

[THE STANDARD IN SILICA-BASED HPLC COLUMN PERFORMANCE]



Waters
THE SCIENCE OF WHAT'S POSSIBLE.™

**The Standard in Silica-based
HPLC Column Performance**



“The SunFire columns were selected for their resolving power and reliability to meet both our analytical and preparative needs. SunFire columns allowed us to load up to 50% more sample, with similar results, and run up to twice as many injections than we had done previously.”

Anthony Paiva

Senior Research Scientist

PhytoCeutica, Inc.

“Being able to load more compound per injection is valuable for saving time without sacrificing purity. Mass recoveries using the OBD Prep Columns are excellent and are higher than other columns I have used. Even after 1,000+ injections, the columns are still performing as they did fresh out of the box.”

Michael J. Mayer, Ph.D.

Senior Research Scientist II

Discovery Services - Medicinal Chemistry

AMRI (Contract Laboratory)

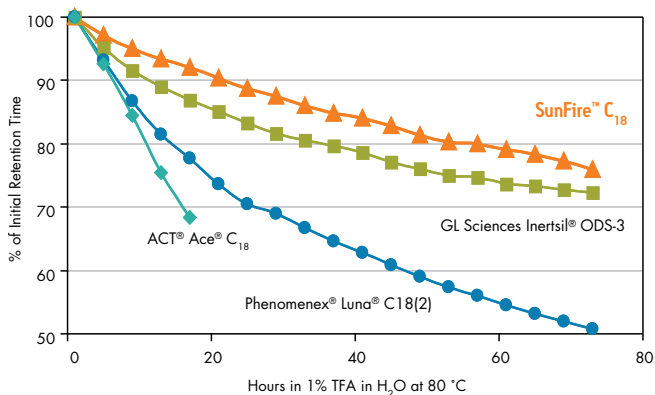


SUNFIRE C₁₈ AND C₈ ANALYTICAL COLUMNS

SunFire™ columns set the standard for the state-of-the-art bonded C₁₈ and C₈ silica HPLC columns. Benefiting from years of research and product development, SunFire columns represent the best in particle and bonding expertise and deliver the industry-leading level of chromatographic performance.

EXCELLENT LOW pH STABILITY

Column lifetime is improved by low pH stability superior to that of many silica-based HPLC column brands.



HIGH EFFICIENCY

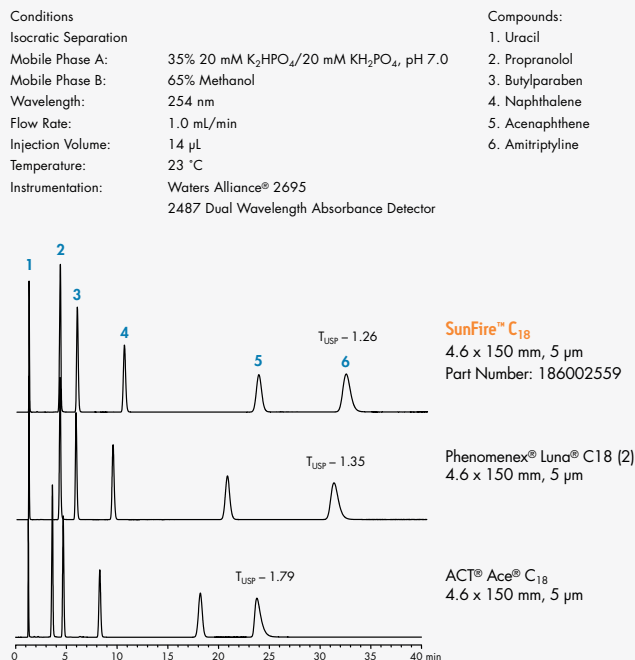
A combination of proprietary, state-of-the-art silica synthesis, bonding, end-capping, and packing technologies produce SunFire columns with high efficiency. One important benefit of these efforts is greater sensitivity.

