

# Reversed-Phase Suitability Standard

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## I. INTRODUCTION

The Suitability Standards portfolio is a unique collection of standards and mixtures. These products allow users to evaluate and benchmark the chromatography system before analysis of critical material. The products in the portfolio are all precisely formulated based on the expertise of Waters scientist.

The Reversed-Phase Suitability Standard contains 7 compounds including uracil, butyl paraben, naphthalene, propranolol, dipropylphthalate, acenaphthene, and amitriptyline at pH 7.

This standard mix should be used to confirm the benchmark performance of your analytical HPLC or UPLC system. This particular suitability standard is a specially formulated mix that includes a void marker, neutral, acidic and basic compounds. These compounds were vigorously tested and evaluated and chosen because they provide the following advantages:

- Well-separated
- Easily visually identified
- Acceptable for use on a variety of column

The compounds in the Reversed Phase-Suitability Standard are listed in Table 1. These compounds were chosen for their varying chemical properties and retention on reversed-phase stationary phases. Under the appropriate method conditions, the compounds can be resolved. The Reversed-Phase Suitability Standard is significantly more complex than the Neutrals Suitability Standard in that it contains compounds which could be challenging to separate. It is designed to provide this complexity and is appropriate when complex assays are routinely performed. It can be used with a variety of column chemistries and dimensions, and system hardware. On different column chemistries or dimensions, methods may need to be modified or re-developed to obtain sufficient resolution.

Compound	Type
Amitriptyline	Base
Acenaphthene	Neutral
Naphthalene	Neutral
Dipropyl phthalate	Polar neutral
Butyl paraben	Weak acid
Propranolol	Base
Uracil	Void marker

Table 1. The seven compounds contained in the Reversed-Phase Suitability Standard.

### a. Benchmarking Performance

Waters recommends to benchmark a chromatographic system with a suitability standard prior to system usage when confident that the system is in good working order. Run and compare the new results to the previous benchmark before any critical assay, and after any hardware, column, or mobile phase changes. Changes to the chromatography of the standard over time may indicate declining performance, which may require troubleshooting.

### b. Evaluating System Variability for Critical Separations

The suitability standard benchmark result will be specific to the performance of the system it is run on. All chromatographic systems have some minor level of variability from run to run. Trending of results over time is useful for defining variability on a single system, across multiple systems or on systems in different locations.

Setting specifications for suitability results should not be done without sufficient data trending. Once variability is understood, suitability standard results will help determine the capability of the system to provide reliable results.

### c. Determining Your Suitability Criteria:

Suitability criteria should be determined based on specific requirements. As mentioned above, specifications should not be set until the variability across all systems the standard will be used on is understood. The criteria and specifications should allow it to be determined if the suitability results indicate that the system is functioning as expected. Typical criteria might include:

- Retention time reproducibility
- Peak area reproducibility
- Peak tailing

- Peak resolution
- Plate Count
- Response.

### d. What Affects Your Suitability Results:

The goal of the suitability specifications and criteria will be to indicate that the system is functioning as expected. The system is comprised of many interdependent components working together to produce results within an expected specification. All components performing correctly will produce results with an expected variability. Any one of the components can affect your suitability result. Variability changes or technical issues within any one of the system components (hardware, software or chemical) may add variability to the suitability result.

Potential causes of variability in suitability results may include the following that may affect suitability results include:

- Mobile phase preparation
- Column performance
- Tubing size
- System component performance (pump, injector, detector)
- Temperature control
- Data collection rate
- Integration.

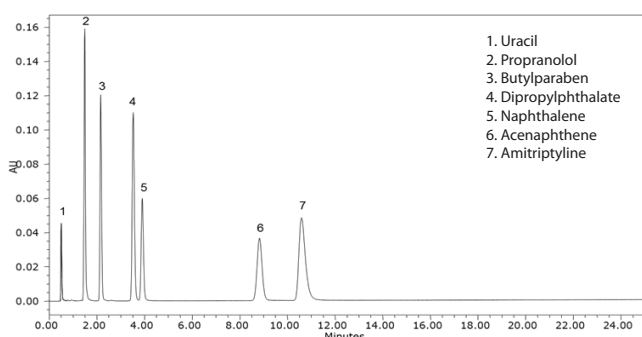
Differences in any of the components mentioned can result in system to system variability of results even when each system's components are functioning correctly.

