



# Symmetry<sup>®</sup> Family of HPLC Columns



Symmetry<sup>®</sup> • SymmetryShield<sup>™</sup> • Symmetry300<sup>™</sup> • SymmetryPrep<sup>™</sup>

Waters

# Solutions for Common HPLC Column Problems

Problem	Impact	Solution and Benefit
Column-to-column and batch-to-batch reproducibility is not consistent	<ul style="list-style-type: none"> <li>Increased labor costs due to individual column QC testing</li> <li>Revalidate/redevelop method with each new batch of columns</li> </ul>	<ul style="list-style-type: none"> <li>Symmetry® brand of HPLC columns have the tightest specifications in the market to provide the most consistent results</li> <li>Symmetry® columns achieve outstanding year-to-year reproducibility to give long life to established analytical methods</li> </ul>
Severe or excessive peak tailing	<ul style="list-style-type: none"> <li>Increased number of experiments to optimize analytical method</li> </ul>	<ul style="list-style-type: none"> <li>SymmetryShield™ columns with embedded polar technology provide less peak tailing for faster and easier method development</li> </ul>
Column selectivity not resolving critical peaks	<ul style="list-style-type: none"> <li>Increased number of experiments required to optimize method</li> </ul>	<ul style="list-style-type: none"> <li>SymmetryShield™ columns are the perfect complement to Symmetry® columns, providing different selectivity and enabling column selection to maximize resolution</li> </ul>
Difficulty resolving individual compounds in complex peptide or protein samples	<ul style="list-style-type: none"> <li>Increased cost and time to isolate compounds</li> </ul>	<ul style="list-style-type: none"> <li>Symmetry300™ columns demonstrate the highest peak capacity of all leading brands</li> <li>Excellent reproducibility for separating large numbers of peptides or proteins</li> </ul>
Scaling-up analytical method to preparative scale requires too many adjustments to achieve good isolation and purification	<ul style="list-style-type: none"> <li>Higher costs due to method development time and labor</li> <li>Higher cost of equipment, samples and prep columns</li> </ul>	<ul style="list-style-type: none"> <li>SymmetryPrep™ columns save development time with direct scale-up while maintaining resolution</li> </ul>

## Symmetry® Columns—the solution for today's demanding analytical requirements



### Physical Characteristics

Packing	Chemistry	Particle Size	Particle Shape	Pore Size	Carbon Load	End-capped
Symmetry®	C <sub>18</sub>	3.5, 5 μm	Spherical	100Å	19%	Yes
	C <sub>8</sub>	3.5, 5 μm	Spherical	100Å	12%	Yes
SymmetryPrep™	C <sub>18</sub>	7 μm	Spherical	100Å	19%	Yes
	C <sub>8</sub>	7 μm	Spherical	100Å	12%	Yes
SymmetryShield™	RP <sub>8</sub>	3.5, 5, 7 μm	Spherical	100Å	15%	Yes
	RP <sub>18</sub>	3.5, 5, 7 μm	Spherical	100Å	17%	Yes
Symmetry300™	C <sub>18</sub>	3.5, 5 μm	Spherical	300Å	8.5%	Yes
	C <sub>4</sub>	3.5, 5 μm	Spherical	300Å	2.8%	Yes

## Setting the Standard for Reproducibility

As today's chemists establish new analytical methods for the latest pharmaceutical and biopharmaceutical products, the selection of a reproducible HPLC column is essential. The selected column needs to provide the same chromatographic results over the life of the new drug product. Symmetry® columns demonstrate superior reproducibility over many years. Batches randomly selected over the past 5 years demonstrate excellent reproducibility in the example shown.

Reproducibility is our number one priority in supplying Symmetry® columns. This excellent reproducibility is a result of our commitment to maintaining the tightest specifications in the HPLC column industry. Symmetry® columns are engineered with high purity raw materials, tightly controlled manufacturing processes and column packing procedures that provide today's scientists with the best, most reproducible HPLC column available.

Our goal is to supply a family of HPLC columns that you can rely on for rugged and robust methods. Symmetry® columns let you increase your laboratories' productivity, and allow easier method transfer between labs and around the globe.

A three-page Certificate of Analysis is included with every Symmetry® column. We report both our specifications, which are the tightest in the industry, and the results of the 22 critical tests each column must pass before it carries the Symmetry® brand.

### Unmatched Year-to-year Reproducibility

**Column:** Symmetry® C<sub>18</sub>,  
4.6 x 150 mm, 5 µm

**Mobile Phase A:** H<sub>2</sub>O

**Mobile Phase B:** MeCN

**Mobile Phase C:** pH 3.75; 100 mM NH<sub>4</sub>COOH in H<sub>2</sub>O

**Flow Rate:** 1.4 mL/min

**Isocratic:** 30% A; 60% B; 10% C

**Injection Volume:** 5.0 µL

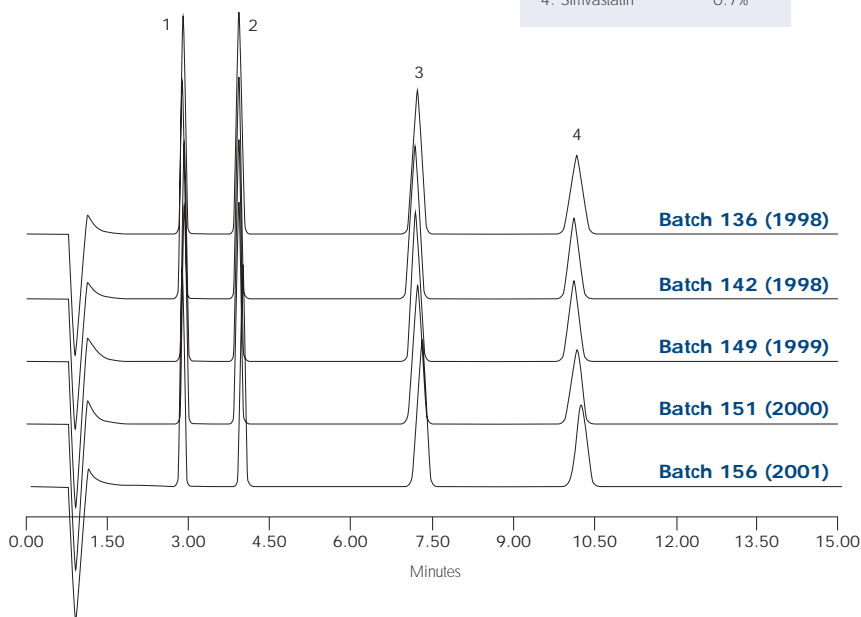
**Temperature:** 30 °C

**Detection:** UV @ 233 nm

**Instrumentation:** Waters Alliance® HT 2795  
Waters 996 PDA detector  
Sampling Rate: 5 pts./sec

#### RSD's for Retention Times

1. Terbinafine HCl	0.7%
2. Ibuprofen	0.8%
3. Lovastatin	0.6%
4. Simvastatin	0.7%



### Comprehensive Certificate of Analysis



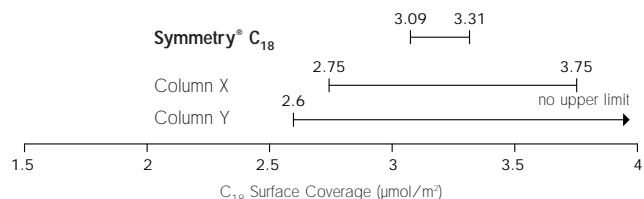
# Symmetry® Columns

## The Benefit of Narrow Specification Ranges

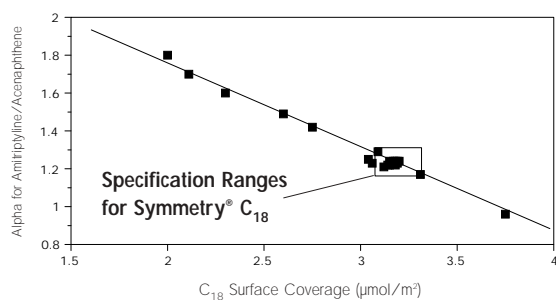
Symmetry® columns have the narrowest ligand surface coverage specifications in the industry. Surface coverage (ligand density) is one of the most important parameters affecting reproducibility. The impact of a small variation in surface coverage on the amitriptyline/acenaphthene alpha specification for Symmetry® C<sub>18</sub> columns is shown here.