MS-COMPATIBILITY

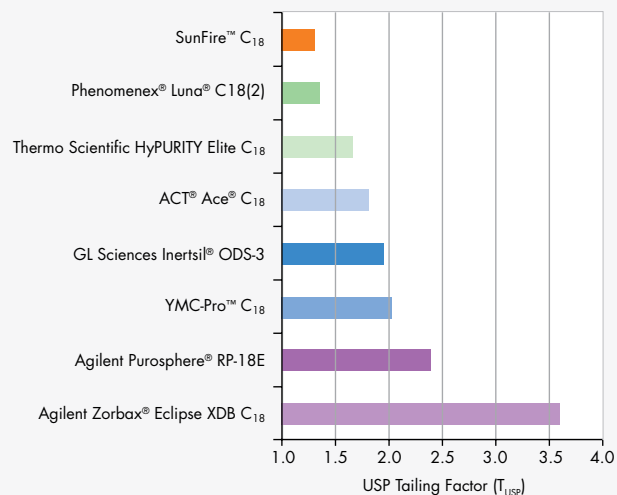
SunFire columns are compatible with mass spectrometry applications, providing sharp peaks, excellent sensitivity, high peak capacity, and ultra-low bleed. In addition, the speed, excellent resolution, and low backpressure offered by SunFire Intelligent Speed (IS™) columns reduce costs and analysis times.

SUPERIOR PEAK SHAPE

With new bonding and new end-capping technologies for the SunFire columns, Waters has developed a sorbent with superior peak shape performance. SunFire columns provide symmetrical peaks for improved resolution and quantitation of acidic, neutral, and basic compounds at low and intermediate pH ranges.



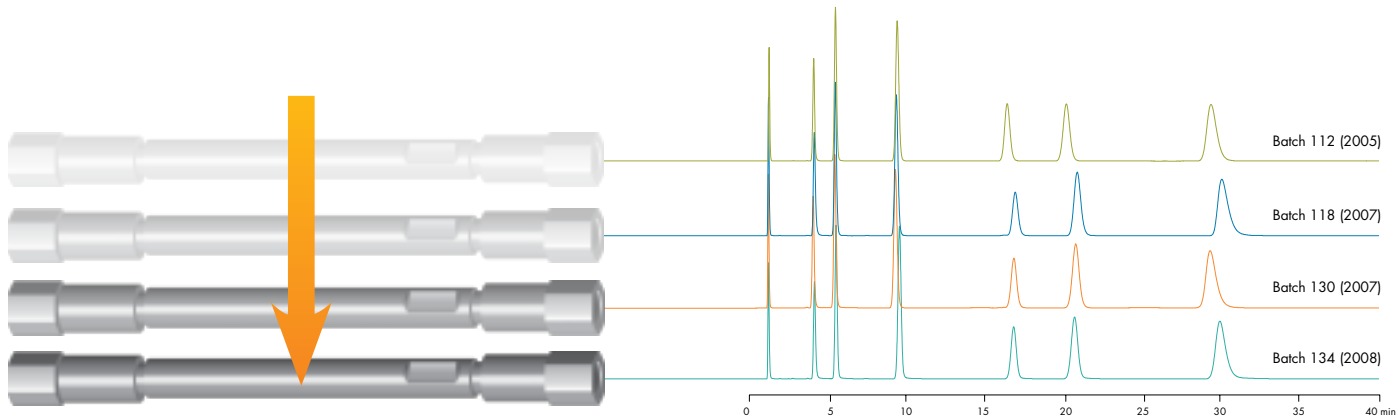
Comparison of C₁₈ 5 µm HPLC Columns



In this comparison test of columns packed with 5 µm particles, SunFire C₁₈ column has the lowest USP tailing factor for the basic probe amitriptyline under the most demanding pH 7 mobile-phase conditions.

