 µm, 120 Å), 250 X 4.6 mmI.D.
Eluent	: A) 2-methylpentane/methyl *tert*-butyl ether (98/2)
	B) 2-propanol/acetonitrile/$CHCl_3$/CH_3COOH (84/8/8/0.025)
	C) 2-propanol/water/triethylamine (50/50/0.2)
Flow rate	: 1 to 2 mL/min
Gradient	: T_{min} : 0 5 15 40 40.1 45 50
	B% : 0 20 52 52 70 0 0
	C% : 0 0 4 14 0 0 0
Flow (mL/min)	: 1 1 1 1.4 1.4 2 2
Nebuliser temperature : 25°C, Evaporation temperature : 35°C	
Detector : ELSD	
Sample	

S : Sterols	CER : Cerebrosides
SE : Sterol Esters	SG : Steryl glycosides
MGDG : Monogalactosyldiacylglycerols	DGDG : Digalactosyldiacylglycerols
PE : Phosphatidylethanolamine	PG : Phosphatidyl glycerols
PC : Phosphatidylcholine	ASG : Acylsterylglycosides
PI : Phosphatidylinositol	DG : Diacylglycerol

Literature: W.W. Christie; R.A. Urwin, J. High Resol. Chromatogr., Vol.18 (1995) 97-100

Analytical columns

YMC-Pack Polyamine Ⅱ

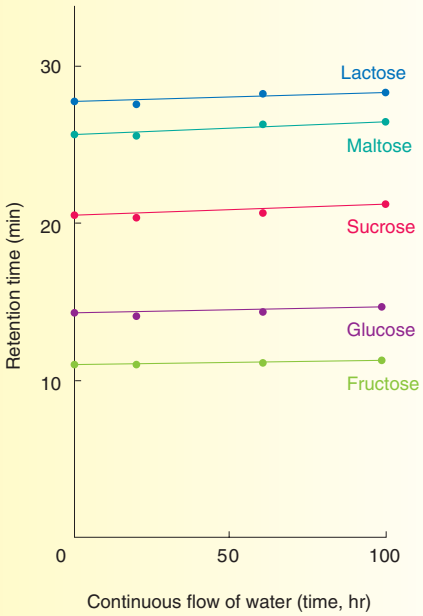
- Silica gel chemically bonded with polyamine
- The most suitable column for separation of sugars
- Useful for separation of hydrophilic compounds including vitamins
- Useful for separation of fat-soluble compounds using nonaqueous mobile phase
- Higher durability than conventional silica-based amino columns

- Pore size : 120 Å
- Usable pH range : 2-7.5
- USP L111

Amino column with improved durability

YMC-Pack Polyamine Ⅱ is a silica-based packing bonded with polyamine. It is particularly useful for separation of sugars. The column lifetime of YMC-Pack Polyamine Ⅱ in aqueous mobile phase is longer than conventional silica-based amino columns, and thus is applicable to separation of oligosaccharides using mobile phase with relatively higher water content. In addition, YMC-Pack Polyamine Ⅱ can be used to separate ionic compounds with a combination of normal-phase mode and weak anion exchange mode.

Excellent durability

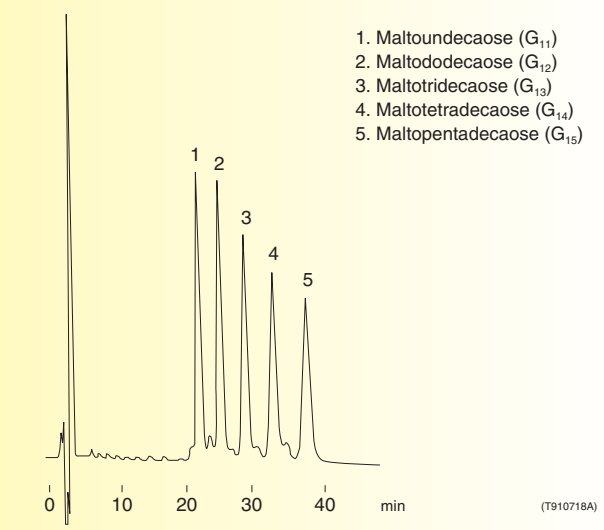


<Flow conditions>
Column : YMC-Pack Polyamine Ⅱ 250 X 4.6 mmI.D.
Eluent : water
Flow rate : 1.0 mL/min
Temperature : ambient
Time : 100 hours