Narrow column specifications benefit the chromatographer in achieving reproducible results. The surface coverage requirements of Symmetry® are the tightest specifications in the industry, resulting in minimal shifts in resolution and more reproducible batch-to-batch and column-to-column results.

## C<sub>18</sub> Ligand Surface Coverage Specification Ranges



## Narrow Specification Ranges Provide Smaller Shifts in Alpha (α)

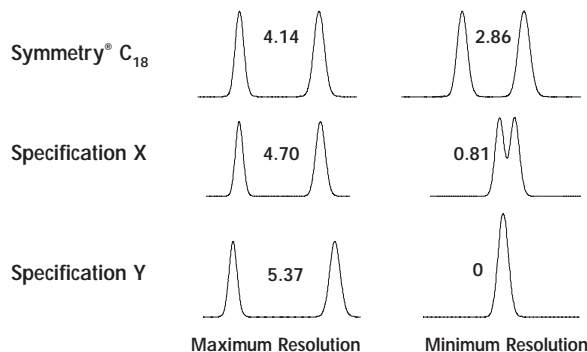


Smaller Shifts in Alpha (α) Reduce Changes in Peak Resolution

$$R = \left( \frac{\sqrt{N}}{4} \right) \left( \frac{\alpha - 1}{\alpha} \right) \left( \frac{K_2}{K_2 + 1} \right)$$

R = resolution  
N = number of peaks  
α = alpha value  
k = peak retention

## Minimal Changes in Resolution Means More Reproducible Results\*



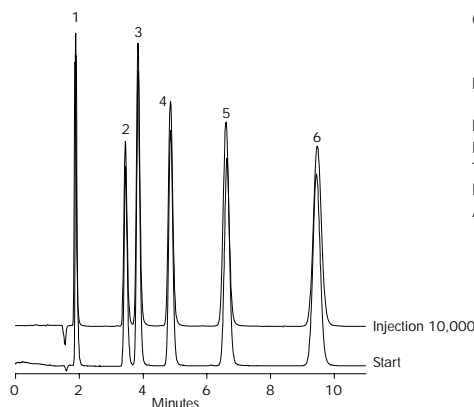
\* Based on vendors column product specifications for ligand density

## Long Lifetime

Columns that last longer save you money. Symmetry® columns can last over 10,000 injections with minimal loss in efficiency, minimal increase in backpressure and minimal change in retention time.

Symmetry® columns deliver guaranteed consistent performance optimizing the two key factors that control column lifetime which are hydrolytic stability of the packing material and mechanical stability of the packed bed.

## Outstanding Packed Bed Stability—10,000 Injections



**Column:** Symmetry® C<sub>8</sub> 3.9 mm x 150 mm, 5 µm with Sentry™ Guard Column 3.9 mm x 20 mm  
**Mobile Phase:** Water/methanol/glacial acetic acid 79:20:1  
**Flow Rate:** 1.0 mL/minute  
**Injection Volume:** 10 µL  
**Temperature:** 25°C  
**Detector:** UV @ 254  
**Analytes:**  
1. Sulfanilamide  
2. Sulfadiazine  
3. Sulfathiazole  
4. Sulfamerazine  
5. Sulfamethazine  
6. Succinylsulfathiazole

The long-term mechanical stability of Symmetry® columns is demonstrated in this analysis of sulfa drugs. Over 10,000 injections were run with minimal loss in column efficiency. The use of the Sentry™ guard column is critical to achieving these types of column lifetimes.

## Superior Peak Shape Regardless of Mobile Phase pH

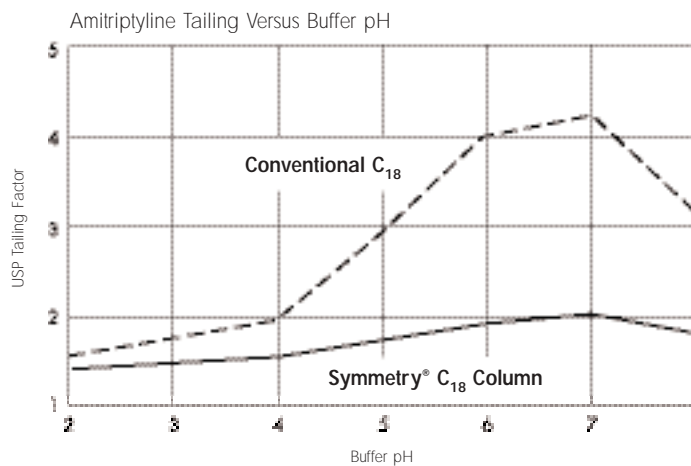
The performance of any reversed-phase column is determined by two factors.

First, the bonded phase coverage (hydrophobicity); and second, the activity of the unbonded, residual silanols on the silica surface.

Symmetry® columns deliver superior peak shape across the pH range of 2–8. This is due to the high bonding density and minimal residual silanol activity of the packing materials.

Now you can work at neutral pH or low pH to optimize your method without compromising peak shape.

## The Influence of Mobile Phase pH on Peak Shape of Amitriptyline



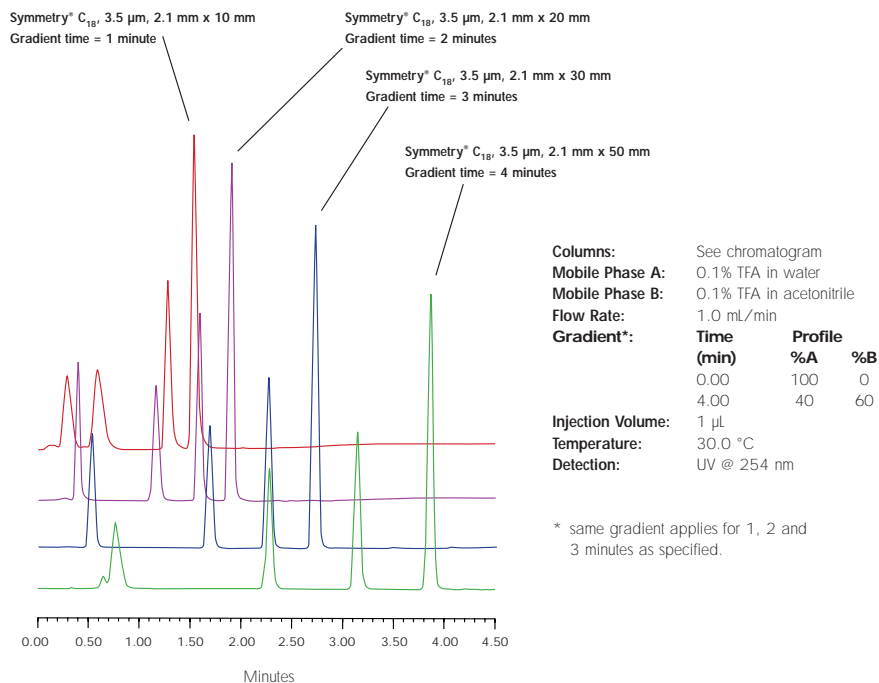
Symmetry® columns deliver superior peak shape for basic compounds across a wide pH range.

## Speed and Resolution

The speed you need for high throughput lead generation – speed that enables rapid analysis and purification of thousands of samples per day and decreases run times by 50% without sacrificing resolution.