BATCH-TO-BATCH REPRODUCIBILITY

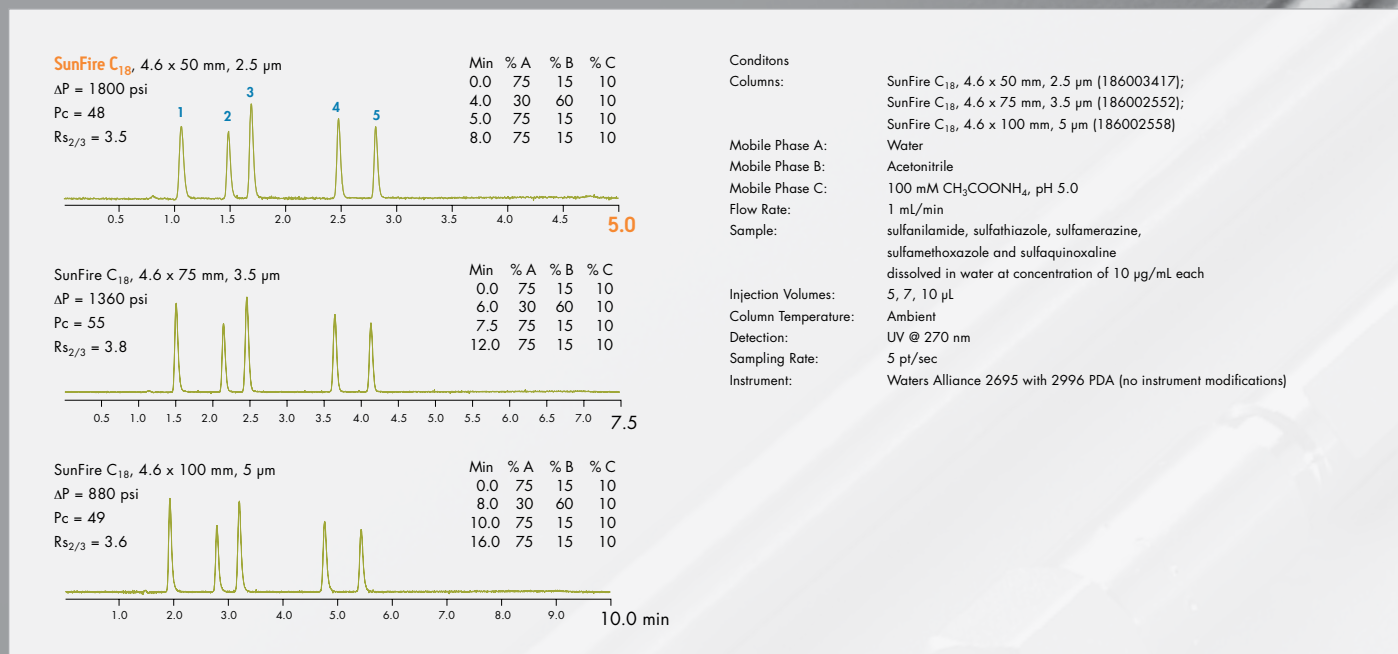
In establishing new analytical methods for the latest pharmaceutical and biopharmaceutical products, the selection of a reproducible HPLC column is essential. The selected column needs to provide the same chromatographic results over the life of the method and the new drug product. SunFire columns have demonstrated superior reproducibility over many years. Batches randomly selected over the past 4 years show excellent reproducibility in the example below.



This excellent reproducibility is a result of our commitment to maintaining the tightest specifications in the HPLC column industry. SunFire columns start with high purity raw materials, and are produced using tightly controlled manufacturing processes and column packing procedures that provide today's scientists with the best, most reproducible HPLC columns available.

SUNFIRE 2.5 µm COLUMNS

This smaller particle size allows chromatographers to gain improved sensitivity and greater efficiency. SunFire columns with 2.5 µm particle size enable faster run times while maintaining the same resolution.



SUNFIRE PREP C₁₈ AND C₈ COLUMNS

Optimum Bed Density (OBD™) preparative columns are the culmination of a two-year research and development project aimed at delivering the most reliable and consistent preparative column performance. This innovative manufacturing procedure combines the influences of hardware, particle characteristics and packed bed densities, resulting in columns with excellent stability, superior reproducibility and extremely high efficiencies.

WATERS OBD COLUMN DESIGN

Waters has combined high-pressure slurry packing with a carefully calculated axial compression element localized at the less-dense inlet end of the bed.

With careful tuning of the packing process for each particle type and column geometry, the Prep OBD design* and process results in predictable, uniform density profiles throughout the column. During the final capping process, Waters Column Packing Operation follows carefully established procedures designed not to over-compress or disrupt, in any non-uniform way, this portion of the bed. Waters scientists have established that too much axial compression applied at the inlet can break particles, build bridges, and lower local bed permeability.

The Prep OBD column is designed to incorporate a pair of specially-designed distributors and chemically inert seals made to prevent leaks at high operating pressures.