## II. STORAGE AND STABILITY

The Reverse-Phase Suitability Standard contains 7 compounds including uracil, butyl paraben, naphthalene, propranolol, dipropylphthalate, acenaphthene, and amitriptyline at pH 7. The compounds used in the suitability products are stable in their original packaging, through the expiration date listed as provided before opening. Standard integrity and stability cannot be guaranteed after opening. Room temperature storage is acceptable for product in the original packaging unless otherwise specified. This is intended to be a single use product. The integrity of the standard cannot be guaranteed if stored after initial use.

### III. RECOMMENDED USAGE OF THE REVERSE PHASE SUITABILITY STANDARD

Figure 1. A sample chromatogram of the Reversed-Phase Suitability Standard on an ACQUITY UPLC HSS C<sub>18</sub>, 2.1 x 50 mm, 1.7 μm column, held at 30°C. The separation is isocratic using 65:35 Methanol:20mM phosphate buffered mobile phase at pH 7. The injection volume is 1.5 μL. The method uses a flow rate of 0.25 mL/min and a UV detection wavelength of 254 nm.



A sample chromatogram for the Reversed-Phase Suitability Standard is shown in Figure 1. Note that the use of different column stationary phases and/or column dimensions will have an effect on the separation. On some column chemistries or dimensions, the method may need to be modified or re-developed to obtain sufficient resolution. To properly transfer the separation across column dimensions, the [ACQUITY UPLC Columns Calculator](#) may be used. The L/dp (length to particle size ratio) for both columns should be kept comparable to maintain resolution.

### IV. SUITABILITY TESTING

The use of reference standards for suitability testing should allow the analyst to track important instrument analytical parameters such as peak width, peak area, retention time, and peak resolution. Each of these important parameters can be tracked and evaluated using control charts. The use of a high quality reference standard allows the analyst to reliably measure and track these parameters.

Suitability testing should be performed on a regular basis for each instrument/analyst combination or instrument per test method. The data should be collected and entered into a control chart allowing the analyst to evaluate the system performance over time. The

use of performance control charts has been a staple of analytical chemistry quality control. The most common form of the control charting is to track the analytical results and statistically analyze the data to a 99% (3 standard deviations) or 95% confidence interval (2 standard deviations) confidence interval around the mean of the data to establish upper control limits (UCL) and lower control limits (LCL).

The initial criteria to establish a mean, standard deviation and control limits involves analyzing a reference material a minimum of 7 times to establish an initial estimate of precision and bias. This provides the analyst with sufficient data to be statistically valid. The analyses should be carried over the course of several days to provide a more realistic view of the system variability. The frequency of analyzing system performance will be dependent on the stability of the analysis and the analytes. Suitability should always be evaluated after maintenance has been performed, or when changes to the system or analytical procedure have been made.

The example in Table 2 uses retention time monitoring to establish a set of control limits for the purpose of monitoring on-going system performance.

Table 2: Reference Standard Retention Time Data Example

Analysis Peak	Retention Time (mins)
1	7.10
2	7.11
3	7.12
4	7.09
5	7.08
6	7.10
7	7.11
8	7.13
9	7.10
10	7.11
<b>Mean 7.11</b>	
<b>Standard Deviation 0.0136</b>	
<b>LCL 7.08</b>	
<b>UCL 7.13</b>	

The standard reference material was analyzed 10 times yielding the above retention times. The mean retention time and standard deviation were calculated and from this the UCL and LCL limits were determined. The control limits represent a 95% confidence interval ( 2 standard deviations) for the data. The control chart in Figure 2 was then produced to establish that the instrument retention times are in control.

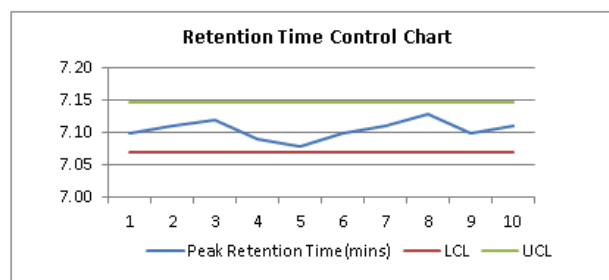


Figure 2: Retention Time Control Chart

The establishment of control limits provides data as to the current capabilities of the system. Control charting allows the quality professional to compare instrument performance to the required method specifications.