- + Achieve increased resolution with smaller particle size material in the same gradient time.
- + Increase throughput and resolution with smaller particle size if flow rate is increased
- + Reduce analysis time by 50% by using shorter columns
- + Maintain resolution by scaling gradient volume proportionally to column volume

## Increased Speed While Maintaining Resolution

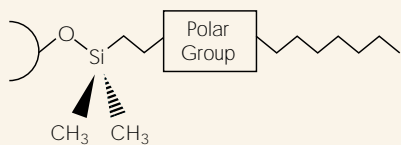


# SymmetryShield™ Columns

## Raising the Standard for Superior Peak Shape

SymmetryShield™ HPLC columns have set the standard of performance for peak shape of basic compounds. This reversed-phase column is based on Waters' patented embedded polar group technology that literally "shields" the silica's residual surface silanols from highly basic analytes.

### Shield Technology



Reduce interaction with silanols  
Improve water-wettability

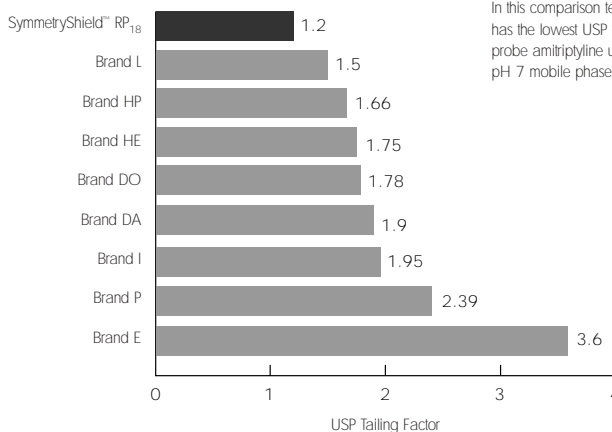
The embedded polar group, which is in close proximity to the silica surface, further reduces the activity of the surface silanols in SymmetryShield™ packing materials.

As a result, SymmetryShield™ columns:

- + Deliver significantly improved peak shape and resolution over a broad pH range
- + Exhibit less retention of basic compounds than conventional C<sub>18</sub> and C<sub>8</sub> columns

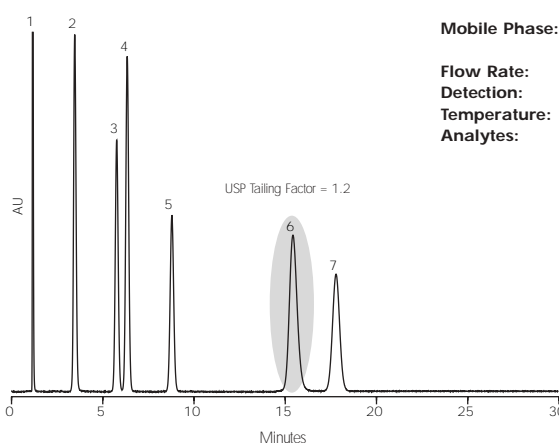
In fact, SymmetryShield™ columns deliver USP Tailing Factors of less than 1.2 over a pH range between pH 2 and pH 8. By delivering lower limits of detection and quantitation, SymmetryShield™ columns will enable you to develop new methods faster and improve the productivity of your laboratory.

### Industry Leader for Peak Shape of Basic Compounds



In this comparison test, SymmetryShield™ RP<sub>18</sub> has the lowest USP tailing factor for the basic probe amitriptyline under the most demanding pH 7 mobile phase conditions.

a: SymmetryShield™ RP<sub>18</sub>



Column:

a. SymmetryShield™ RP<sub>18</sub> 3.9 x 150 mm  
b. Leading Brand C<sub>18</sub>

Mobile Phase:

65% methanol; 35% 20 mM  
KH<sub>2</sub>PO<sub>4</sub>/K<sub>2</sub>HPO<sub>4</sub> @ pH 7

Flow Rate:

1.0 mL/minute

Detection:

UV @ 254 nm

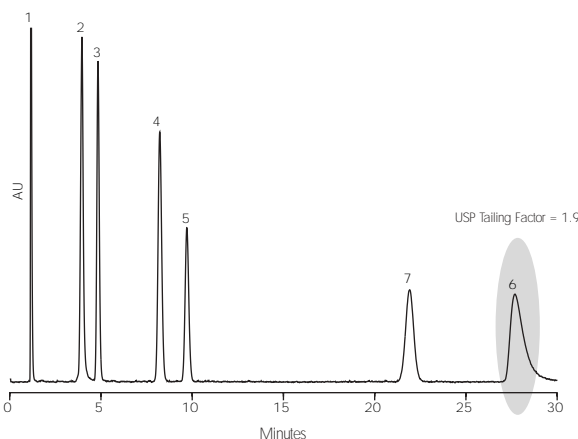
Temperature:

23°C

Analytes:

1. Uracil
2. Propranolol
3. Butylparaben
4. Dipropylphthalate
5. Naphthalene
6. Amitriptyline
7. Acenaphthene

b: Leading Brand C<sub>18</sub>

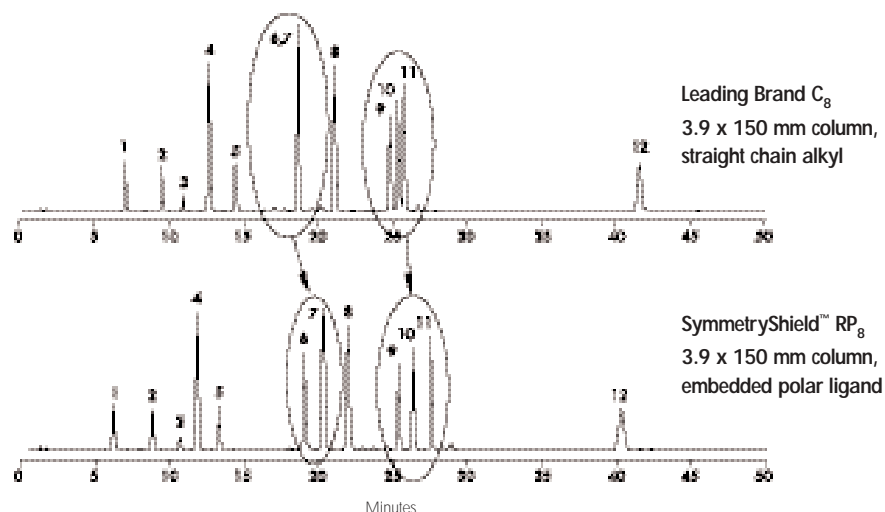


## Unique Selectivity

Obtaining a good separation is paramount. SymmetryShield™ columns exhibit less retention for basic compounds due to lower silanol activity than conventional C<sub>18</sub> and C<sub>8</sub> columns. SymmetryShield™ columns are an excellent methods development tool.

In the example shown, a leading pharmaceutical company was faced with a challenging separation. It was only when a SymmetryShield™ column was substituted for a conventional C<sub>8</sub> column that a much better separation was achieved without having to change mobile phase conditions.

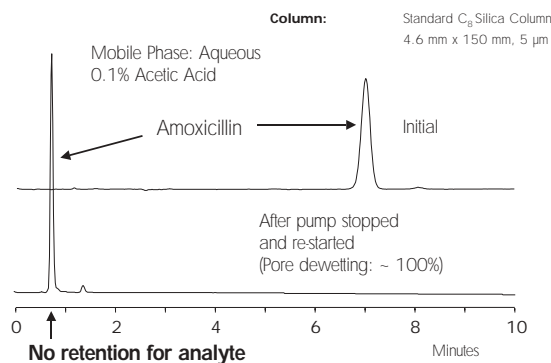
### SymmetryShield™ Columns Deliver Unique Selectivity



## Perfect for Use with Highly Aqueous Mobile Phases

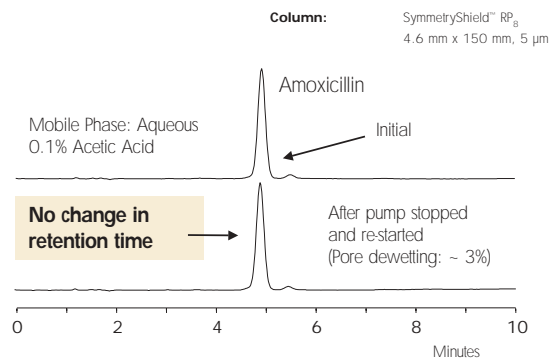
SymmetryShield™ columns with Shield Technology are the perfect choice for applications that require low organic, highly aqueous mobile phase conditions. These reversed-phase particles are water-wettable allowing better interaction between the particles and your sample. The result is stable retention in highly aqueous mobile phases with superior peak shape.