*US Patent Number 7,399,410 and UK Patent Number GB 2408 469

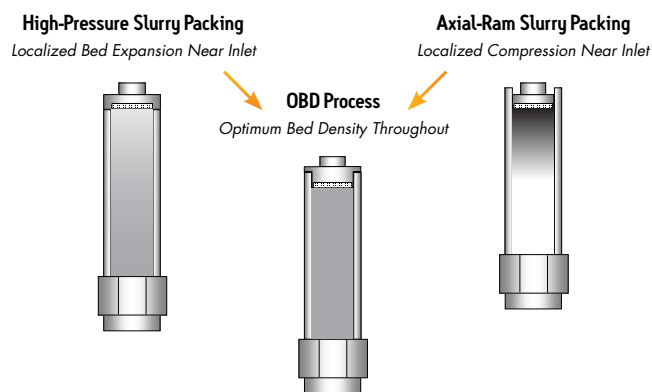
LOADABILITY BY DESIGN

The physicochemical characteristics of sorbents used for preparative separations must be designed and/or chosen not only to achieve the selectivity necessary for optimal separations but also the load capacity that enables maximum throughput. This becomes especially tricky for ionizable compounds in mobile phases with low to moderate pH. SunFire sorbents are made from an engineered synthetic silica with proprietary surface-chemistry modifications, all done under cGMP protocols, that extend loadability far beyond that of competitive packings.

High mass-load capacity means that you may:

Save time - fewer injections required to purify the required quantity analyte

Reduce cost - a smaller, less expensive column may be used successfully with lower solvent consumption.



Optimized bed density in an OBD column is achieved by judicious application of a tuned amount of axial force only at the column inlet.

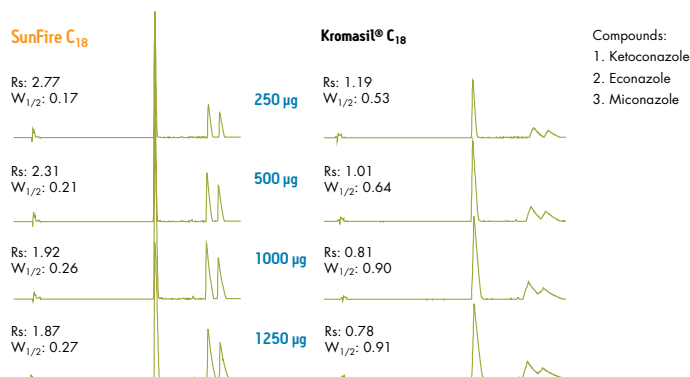


An exploded view of the elements of an empty OBD column.

Conditions
 Mobile Phase A: 0.1% TFA in water
 Mobile Phase B: 0.1% TFA in acetonitrile
 Gradient: 15 min linear gradient from 20% B to 85% B, 2 min initial holding time
 Flow Rate: 1 mL/min
 Injection Volume: 10 µL
 Column: 4.6 x 150 mm, 5 µm
 Detection: UV @ 254 nm
 Instrument: Alliance HT 2795

Sample Concentration:
 As indicated in the table, dissolved in DMSO

Analyte	mg/mL	mg/mL	mg/mL	mg/mL
Ketoconazole	25	20	10	5
Econazole	50	40	20	10
Miconazole	50	40	20	10
Total Concentration	125	100	50	25



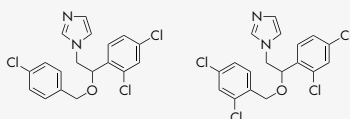
The high mass loading of SunFire sorbents enables the use of smaller preparative column dimensions.

Straightforward Scale-Up of the Separation of Two Structurally Similar Compounds on SunFire C₁₈ Columns

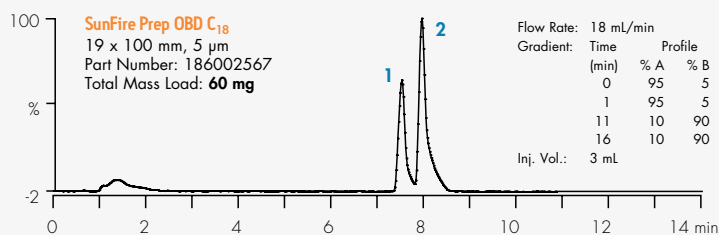
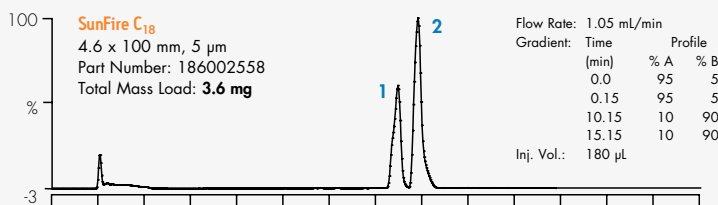
Conditions

Mobile Phase A: 0.1% TFA in water
 Mobile Phase B: 0.1% TFA in acetonitrile
 Sample Concentration: 20 mg/mL in DMSO
 Temperature: Ambient
 Instrument: Waters AutoPurification™ System
 Detection: UV @ 285 nm

Antifungal compounds:



1. Econazole (10 mg/mL) 2. Miconazole (10 mg/mL)



EFFICIENCY AND SCALABILITY

A major challenge for purification scientists is the isolation and purification of pairs of compounds that are structurally similar and/or that share nearly the same chromatographic retention characteristics. Often a successful analytical separation will not scale up directly due to the lower performance of, or less than optimal separation on, a preparative column.