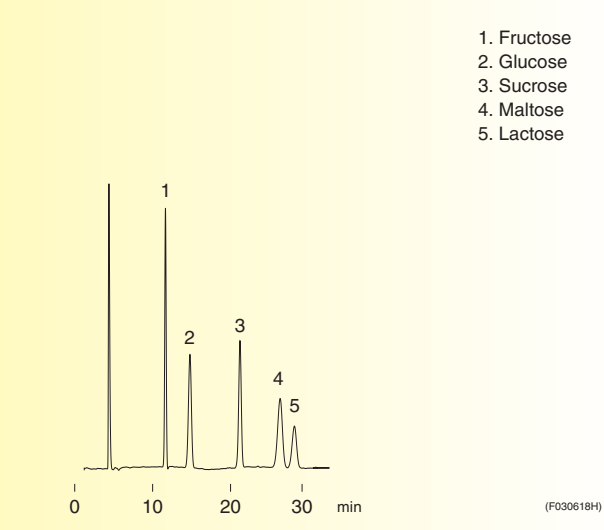
<Analytical conditions>
Eluent : acetonitrile/water (75/25)
Flow rate : 1.0 mL/min
Temperature : 26°C
Detection : RI, 32 X 10^{-6} RIU/FS

Even in a hard flow durability test using a mobile phase that consists only of water, the retention time of sugars changes little.

The most suitable columns for separation of sugars, including oligosaccharides

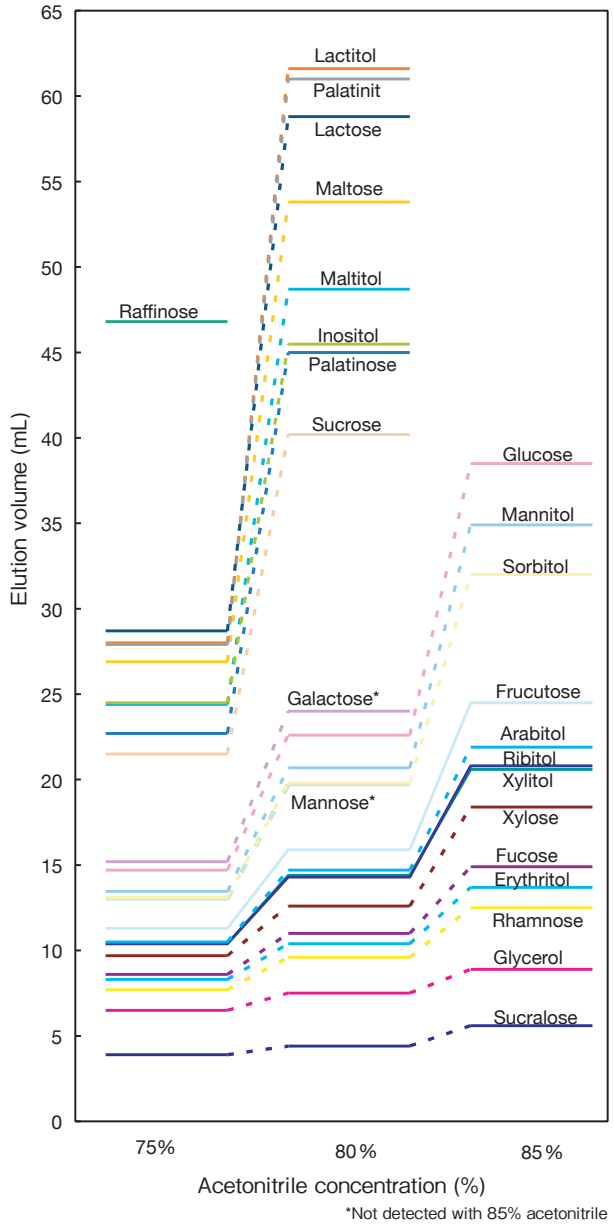


Column : YMC-Pack Polyamine Ⅱ 250 X 4.6 mmI.D.
Eluent : acetonitrile/water (55/45)
Flow rate : 1.0 mL/min
Temperature : 26°C
Detection : RI, 32 X 10^{-6} RIU/FS



Column : YMC-Pack Polyamine Ⅱ 250 X 4.6 mmI.D.
Eluent : acetonitrile/water (75/25)
Flow rate : 1.0 mL/min
Temperature : 25°C
Detection : RI, 32 X 10^{-6} RIU/FS

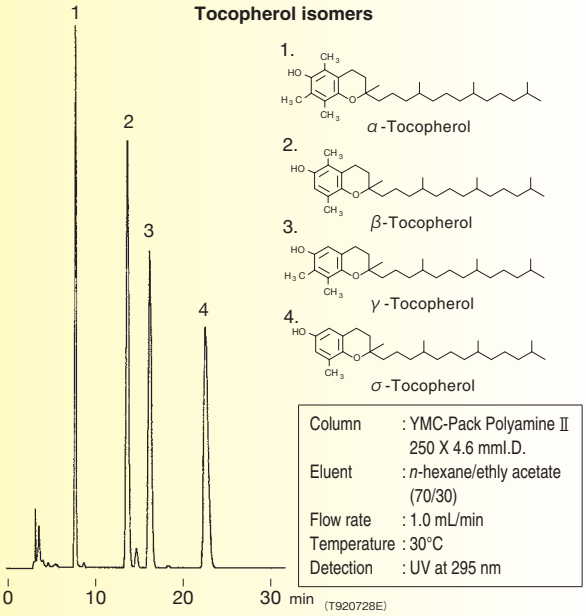
Elution volume of sugars and sugar alcohols