### Standard Silica C<sub>8</sub> Columns — Pore Dewetting



Most HPLC columns lose their retention when running low or 0% organic mobile phases if the flow is stopped. When this happens the bonded particle pores become dewetted. The result is termed "pore dewetting" and you lose the sensitivity of your analyte.

### SymmetryShield™ RP<sub>8</sub> Columns — No Pore Dewetting!



SymmetryShield™ columns prevent this from happening because the embedded polar group maintains the wetted pore surface, ensuring retention of your analyte and eliminating the need for a lengthy re-wetting and column re-equilibration process.

# Symmetry300™ Columns

## High Recoveries of Proteins and Peptides

Symmetry300™ columns are wide-pore, reversed-phase columns which are built on the Symmetry® column platform, the standard that the pharmaceutical industry has come to rely on for sensitive, rugged and robust HPLC analyses.

Symmetry300™ C<sub>18</sub> columns provide better peak shape and peak capacity compared to other leading brands when separating biologically active peptides. In the examples shown, Symmetry300™ columns demonstrate superior performance when simultaneously separating hydrophilic and hydrophobic peptides, as well as neutral and highly basic peptides. Also, hydrophobicity (Meek retention prediction<sup>1</sup>) is included. The lower hydrophobicity values indicate the peptide is more hydrophilic.

Symmetry300™ columns perform better at high and low mass load conditions. For mass spectrometry applications, we recommend low TFA mobile phases or 0.1% formic acid.

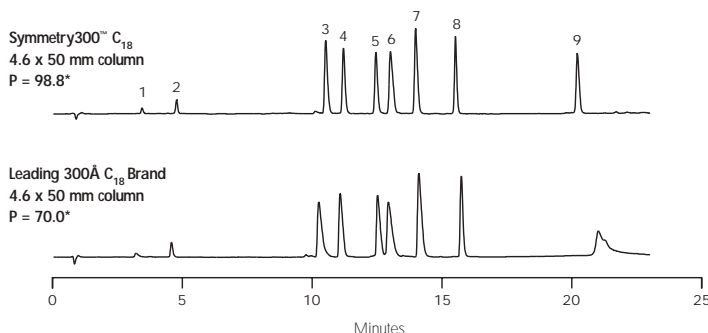
Column-after-column, no matter who uses your methods or where they are used around the world, the Symmetry300™ columns are the best solution for validation compliance.

Symmetry300™ columns are available in two particle sizes: 3.5 µm and 5 µm, and in two chemistries: C<sub>4</sub> for large peptides and proteins, and C<sub>18</sub> for smaller peptides.

### Peptide Separation at High Mass Load (0.1% TFA)

**Columns:** 4.6 x 50 mm, 5 µm  
**Mobile Phase A:** 0.1% TFA in H<sub>2</sub>O  
**Mobile Phase B:** 0.08% TFA in ACN  
**Flow Rate:** 0.75 ml/min  
**Gradient:** 0:50% B in 25 min.

**Injection Volume:**  
**Temperature:** 40°C  
**Detection:** UV 220nm  
**Instrument:** Alliance® 2690



#### Biologically Active Peptide Mixture<sup>1</sup>

Name	MW	pI	Hydrophobicity (Meek)	Number of Amino Acids
1. I2275	986.6	12.04	2.8	9
2. A6677	1001.5	9.34	3.0	10
3. Bradykinin	1060.2	12.00	42.6	9
4. Angiotensin II	1046.2	7.35	43.7	8
5. Angiotensin I	1296.5	7.51	54.0	10
6. Substance P	1347.6	11.20	52.7	11
7. Renin substrate	1759.0	7.61	63.5	14
8. Insulin B chain	3495.9	7.51	129.4	30
9. Melittin	2845.8	12.06	92.3	26

<sup>1</sup> J. L. Meek and Z. L. Rosselli, *J. Chromatogr.*, 211 (1981) 15-28.  
 pI = Isoelectric pH

#### \* Note:

Peak Capacity (P) is defined as the number of theoretical peaks that can fit into a chromatographic run within a certain gradient time

$$P = 1 + (t_g / w_{50})$$

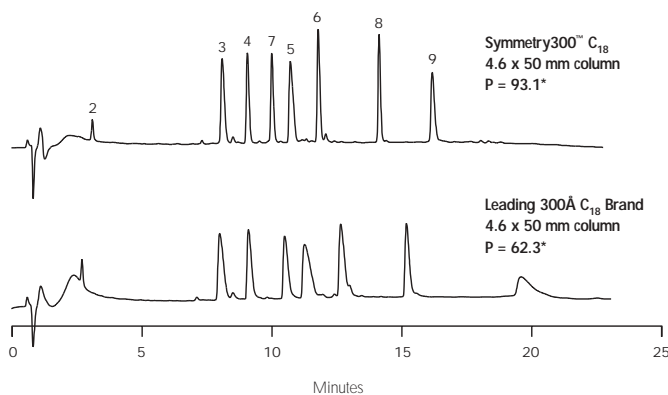
Where  $t_g$  = gradient time

$w_{50}$  = peak measured at 4.4% of peak height

### Peptide Separation at Low Mass Load (0.1% Formic Acid)

**Columns:** 4.6 x 50 mm, 5 µm  
**Mobile Phase A:** 0.1% formic acid in H<sub>2</sub>O  
**Mobile Phase B:** 0.08% formic acid in ACN  
**Flow Rate:** 0.75 ml/min  
**Gradient:** 0:50% B in 25 min.

**Injection Volume:**  
**Temperature:** 40°C  
**Detection:** UV 220nm  
**Instrument:** Alliance® 2690





## Sharpest Peaks for Highest Resolution

The heart of the column is the high purity base deactivated silica. The silica used in Symmetry300™ columns is synthesized using ultrapure organic reagents, resulting in high purity with very low silanol activity.

In addition, when combined with the high surface coverage of the bonded phase the result is higher recoveries of proteins and peptides even when injected at low concentrations.

Symmetry300™ columns deliver the sharpest peaks for biomolecules and deliver more peak capacity for complex tryptic maps.

They are packed to the highest efficiency and reproducibility of any product on the market. This results in improved precision for impurity and stability assays, more accurate quantitation, and adaptability to more rugged methods.

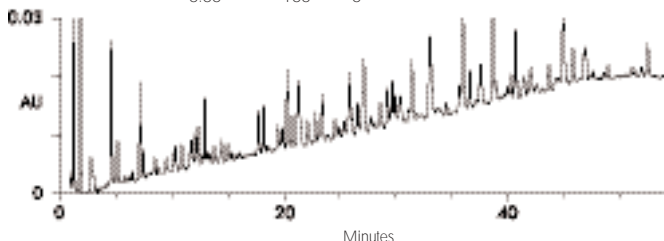
## Excellent Protein Separations

Symmetry300™ C<sub>4</sub> columns have the highest average peak capacity when compared to over 20 leading brands of HPLC columns. In the example shown, which is considered to be a difficult protein separation, the Symmetry300™ C<sub>4</sub> column provided a better separation with better peak shape compared to a leading competitive 300Å column.