The OBD column design in combination with efficient SunFire particles ensures equivalent chromatographic performance when scaling up from pilot analytical to preparative columns, eliminating the need for any further time-consuming method reoptimization.

NORMAL-PHASE SUNFIRE PREP SILICA COLUMNS

SunFire Prep silica columns allow you to use normal-phase protocols. This gives you a significant selectivity alternative to reversed-phase preparative chromatography on bonded silicas. Analytes that are highly hydrophilic or that are insoluble/unstable in water are ideal candidates for normal-phase purification. Unlike the more viscous, higher-boiling aqueous-organic mobile phases used in reversed phase, typical normal-phase eluents are lower-viscosity, lower-boiling organic solvents. As a consequence, SunFire Silica separations yield several key benefits:

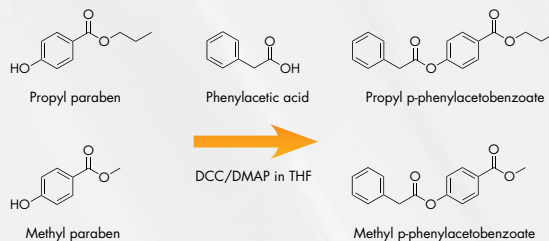
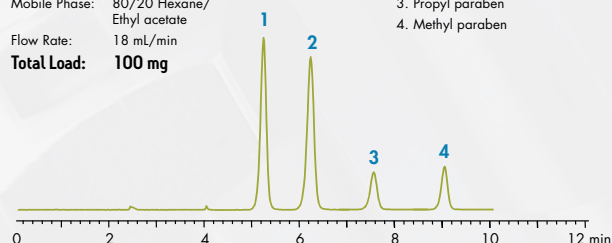
- High efficiency (plate counts similar to those of analytical columns)
- Excellent scale-up capability
- Lower back pressure
- Faster analyte recovery (rapid solvent-evaporation rates)

SunFire Prep columns, available in 5 µm and 10 µm particle sizes, exhibit enhanced column life and stability due to the OBD design as well as excellent peak shapes and high mass-load capacity.

Purification of Diesters from Standard DCC/DMAP Protocol^{1*}

Conditions
 Column: **SunFire Silica**, 19 x 150 mm, 5 µm
 Part Number: 186002568
 Mobile Phase: 80/20 Hexane/
 Ethyl acetate
 Flow Rate: 18 mL/min
Total Load: 100 mg

Analytes:
 1. Propyl p-phenylacetobenzoate
 2. Methyl p-phenylacetobenzoate
 3. Propyl paraben
 4. Methyl paraben



¹A base-catalyzed (DMAP) esterification reaction, driven to completion using a dehydrating agent (DCC). $\text{RCOOH} + \text{R}'\text{OH} \rightleftharpoons \text{RCOOR}' + \text{H}_2\text{O}$

DMAP = 4-Dimethylaminopyridine; DCC = 1,3-Dicyclohexylcarbodiimide; THF = Tetrahydrofuran

Physical Characteristics

Chemistry	Particle Size	Particle Shape	Pore Size	Carbon Load	End-capped
C ₁₈	2.5, 3.5, 5, 10 µm	Spherical	100Å	16%	Yes
C ₈	2.5, 3.5, 5, 10 µm	Spherical	100Å	11.5%	Yes
Silica	5, 10 µm	Spherical	100Å	N/A	N/A

SunFire 2.5 µm Analytical Columns

Particle Size	Dimensions	C ₁₈	C ₈
2.5 µm	1.0 x 50 mm	186003392	186003394
2.5 µm	2.1 x 20 mm <i>IS</i>	186003397	186003398
2.5 µm	2.1 x 30 mm	186003399	186003400
2.5 µm	2.1 x 50 mm	186003401	186003402
2.5 µm	3.0 x 20 mm <i>IS</i>	186003403	186003404
2.5 µm	3.0 x 30 mm	186003407	186003408
2.5 µm	3.0 x 50 mm	186003409	186003410
2.5 µm	4.6 x 20 mm <i>IS</i>	186003411	186003412
2.5 µm	4.6 x 30 mm	186003415	186003416
2.5 µm	4.6 x 50 mm	186003417	186003418
2.5 µm	4.6 x 75 mm	186003419	186003420