*Not detected with 85% acetonitrile

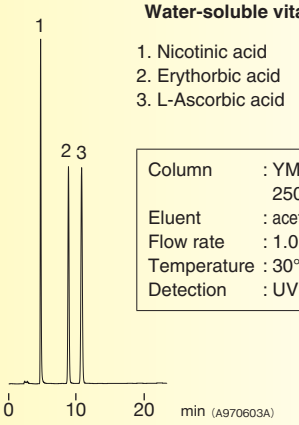
For normal-phase separation

Tocopherol isomers



Column	: YMC-Pack Polyamine Ⅱ 250 X 4.6 mmI.D.
Eluent	: *n*-hexane/ethly acetate (70/30)
Flow rate	: 1.0 mL/min
Temperature	: 30°C
Detection	: UV at 295 nm

Water-soluble vitamins



1. Nicotinic acid
2. Erythorbic acid
3. L-Ascorbic acid

Column	: YMC-Pack Polyamine Ⅱ 250 X 4.6 mmI.D.
Eluent	: acetonitrile/50 mM $NH_4H_2PO_4$ (70/30)
Flow rate	: 1.0 mL/min
Temperature	: 30°C
Detection	: UV at 250 nm

YMC-Pack Polyamine Ⅱ is applicable for separation of fat-soluble vitamins and water-soluble vitamins as a normal-phase column that can be used with water or buffer and various organic solvents.

Analytical columns

YMC-Pack NH_2

- Silica gel chemically bonded with aminopropyl groups
- Useful for separation of sugars
- Enables normal-phase mode separation using aqueous or nonaqueous mobile phase

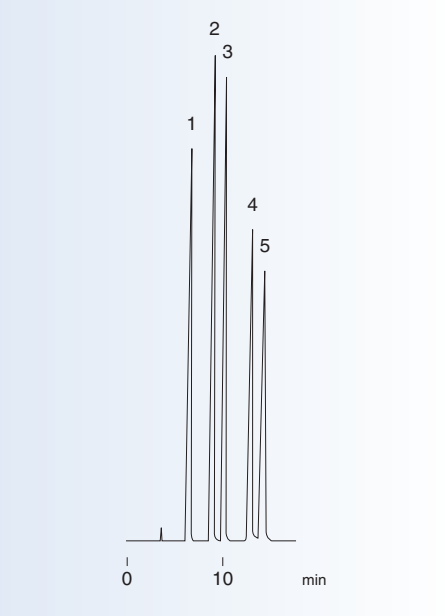
- Pore size : 120 Å
- Usable pH range : 2-7.5
- USP L8

Normal-phase separation column utilizing amino groups

YMC-Pack NH_2 is a normal-phase separation column utilizing the polarity of primary amino groups. It is also applicable to separations utilizing weak anion exchange. YMC-Pack NH_2 is often used for separation of sugars.

Application

(T920525D)



Nucleotides

1. 5'-CMP
2. 5'-AMP
3. 5'-UMP
4. 5'-IMP
5. 5'-GMP

Column	: YMC-Pack NH_2 (5 µm, 120 Å) 250 X 4.6 mmI.D.
Eluent	: 50 mM KH_2PO_4-H_3PO_4 (pH 3.5)
Flow rate	: 1.0 mL/min
Temperature	: 40°C
Detection	: UV at 260 nm

Analytical columns

YMC-Pack PA-G

- Silica gel chemically bonded with polyamine
- Useful for separation of acidic oligosaccharides

- Pore size : 120 Å
- Usable pH range : 4-7.5

Normal-phase separation column utilizing amino groups

YMC-Pack PA-G is useful for separation of acidic oligosaccharides. YMC-Pack PA-G is similar selectivity as YMC-Pack PA.