## Greater Peak Capacity

### Tryptic Map of Bovine Serum Albumin

<b>Column:</b>	Symmetry300™ C <sub>18</sub> , 4.6 mm x 50 mm	<b>Injection Volume:</b>	20 µL
<b>Mobile Phase:</b>	Eluent A: 0.1% TFA in water Eluent B: 0.1% TFA in acetonitrile	<b>Temperature:</b>	35 °C
<b>Flow Rate:</b>	1.0 mL/min	<b>Detection:</b>	UV @ 214 nm
<b>Gradient:</b>			
	<b>Time (min)</b>	<b>Profile %A %B</b>	
	0.00	100 0	

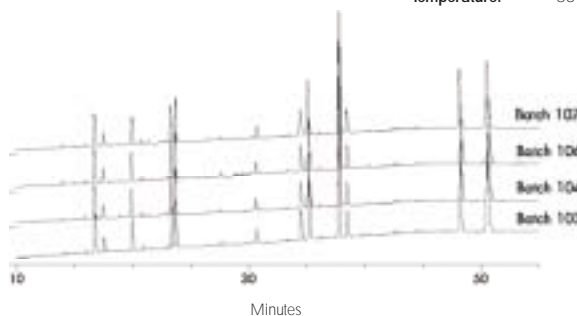


## Unsurpassed Reproducibility

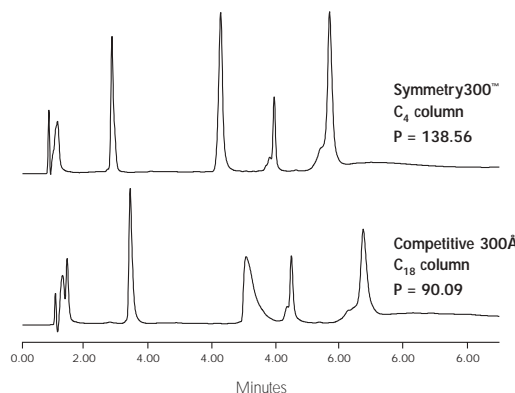
### Cytochrome c Tryptic Map Q.C. Test

Waters batch release protocol includes a tryptic map of cytochrome c which is used to test for reproducibility of retention time and resolution. In this test, the tryptic map was run on four Symmetry300™ columns, each containing a different batch of packing.

<b>Column:</b>	Symmetry300™ C <sub>18</sub> 3.9 x 150 mm, 5 µm	
<b>Mobile Phase A:</b>	0.05% TFA in water	
<b>Mobile Phase B:</b>	0.1% TFA in acetonitrile	
<b>Flow rate:</b>	1.0 mL/min	
<b>Gradient:</b>		
	<b>Time (min)</b>	<b>Profile %A %B</b>
	0.00	100 0
	45	72 28
<b>Injection volume:</b>	20 µL	
<b>Temperature:</b>	35 °C	
	@ 220 nm	



## Protein: Symmetry300™ C<sub>4</sub> Versus Competitors



<b>Columns:</b>	4.6 x 50 mm, 5 µm	
<b>Mobile Phase A:</b>	0.1% TFA in water	
<b>Mobile Phase B:</b>	0.08% TFA in acetonitrile	
<b>Flow Rate:</b>	0.75 mL/min	
<b>Gradient:</b>		
	<b>Time (min)</b>	<b>Profile %A %B</b>
	0.00	80 20
	15.00	35 65
<b>Injection Volume:</b>	20 µL	
<b>Temperature:</b>	40° C	
<b>Detection:</b>	UV @ 220 nm	
<b>Instrument:</b>	Alliance® 2790, 996 PDA	
<b>Analytes:</b>	1. RNase 2. BSA 3. B-Lactoglobulin 4. Ovalbumin	

# SymmetryPrep™ Columns

## Fast, Direct Scale Up From Analytical to Prep

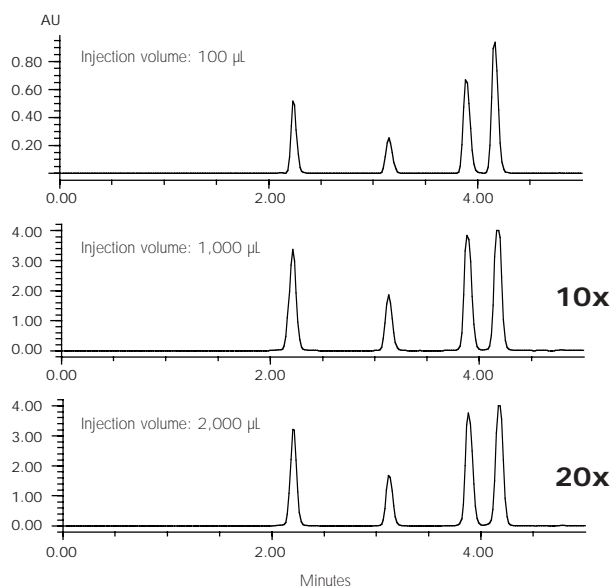
Direct scale-up from analytical to preparative applications – columns that deliver the requisite capacity to take new drug substances from the lead generation to the lead optimization stage of the drug discovery process. The high capacity of Symmetry® columns enables you to scale-up using the same analytical method in order to produce 10-100 milligrams of a new drug substance to expedite the start of preclinical drug metabolism studies.

If you're involved with purifying new lead candidates, supporting toxicology work or isolating impurities and degradants, there is a Symmetry® column to meet your needs. SymmetryPrep™ 7 µm columns have chromatographic selectivity identical to Symmetry® 3.5 µm and 5 µm columns. An HPLC method developed on a Symmetry® analytical column can be scaled up directly to a SymmetryPrep™ column with no further method development. SymmetryPrep™ columns deliver sharp, symmetrical peaks using simple, volatile mobile phase buffers such as TFA and ammonium acetate.

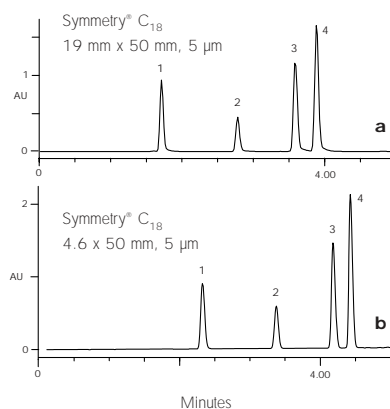
Should your preparative separations require the efficiency of a 5 µm column, an extensive line of Symmetry® semiprep columns packed with 5 µm particles are available.

### High Capacity

**Column:** Symmetry® C<sub>18</sub>, 5 µm, 19 mm x 50 mm  
**Mobile Phase A:** 0.1% TFA in water  
**Mobile Phase B:** 0.1% TFA in acetonitrile  
**Flow Rate:** 15 mL/min  
**Gradient:** 0-60% B in 4 minutes  
**Temperature:** 30 °C  
**Detection:** UV @ 254 nm



### Scale-up Capability



**Column:** See chromatogram  
**Mobile Phase A:** 0.1% TFA in water  
**Mobile Phase B:** 0.08% TFA in acetonitrile  
**Flow Rate:** A: 15 mL/min  
B: 1.0 mL/min  
**Gradient\*:**

Time (min)	Profile %A	%B
0.00	100	0
4.00	40	60

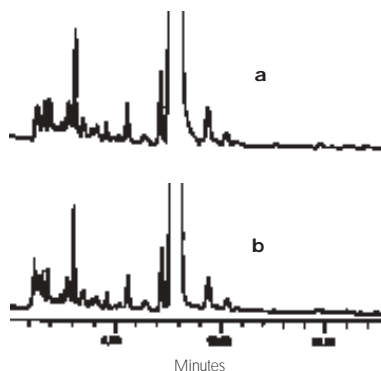
**Injection Volume:** A: 100 µL  
B: 5 µL  
**Temperature:** 30 °C  
**Detection:** UV @ 254 nm  
**Analytes:**

- 1-hydroxy-7-aza-benzotriazole
- 4-methylbenzene sulfonamide
- methyl 3-amino-2-thiophenecarboxylate
- 4-aminobenzophenone

## Impurity Profiling: Resolution Maintained when Scaling-up

SymmetryPrep™ columns are manufactured under the same rigid standards as Symmetry® analytical columns which allows for direct scale-up while maintaining resolution as shown. This can be a significant benefit in saving both time and labor costs when isolating and purifying trace analytes.