SunFire 3.5 µm Analytical Columns

Particle Size	Dimensions	C ₁₈	C ₈
3.5 µm	1.0 x 50 mm	186002526	186002705
3.5 µm	1.0 x 150 mm	186002528	186002706
3.5 µm	2.1 x 20 mm <i>IS</i>	186002531	186002697
3.5 µm	2.1 x 30 mm	186002532	186002709
3.5 µm	2.1 x 50 mm	186002533	186002710
3.5 µm	2.1 x 100 mm	186002534	186002711
3.5 µm	2.1 x 150 mm	186002535	186002712
3.5 µm	3.0 x 20 mm <i>IS</i>	186002686	186002701
3.5 µm	3.0 x 30 mm	186003254	Custom
3.5 µm	3.0 x 50 mm	186002542	186002719
3.5 µm	3.0 x 100 mm	186002543	186002720
3.5 µm	3.0 x 150 mm	186002544	186002721
3.5 µm	4.6 x 20 mm <i>IS</i>	186002549	186002699
3.5 µm	4.6 x 30 mm	186002550	186002728
3.5 µm	4.6 x 50 mm	186002551	186002729
3.5 µm	4.6 x 75 mm	186002552	186002730
3.5 µm	4.6 x 100 mm	186002553	186002731
3.5 µm	4.6 x 150 mm	186002554	186002732

SunFire 5 µm Analytical Columns

Particle Size	Dimensions	C ₁₈	C ₈
5 µm	1.0 x 150 mm	186002529	186002707
5 µm	2.1 x 20 mm <i>IS</i>	186002537	186002698
5 µm	2.1 x 30 mm	186002538	186002714
5 µm	2.1 x 50 mm	186002539	186002715
5 µm	2.1 x 100 mm	186002540	186002716
5 µm	2.1 x 150 mm	186002541	186002717
5 µm	3.0 x 20 mm <i>IS</i>	186002685	186002702
5 µm	3.0 x 50 mm	186002545	186002723
5 µm	3.0 x 100 mm	186002546	186002724
5 µm	3.0 x 150 mm	186002547	186002725
5 µm	3.0 x 250 mm	186002548	186002726
5 µm	4.6 x 20 mm <i>IS</i>	186002555	186002700
5 µm	4.6 x 30 mm	186002556	186002734
5 µm	4.6 x 50 mm	186002557	186002735
5 µm	4.6 x 100 mm	186002558	186002736
5 µm	4.6 x 150 mm	186002559	186002737
5 µm	4.6 x 250 mm	186002560	186002738

SunFire Method Validation Kits

Particle Size	Dimensions	C ₁₈	C ₈
3.5 µm	2.1 x 100 mm MV Kits	186002674	186002739
3.5 µm	4.6 x 100 mm MV Kits	186002675	186002740
3.5 µm	4.6 x 150 mm MV Kits	186002676	186002741
5 µm	4.6 x 100 mm MV Kits	186002677	186002742
5 µm	2.1 x 150 mm MV Kits	186002678	186002743
5 µm	4.6 x 150 mm MV Kits	186002679	186002744
5 µm	4.6 x 250 mm MV Kits	186002680	186002745

SunFire Analytical Guard Columns

Particle Size	Dimensions	C ₁₈	C ₈
2.5 µm	2.1 x 10 mm Sentry® Guard Columns (2/pk)	186003395 ³	186003396 ³
2.5 µm	3.0 x 20 mm Sentry Guard Columns (2/pk)	186003405 ⁴	186003406 ⁴
2.5 µm	4.6 x 20 mm Sentry Guard Columns (2/pk)	186003413 ⁴	186003414 ⁴
3.5 µm	2.1 x 10 mm Sentry Guard Columns (2/pk)	186002530 ³	186002708 ³
3.5 µm	3.0 x 20 mm Sentry Guard Columns (2/pk)	186002681 ⁴	186002718 ⁴
3.5 µm	4.6 x 20 mm Sentry Guard Columns (2/pk)	186002682 ⁴	186002727 ⁴
5 µm	2.1 x 10 mm Sentry Guard Columns (2/pk)	186002536 ³	186002713 ³
5 µm	4.6 x 20 mm Sentry Guard Columns (2/pk)	186002684 ⁴	186002733 ⁴
5 µm	3.0 x 20 mm Sentry Guard Columns (2/pk)	186002683 ⁴	186002722 ⁴