The process of continuous quality improvement can also be tracked using control charts. When improvements are made to a method, control charts allow you to see that the changes you have made are effective and having the desired impact. The control chart will also allow you to track trends over time. By observing the data trending higher or lower over time, you can take preventative action prior to having an out of specification result.

Control charting can be employed for each suitability criteria; peak retention time, peak area, peak width, and peak resolution. Control charts allow quality control professionals to establish statistically significant criteria to monitor and control their HPLC analyses thereby avoiding criteria that are too stringent or set arbitrarily.

## Summary

The use of high quality reference standards specifically designed for the system suitability analysis, provide a controlled, consistent, and reliable measure of system performance. Regular use of reference standards and control charting the data provides improved monitoring of system performance and system robustness, while at the same time providing assurance that any results produced are high quality, reliable, and reproducible.

## References

- 1) Taylor, J.K., "Quality Assurance of Chemical Measurements", Lewis Publishers, 1987
- 2) Smith, G.M., "Statistical Process Control and Quality Improvement", 3rd edition, Prentice Hall, 1998
- 3) Ahuja, S. and Dong, M.W., "Handbook of Pharmaceutical Analysis by HPLC", Elsevier Inc., 2005

## V. TROUBLESHOOTING:

The Reversed-Phase Suitability Standard contains a variety of acids, bases and neutral compounds. Due to the vastly different properties of reversed-phase stationary phases, not all compounds will behave similarly on each column. For instance, basic compounds often have poor peak shape on reversed-phase columns at neutral pH due to increased interactions between the charged bases and silanols on the surface of the stationary phase. For this reason, it is very important to benchmark the performance of the Reversed-Phase Suitability Standard on a new column and functioning system. This will help to identify whether poor peak shape issues are due to compound interactions on the column, or failing column/system performance.

Failure to meet system suitability criteria will result in the need to troubleshoot the system. Some chromatographic issues may be easily resolved, for instance, a missing peak may simply be due to co-elution of two peaks. However, most issues such as poor peak shape, tailing peaks, retention time shifts and poor peak response, to name a few, may be due to a variety of causes that can be difficult to pinpoint. For a detailed and comprehensive guide to troubleshooting, please refer to the HPLC Troubleshooting Guide (WA20769) on the Waters website.

## VI. ORDERING INFORMATION

Description	Part Number
Reversed-Phase Standard	186006363

Thank you for choosing a Suitability Standard from Waters. The standards are manufactured in our ISO 9001 ISO 17025 facility. Each standard is manufactured to ensure optimal reproducibility from lot to lot. A Waters suitability standard can be depended on for its' accuracy. This removes one variable from your system variability and provides you the most dependable starting point for your testing.

If the suitability standard box shows significant damage, notify the carrier and your supplier at once and retain evidence of shipping damage so that a claim can be made.