## Valerophenone Impurities: Scaling up from Symmetry® 5 µm to SymmetryPrep™ 7 µm Columns



**Column:** a: Symmetry® C<sub>18</sub>, 3.9 mm x 150 mm, 5 µm  
b: SymmetryPrep™ C<sub>18</sub>, 7.8 mm x 300 mm, 7 µm  
**Mobile Phase:** 60% acetonitrile/40% water  
**Flow Rate:** a: 0.70 mL/min  
b: 5.60 mL/min  
**Sample:** 4 mg/mL valerophenone  
**Injection Volume:** a: 100 µL  
b: 800 µL  
**Detection:** UV @ 254 nm

## Extended Column Lifetimes

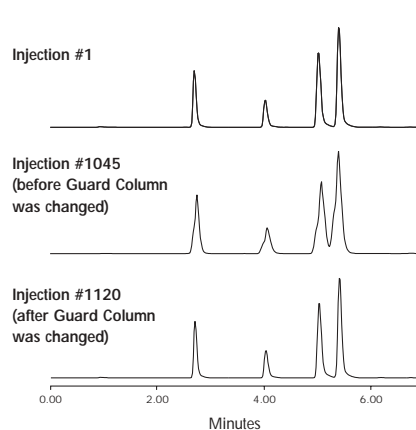
SymmetryPrep™ columns achieve longer column lifetimes with minimal change of efficiency, backpressure, or retention.

### Symmetry® Guard Columns Recommended

SymmetryPrep™ columns lifetimes can be further extended with negligible increase in run time with the addition of a Symmetry® guard column. The guard column will protect the prep column and can be replaced as necessary.

The Symmetry® guard column can protect the prep column against pressure shock. Pressure shock associated with the sampler valve switching (particularly with large injection volumes of different viscosity sample solvents) can cause packed bed damage especially if the surface area is large (i.e. 19 mm i.d. column or greater).

## Long Column Lifetimes



**Column:** Symmetry® C<sub>18</sub>, 19 x 50 mm, 5 µm  
Symmetry® Guard C<sub>18</sub>, 7.8 x 10 mm, 5 µm  
**Mobile Phase A:** 0.1% TFA in water  
**Mobile Phase B:** 0.1% TFA in acetonitrile  
**Flow Rate:** 12 mL/min  
**Gradient:** 0-60% B in 4 minutes  
**Injection Volume:** 100 µL  
**Temperature:** 30 °C  
**Detection:** UV @ 254 nm

Extend column lifetime with negligible increase in run time



**NEW—Purification and Isolation Cartridge Holders**

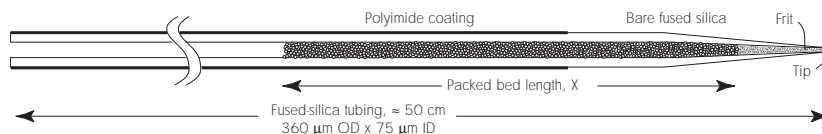
# Symmetry<sup>®</sup> Capillary Columns

## Columns and Chemistries: Small in Size, Big in Performance

When it comes to LC/MS applications, the choice of column can greatly impact speed and sensitivity gains. With this in mind, Waters has developed microbore and capillary columns to meet your LC/MS method development needs.

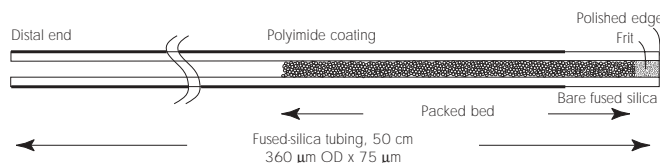
Symmetry<sup>®</sup> columns provide the highest standard of reproducibility with unmatched peak symmetry for maximum sensitivity and accurate quantification.

### PicoFrit<sup>™</sup> 75 $\mu$ m Columns



PicoFrit<sup>™</sup> columns allow you to do femtomole peptide analysis. You can also spray directly from column to inlet of a mass spectrometer and minimize post-column loss of sample.

### IntegraFrit<sup>™</sup> 75 $\mu$ m Columns



IntegraFrit<sup>™</sup> columns provide very low back pressure and are free of adhesives, binders and polymers. They can be used with both ESI-MS and MALDI, and are Biomolecule and MS-compatible.

## Method Development

### Stability-Indicating HPLC Method Development Kit

Waters offers a four column Method Development Kit with a step-by-step protocol for selecting HPLC columns and identifying optimum pH levels. The Method Development Kit also includes a comprehensive Applications Notebook.

Symmetry<sup>®</sup> C<sub>18</sub> 3.5  $\mu$ m column 4.6 x 100 mm

SymmetryShield<sup>™</sup> RP<sub>18</sub> 3.5  $\mu$ m column 4.6 x 100 mm

XTerra<sup>®</sup> MS C<sub>18</sub> 3.5  $\mu$ m column 4.6 x 100 mm

XTerra<sup>®</sup> RP<sub>18</sub> 3.5  $\mu$ m column 4.6 x 100 mm

Comprehensive Applications Notebook.

Part Number :186001100

#### Applications Notebook with Proven Methodology

Step-by-step four-column approach completed at pH 3, pH 7, and pH 10 on the following drugs:

- Diltiazem Hydrochloride
- Fluconazole
- Lansoprazole
- Paclitaxel
- Pravastatin Sodium
- Risperidone
- Simvastatin
- Terbinafine Hydrochloride
- Zidovudine



## Symmetry® Columns and Cartridges

### Symmetry® Analytical Columns

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>8</sub>
1.0 x 50 mm	3.5 µm	WAT106056	WAT106052
1.0 x 150 mm	3.5 µm	WAT248059	WAT248072
2.1 x 30 mm	3.5 µm	WAT058973	WAT058977
2.1 x 50 mm	3.5 µm	WAT200650	WAT200624
2.1 x 100 mm	3.5 µm	WAT058965	WAT058961
2.1 x 150 mm	3.5 µm	WAT106005	WAT106011
3.0 x 100 mm	3.5 µm	186000696	186000698
3.0 x 150 mm	3.5 µm	186000695	186000697
4.6 x 30 mm	3.5 µm	186000271	186000270
4.6 x 50 mm	3.5 µm	WAT200625	WAT200620
4.6 x 75 mm	3.5 µm	WAT066224	WAT066200
4.6 x 100 mm	3.5 µm	WAT066220	WAT066204
4.6 x 150 mm	3.5 µm	WAT200632	WAT200630
2.1 x 50 mm	5 µm	186000206	186000212
2.1 x 150 mm	5 µm	WAT056975	WAT056955
3.0 x 150 mm	5 µm	WAT054200	WAT054230
3.0 x 250 mm	5 µm	186000690	186000691
3.9 x 150 mm	5 µm	WAT046980	WAT046970
4.6 x 50 mm	5 µm	186000207	186000213
4.6 x 150 mm	5 µm	WAT045905	WAT045995
4.6 x 250 mm	5 µm	WAT054275	WAT054270

### Symmetry® Cartridge Columns (Requires endfittings, see Page 13)

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>8</sub>
2.1 x 20 mm	3.5 µm	186000269	186000268
2.1 x 50 mm	3.5 µm	186000152	186000149
2.1 x 100 mm	3.5 µm	186000151	186000153
2.1 x 150 mm	3.5 µm	186000150	186000148
4.6 x 75 mm	3.5 µm	WAT066260	WAT066210
4.6 x 100 mm	3.5 µm	WAT066265	WAT066215
3.9 x 50 mm	5 µm	WAT054220	WAT054240
3.9 x 150 mm	5 µm	WAT054205	WAT054235
4.6 x 150 mm	5 µm	WAT054210	WAT054255
4.6 x 250 mm	5 µm	WAT054215	WAT054245