SunFire 5 µm Prep Columns

Particle Size	Dimensions	C ₁₈	C ₈	Silica
5 µm	10 x 50 mm	186002561	186002746	186003425
5 µm	10 x 100 mm	186002562	186002747	186003426
5 µm	10 x 150 mm	186002563	186002748	186003427
5 µm	10 x 250 mm	186002564	186002749	186003428
5 µm	OBD 19 x 30 mm	186002879	186002881	186003430
5 µm	OBD 19 x 50 mm	186002566	186002751	186003431
5 µm	OBD 19 x 100 mm	186002567	186002752	186003432
5 µm	OBD 19 x 150 mm	186002568	186002753	186003433
5 µm	OBD 30 x 50 mm	186002570	186002755	186003435
5 µm	OBD 30 x 75 mm	186002571	186002756	186003436
5 µm	OBD 30 x 100 mm	186002572	186002757	186003437
5 µm	OBD 30 x 150 mm	186002797	186002795	186003438
5 µm	OBD 30 x 250 mm	186003969	-	-
5 µm	OBD 50 x 50 mm	186002867	186002868	186003439
5 µm	OBD 50 x 100 mm	186002869	186002870	186003440
5 µm	OBD 50 x 150 mm	186003941	-	-
5 µm	OBD 50 x 250 mm	186003970	-	-

SunFire 10 µm Prep Columns

Particle Size	Dimensions	C ₁₈	C ₈	Silica
10 µm	10 x 50 mm	186003840	186003841	Custom
10 µm	10 x 150 mm	186002664	186002759	186003442
10 µm	10 x 250 mm	186002665	186002760	186003443
10 µm	OBD 19 x 50 mm	186002667	186002762	186003445
10 µm	OBD 19 x 150 mm	186002668	186002763	186003446
10 µm	OBD 19 x 250 mm	186002669	186002764	186003447
10 µm	OBD 30 x 50 mm	186003854	186003853	186003855
10 µm	OBD 30 x 100 mm	186003971	-	-
10 µm	OBD 30 x 150 mm	186002670	186002765	186003448
10 µm	OBD 30 x 250 mm	186002671	186002766	186003449
10 µm	OBD 50 x 50 mm	186002871	186002872	186003450
10 µm	OBD 50 x 100 mm	186003972	-	-
10 µm	OBD 50 x 150 mm	186002672	186002767	186003451
10 µm	OBD 50 x 250 mm	186002673	186002768	186003452
10 µm	OBD 100 x 250 mm	186003928	-	-

SunFire Prep Guard Columns

Particle Size	Dimensions	C ₁₈	C ₈	Silica
5 µm	10 x 10 mm	186002565 ¹	186002750 ¹	186003429 ¹
5 µm	19 x 10 mm	186002569 ²	186002754 ²	186003434 ²
10 µm	10 x 10 mm	186002663 ¹	186002758 ¹	186003441 ¹
10 µm	19 x 10 mm	186002666 ²	186002761 ²	186003444 ²

SunFire Prep Scouting Columns

Particle Size	Dimensions	C ₁₈	C ₈	Silica
5 µm	4.6 x 150 mm	-	-	186003453
5 µm	4.6 x 250 mm	-	-	186003454
10 µm	4.6 x 150 mm	186003390	Custom	186003467
10 µm	4.6 x 250 mm	186003391	Custom	186003468

www.waters.com/sunfire



¹ Requires 10 x 10 mm Prep Guard Cartridge Holder 289000779
² Requires 19 x 10 mm Prep Guard Cartridge Holder 186000709
³ Requires Universal Sentry Guard Column Holder - 2.1 x 10 mm WAT097958
⁴ Requires Universal Sentry Guard Column Holder - 3.0 x 20 mm WAT046910

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The quality management system of Waters' manufacturing facilities in Taunton, Massachusetts and Wexford, Ireland complies with the International Standard ISO 9001:2000 Quality Management and Quality Assurance Standards. Waters' quality management system is periodically audited by the registering body to ensure compliance.

Waters

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