Ordering Information –Columns–

YMC-Pack SIL

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
120 Å 3 µm	4.6	—	—	SL12S03-1046WT	SL12S03-1546WT	—	4.0	SL12S03-0104GC
	6.0	—	—	SL12S03-1006WT	SL12S03-1506WT	—		
120 Å 5 µm	4.6	—	—	SL12S05-1046WT	SL12S05-1546WT	SL12S05-2546WT	4.0	SL12S05-0104GC
	6.0	—	—	SL12S05-1006WT	SL12S05-1506WT	SL12S05-2506WT		
	10	—	—	—	SL12S05-1510WT	SL12S05-2510WT	10	SL12S05-0110CC

YMC-Pack SIL-06

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
60 Å 5 µm	4.6	—	—	SL06S05-1046WT	SL06S05-1546WT	SL06S05-2546WT	4.0	SL06S05-0104GC
	6.0	—	—	SL06S05-1006WT	SL06S05-1506WT	SL06S05-2506WT		
	10	—	—	—	SL06S05-1510WT	SL06S05-2510WT	10	SL06S05-0110CC

YMC-Pack Diol-NP *Shipping solvent for Diol-NP is *n*-hexane/2-propanol (99.5/0.5). In case of using eluent including water, take care of miscibility.

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
Diol-60 60 Å 5 µm	3.0	—	—	—	DN06S05-1503WT	—	3.0	DN06S05-0103GC
	4.6	—	—	DN06S05-1046WT	DN06S05-1546WT	DN06S05-2546WT	4.0	DN06S05-0104GC
Diol-120 120 Å 5 µm	2.0	—	—	—	DN12S05-1502WT	—	2.1	DN12S05-01Q1GC
	3.0	—	—	—	DN12S05-1503WT	—	3.0	DN12S05-0103GC
	4.6	DN12S05-0546WT	—	DN12S05-1046WT	DN12S05-1546WT	DN12S05-2546WT	4.0	DN12S05-0104GC

YMC-Pack CN *Shipping solvent for CN is acetonitrile/water (50/50). Take care of miscibility in normal-phase separation.

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
120 Å 3 µm	2.0	CN12S03-0502WT	CN12S03-L502WT	CN12S03-1002WT	CN12S03-1502WT	—	2.1	CN12S03-01Q1GC
	3.0	CN12S03-0503WT	—	CN12S03-1003WT	CN12S03-1503WT	—	3.0	CN12S03-0103GC
	4.6	—	—	CN12S03-1046WT	CN12S03-1546WT	—	4.0	CN12S03-0104GC
120 Å 5 µm	2.0	—	—	—	CN12S05-1502WT	CN12S05-2502WT	2.1	CN12S05-01Q1GC
	4.6	—	CN12S05-L546WT	CN12S05-1046WT	CN12S05-1546WT	CN12S05-2546WT	4.0	CN12S05-0104GC
	6.0	—	—	CN12S05-1006WT	CN12S05-1506WT	CN12S05-2506WT		
	10	—	—	—	CN12S05-1510WT	CN12S05-2510WT	10	CN12S05-0110CC
300 Å 5 µm	2.0	—	—	—	CN30S05-1502WT	CN30S05-2502WT	2.1	CN30S05-01Q1GC
	4.6	—	CN30S05-L546WT	CN30S05-1046WT	CN30S05-1546WT	CN30S05-2546WT	4.0	CN30S05-0104GC
	6.0	—	—	CN30S05-1006WT	CN30S05-1506WT	CN30S05-2506WT		

YMC-Pack PVA-Sil

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
120 Å 5 µm	4.6	PV12S05-0546WT	—	PV12S05-1046WT	PV12S05-1546WT	PV12S05-2546WT	4.0	PV12S05-0104GC

YMC-Pack Polyamine Ⅱ

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
120 Å 5 µm	4.6	—	—	—	PB12S05-1546WT	PB12S05-2546WT	4.0	PB12S05-0104GC
	6.0	—	—	—	PB12S05-1506WT	PB12S05-2506WT		
	10	—	—	—	—	PB12S05-2510WT	10	PB12S05-0110CC

YMC-Pack NH_2

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
120 Å 5 µm	4.6	—	—	NH12S05-1046WT	NH12S05-1546WT	NH12S05-2546WT	4.0	NH12S05-0104GC
	6.0	—	—	NH12S05-1006WT	NH12S05-1506WT	NH12S05-2506WT		
	10	—	—	—	NH12S05-1510WT	NH12S05-2510WT	10	NH12S05-0110CC

YMC-Pack PA-G

Phase dimension	Column I.D. (mm)	Column length (mm)					Guard cartridges	
		50	75	100	150	250	I.D. (mm)	10 mm length
120 Å 5 µm	4.6	—	—	—	PG12S05-1546WT	PG12S05-2546WT	4.0	PG12S05-0104GC

* Guard cartridge holder required, part no. XPGCH-Q1 for 2.1 - 4.0 mmI.D. and XPCHSPW1 for 10 mmI.D.

✻ See pp.115-116 for preparative columns other than those listed above.