### Symmetry® Sentry™ Guard Columns (2 per pack)

(Requires Sentry™ Guard Holders, see Page 13)

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>8</sub>
2.1 x 10 mm	3.5 µm	WAT106127	WAT106128
3.9 x 20 mm	5 µm	WAT054225	WAT054250

### Symmetry® Capillary Columns

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>8</sub>
0.32 x 50 mm	3.5 µm	186000945	186000946
0.32 x 100 mm	3.5 µm	186000951	186000952
0.32 x 150 mm	3.5 µm	186000957	186000958
0.32 x 50 mm	5 µm	186000929	186000930
0.32 x 100 mm	5 µm	186000935	186000936
0.32 x 150 mm	5 µm	186000347	186000941

### Symmetry® C<sub>18</sub> PicoFrit™ Columns

Dimension	Particle Size	Part Number
75 µm x 50 mm	3.5 µm	186001407
75 µm x 100 mm	3.5 µm	186001408
75 µm x 100 mm	5 µm	186001409
75 µm x 150 mm	5 µm	186001410

### Symmetry® C<sub>18</sub> IntegraFrit™ Columns

Dimension	Particle Size	Part Number
75 µm x 50 mm	3.5µm	186001403
75 µm x 100 mm	3.5 µm	186001404
75 µm x 100 mm	5 µm	186001405
75 µm x 150 mm	5µm	186001406

### Symmetry® Column and Cartridge Column Method Validation Kits

Three Columns from Three Different Batches to Test Reproducibility.

Dimension	Type	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>8</sub>
4.6 x 150 mm	Column	3.5 µm	WAT094240	WAT094237
2.1 x 150 mm	Column	5 µm	WAT094234	WAT094231
3.0 x 150 mm	Column	5 µm	WAT054446	WAT054434
3.9 x 150 mm	Column	5 µm	WAT047210	WAT046955
4.6 x 150 mm	Column	5 µm	WAT054448	WAT054435
4.6 x 250 mm	Column	5 µm	WAT054450	WAT054438
3.9 x 150 mm	Cartridge*	5 µm	WAT054452	WAT054440
4.6 x 150 mm	Cartridge*	5 µm	WAT054454	WAT054442
4.6 x 250 mm	Cartridge*	5 µm	WAT054456	WAT054444

\* Require Endfittings, see Page 13

### SymmetryPrep™ Columns for Purification and Isolation

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>8</sub>
7.8 x 10 mm	5 µm	186000711	186000712
7.8 x 50 mm	5 µm	186000208	186000214
7.8 x 100 mm	5 µm	186000209	186000215
19 x 10 mm	5 µm	186000715	186000716
19 x 50 mm	5 µm	186000210	186000216
19 x 100 mm	5 µm	186000211	186000229
30 x 50 mm	5 µm	186000235	186000237
30 x 100 mm	5 µm	186000236	186000238
7.8 x 10 mm	7 µm	186000713	186000714
7.8 x 150 mm	7 µm	WAT066288	WAT066285
7.8 x 300 mm	7 µm	WAT066235	WAT066225
19 x 10 mm	7 µm	186000717	186000718
19 x 150 mm	7 µm	WAT066240	WAT066228
19 x 300 mm	7 µm	WAT066245	WAT066230

### Purification and Isolation Cartridge Column Holders

7.8 x 10 mm	5, 7 µm	—	186000708
19 x 10 mm	5, 7 µm	—	186000709
Replacement o-ring 7.8 mm, 2 pkg			700001019
Replacement o-ring 19 mm, 2 pkg			700001020

## SymmetryShield™ Columns and Cartridges

### SymmetryShield™ Columns

Dimension	Particle Size	Part No. RP <sub>18</sub>	Part No. RP <sub>8</sub>
1.0 x 50 mm	3.5 µm	186000175	WAT106060
1.0 x 150 mm	3.5 µm	186000176	WAT106048
2.1 x 30 mm	3.5 µm	186000171	WAT106001
2.1 x 50 mm	3.5 µm	186000172	WAT094257
2.1 x 100 mm	3.5 µm	186000173	WAT058969
2.1 x 150 mm	3.5 µm	186000174	WAT106008
3.0 x 100 mm	3.5 µm	186000700	186000703
3.0 x 150 mm	3.5 µm	186000699	186000702
4.6 x 50 mm	3.5 µm	186000177	WAT094260
4.6 x 75 mm	3.5 µm	186000178	WAT094263
4.6 x 100 mm	3.5 µm	186000179	WAT094266
4.6 x 150 mm	3.5 µm	186000180	WAT094269
2.1 x 50 mm	5 µm	186000217	186000223
2.1 x 150 mm	5 µm	186000111	WAT094245
3.0 x 150 mm	5 µm	186000692	WAT094243
3.0 x 250 mm	5 µm	186000693	186000694
3.9 x 150 mm	5 µm	186000108	WAT200655
4.6 x 50 mm	5 µm	186000218	186000224
4.6 x 150 mm	5 µm	186000109	WAT200662
4.6 x 250 mm	5 µm	186000112	WAT200670

### SymmetryShield™ Cartridge Columns (Requires endfittings, see Page 13)

Dimension	Particle Size	Part No. RP <sub>18</sub>	Part No. RP <sub>8</sub>
2.1 x 50 mm	3.5 µm	186000168	186000147
2.1 x 100 mm	3.5 µm	186000167	186000146
2.1 x 150 mm	3.5 µm	186000166	186000145
4.6 x 75 mm	3.5 µm	186000183	WAT094272
4.6 x 100 mm	3.5 µm	186000170	WAT094275
3.9 x 50 mm	5 µm	—	WAT094248
3.9 x 150 mm	5 µm	186000106	WAT200658
4.6 x 150 mm	5 µm	186000110	WAT200665
4.6 x 250 mm	5 µm	186000113	WAT200661

### SymmetryShield™ Sentry™ Guard Columns (2 per pack)

(Requires Sentry™ Guard Holders, see Page 13)

Dimension	Particle Size	Part No. RP <sub>18</sub>	Part No. RP <sub>8</sub>
2.1 x 10 mm	3.5 µm	186000169	WAT106129
3.9 x 20 mm	3.5 µm	186000701	186000704
3.9 x 20 mm	5 µm	186000107	WAT200675

### SymmetryShield™ Capillary Columns

Dimension	Particle Size	Part No. RP <sub>18</sub>	Part No. RP <sub>8</sub>
0.32 x 50 mm	3.5 µm	186000947	186000948
0.32 x 100 mm	3.5 µm	186000953	186000954
0.32 x 150 mm	3.5 µm	186000959	186000960
0.32 x 50 mm	5 µm	186000931	186000932
0.32 x 100 mm	5 µm	186000937	186000938
0.32 x 150 mm	5 µm	186000942	186000943

## SymmetryShield™ Column and Cartridge Column Method Validation Kits

Three Columns from Three Different Batches to Test Reproducibility.

Dimension	Type	Particle Size	Part No. RP <sub>18</sub>	Part No. RP <sub>8</sub>
2.1 x 150 mm	Column	3.5 µm	186000182	—
4.6 x 150 mm	Column	3.5 µm	186000181	WAT094278
2.1 x 150 mm	Column	5 µm	186000100	WAT094254
3.0 x 150 mm	Column	5 µm	-	WAT094251
3.9 x 150 mm	Column	5 µm	186000104	WAT210594
4.6 x 150 mm	Column	5 µm	186000103	WAT210588
4.6 x 250 mm	Column	5 µm	186000102	WAT210591
3.9 x 150 mm	Cartridge*	5 µm	186000105	WAT210582
4.6 x 150 mm	Cartridge*	5 µm	186000101	WAT210585
4.6 x 250 mm	Cartridge*	5 µm	186000114	WAT210579

\* Require endfittings, see Page 13

### SymmetryShield™ Columns for Purification and Isolation

Dimension	Particle Size	Part No. RP <sub>18</sub>	Part No. RP <sub>8</sub>
19 x 10 mm	5 µm	186001835	186001841
19 x 50 mm	5 µm	186001836	186001842
19 x 100 mm	5 µm	186001837	186001843
19 x 150 mm	5 µm	186001838	186001844
19 x 150 mm	7 µm	186001839	186001845
19 x 300 mm	7 µm	186001840	186001846

#### Purification and Isolation Cartridge Column Holders

7.8 x 10 mm	5, 7 µm	—	186000708
19 x 10 mm	5, 7 µm	—	186000709
Replacement o-ring 7.8 mm, 2 pkg			700001019
Replacement o-ring 19 mm, 2 pkg			700001020

## Symmetry300™ Columns and Cartridges

### Symmetry300™ Analytical Columns

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>4</sub>
1.0 x 150 mm	3.5 µm	186000185	186000276
2.1 x 50 mm	3.5 µm	186000187	186000277
2.1 x 100 mm	3.5 µm	186000188	186000278
2.1 x 150 mm	3.5 µm	186000200	186000279
4.6 x 50 mm	3.5 µm	186000201	186000280
4.6 x 75 mm	3.5 µm	186000189	186000281
4.6 x 100 mm	3.5 µm	186000190	186000282
4.6 x 150 mm	3.5 µm	186000197	186000283
2.1 x 150 mm	5 µm	WAT106172	186000285
3.9 x 150 mm	5 µm	WAT106154	186000286
4.6 x 50 mm	5 µm	WAT106209	186000287
4.6 x 150 mm	5 µm	WAT106157	186000288
4.6 x 250 mm	5 µm	WAT106151	186000289

## Symmetry300™ Cartridge Columns (Requires endfittings, see below)

Dimension	Particle Size	Part No. C <sub>18</sub>
2.1 x 50 mm	3.5 µm	186000199
2.1 x 100 mm	3.5 µm	186000191
2.1 x 150 mm	3.5 µm	186000196
4.6 x 75 mm	3.5 µm	186000192
4.6 x 100 mm	3.5 µm	186000193
3.9 x 150 mm	5 µm	WAT106169
4.6 x 150 mm	5 µm	WAT106163
4.6 x 250 mm	5 µm	WAT106160

## Symmetry300™ Sentry™ Guard Columns (2 per pack)

(Requires Sentry™ Guard Holders, see below)

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>4</sub>
2.1 x 10 mm	3.5 µm	186000198	186000275
3.9 x 20 mm	5 µm	WAT106166	186000284

## Symmetry300™ Capillary Columns

Dimension	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>4</sub>
0.32 x 50 mm	3.5 µm	186000949	186000950
0.32 x 100 mm	3.5 µm	186000955	186000956
0.32 x 150 mm	3.5 µm	186000961	186000962
0.32 x 50 mm	5 µm	186000933	186000934
0.32 x 100 mm	5 µm	186000939	186000940
0.32 x 150 mm	5 µm	186000348	186000944

## Symmetry300™ Column and Cartridge Column Method Validation Kits

Three Columns from Three Different Batches to Test Reproducibility.

Dimension	Type	Particle Size	Part No. C <sub>18</sub>	Part No. C <sub>4</sub>
2.1 x 150 mm	Column	3.5 µm	186000194	186000290
4.6 x 150 mm	Column	3.5 µm	186000195	186000291
2.1 x 150 mm	Column	5 µm	WAT106193	186000292
3.9 x 150 mm	Column	5 µm	WAT106187	186000293
4.6 x 150 mm	Column	5 µm	WAT106190	186000294
4.6 x 250 mm	Column	5 µm	WAT106184	186000295
3.9 x 150 mm	Cartridge*	5 µm	WAT106181	—
4.6 x 150 mm	Cartridge*	5 µm	WAT106175	—
4.6 x 250 mm	Cartridge*	5 µm	WAT106178	—

\* Require endfittings, see below

## Symmetry300™ Columns for Purification and Isolation

Dimension	Particle Size	Part No. C <sub>18</sub>
19 x 10 mm	5 µm	186001847
19 x 50 mm	5 µm	186001848
19 x 100 mm	5 µm	186001849
19 x 150 mm	5 µm	186001850

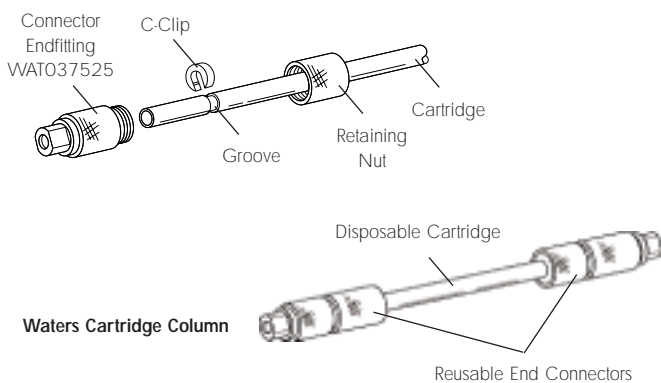
### Purification and Isolation Cartridge Column Holders

7.8 x 10 mm	186000708
19 x 10 mm	186000709
Replacement o-ring 7.8 mm, 2 pkg	700001019
Replacement o-ring 19 mm, 2 pkg	700001020

## Cartridge and Guard Columns

### Waters Cartridge Column

Waters cartridge system requires re-useable endfittings. **These cartridge endfittings need to be ordered when purchasing a Waters HPLC cartridge column for the first time.** These cartridge columns should be connected to your HPLC instrument using Waters standard connectors.

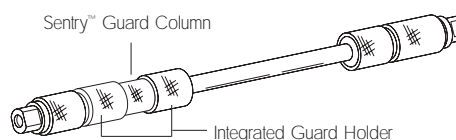


#### Cartridge End-Fittings

2.1 x 50 mm, 2.1 x 100 mm, 2.1 x 150 mm, 2.1 x 250 mm use Part Number 700000117  
 3.0 x 50 mm, 3.0 x 100 mm, 3.0 x 150 mm, 3.0 x 250 mm use Part Number WAT037525  
 3.9 x 50 mm, 3.9 x 100 mm, 3.9 x 150 mm, 3.9 x 250 mm use Part Number WAT037525  
 4.6 x 50 mm, 4.6 x 100 mm, 4.6 x 150 mm, 4.6 x 250 mm use Part Number WAT037525

### Waters Sentry™ Guard Column and Universal Guard Holder

Waters offers a line of Sentry™ Guard columns that contain the same high performance packing materials as all of the Waters analytical columns. Developed for customers needing increased capacity for biological fluid clean-up and/or temperature control, the Sentry™ Guard column is available in two holder designs—one to be used as an integrated part of the Waters steel cartridge column with reusable endfitting, the other for use with any HPLC column. Both are installed without tools.

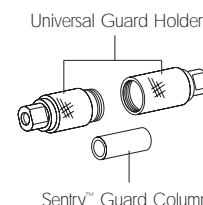


#### Integrated Sentry™ Guard Holder to go with cartridge end-fittings (see above)

3.0 x 20 mm, 3.9 x 20 mm – use Part Number WAT046905

#### Universal Sentry™ Guard Holder (Use on any column)

2.1 x 10 mm use Part Number WAT097958  
 2.1 x 20 mm use Part Number 186000262  
 3.0 x 20 mm use Part Number WAT046910  
 3.9 x 20 mm use Part Number WAT046910  
 4.6 x 20 mm use Part Number WAT046910





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**Literature**

Symmetry® Application Notebook

SymmetryShield™ Application Notebook

SymmetryShield™ White Paper

**Code**

WN033

WN035

720000207EN

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The quality management system of Waters' manufacturing facility, Taunton, Massachusetts, and Wexford, Ireland complies with the International Standard ISO 9002 Quality Management and Quality Assurance Standards. Waters' quality management system is periodically audited by the registering body to ensure compliance.



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