**ACQUITY UPLC CSH Columns**

Chemistry	Particle Size	Dimensions	Part No. 1 pack	Part No. 3 pack
CSH C <sub>18</sub>	1.7 µm	1.0 x 50 mm	186005292	176002136
CSH C <sub>18</sub>	1.7 µm	1.0 x 100 mm	186005293	176002137
CSH C <sub>18</sub>	1.7 µm	1.0 x 150 mm	186005294	176002138
CSH C <sub>18</sub>	1.7 µm	2.1 x 30 mm	186005295	176002139
CSH C <sub>18</sub>	1.7 µm	2.1 x 50 mm	186005296	176002140
CSH C <sub>18</sub>	1.7 µm	2.1 x 75 mm	186005620	—
CSH C <sub>18</sub>	1.7 µm	2.1 x 100 mm	186005297	176002141
CSH C <sub>18</sub>	1.7 µm	2.1 x 150 mm	186005298	176002142
CSH C <sub>18</sub>	1.7 µm	3.0 x 30 mm	186005299	176002143
CSH C <sub>18</sub>	1.7 µm	3.0 x 50 mm	186005300	176002144
CSH C <sub>18</sub>	1.7 µm	3.0 x 75 mm	186005623	—
CSH C <sub>18</sub>	1.7 µm	3.0 x 100 mm	186005301	176002145
CSH C <sub>18</sub>	1.7 µm	3.0 x 150 mm	186005302	176002146
CSH Fluoro-Phenyl	1.7 µm	1.0 x 50 mm	186005349	176002150
CSH Fluoro-Phenyl	1.7 µm	1.0 x 100 mm	186005347	176002148
CSH Fluoro-Phenyl	1.7 µm	1.0 x 150 mm	186005348	176002149
CSH Fluoro-Phenyl	1.7 µm	2.1 x 30 mm	186005350	176002151
CSH Fluoro-Phenyl	1.7 µm	2.1 x 50 mm	186005351	176002152
CSH Fluoro-Phenyl	1.7 µm	2.1 x 75 mm	186005622	—
CSH Fluoro-Phenyl	1.7 µm	2.1 x 100 mm	186005352	176002153
CSH Fluoro-Phenyl	1.7 µm	2.1 x 150 mm	186005353	176002154
CSH Fluoro-Phenyl	1.7 µm	3.0 x 30 mm	186005354	176002155
CSH Fluoro-Phenyl	1.7 µm	3.0 x 50 mm	186005355	176002156
CSH Fluoro-Phenyl	1.7 µm	3.0 x 75 mm	186005625	—
CSH Fluoro-Phenyl	1.7 µm	3.0 x 100 mm	186005356	176002157
CSH Fluoro-Phenyl	1.7 µm	3.0 x 150 mm	186005357	176002158
CSH Phenyl-Hexyl	1.7 µm	1.0 x 50 mm	186005404	176002161
CSH Phenyl-Hexyl	1.7 µm	1.0 x 100 mm	186005402	176002159
CSH Phenyl-Hexyl	1.7 µm	1.0 x 150 mm	186005403	176002160
CSH Phenyl-Hexyl	1.7 µm	2.1 x 30 mm	186005405	176002162
CSH Phenyl-Hexyl	1.7 µm	2.1 x 50 mm	186005406	176002163
CSH Phenyl-Hexyl	1.7 µm	2.1 x 75 mm	186005621	—
CSH Phenyl-Hexyl	1.7 µm	2.1 x 100 mm	186005407	176002164
CSH Phenyl-Hexyl	1.7 µm	2.1 x 150 mm	186005408	176002165
CSH Phenyl-Hexyl	1.7 µm	3.0 x 30 mm	186005409	176002166
CSH Phenyl-Hexyl	1.7 µm	3.0 x 50 mm	186005410	176002167
CSH Phenyl-Hexyl	1.7 µm	3.0 x 75 mm	186005624	—
CSH Phenyl-Hexyl	1.7 µm	3.0 x 100 mm	186005411	176002168
CSH Phenyl-Hexyl	1.7 µm	3.0 x 150 mm	186005412	176002169

**ACQUITY UPLC BEH Columns**

Chemistry	Particle Size	Dimensions	Part No. 1 pack	Part No. 3 pack
BEH C <sub>18</sub>	1.7 µm	1.0 x 50 mm	186002344	176000861
BEH C <sub>18</sub>	1.7 µm	1.0 x 100 mm	186002346	176000862
BEH C <sub>18</sub>	1.7 µm	1.0 x 150 mm	186002347	176001044
BEH C <sub>18</sub>	1.7 µm	2.1 x 30 mm	186002349	176001304
BEH C <sub>18</sub>	1.7 µm	2.1 x 50 mm	186002350	176000863
BEH C <sub>18</sub>	1.7 µm	2.1 x 75 mm	186005604	—
BEH C <sub>18</sub>	1.7 µm	2.1 x 100 mm	186002352	176000864
BEH C <sub>18</sub>	1.7 µm	2.1 x 150 mm	186002353	176001048
BEH C <sub>18</sub>	1.7 µm	3.0 x 30 mm	186004659	176001794
BEH C <sub>18</sub>	1.7 µm	3.0 x 50 mm	186004660	176001795
BEH C <sub>18</sub>	1.7 µm	3.0 x 75 mm	186005609	—
BEH C <sub>18</sub>	1.7 µm	3.0 x 100 mm	186004661	176001796
BEH C <sub>18</sub>	1.7 µm	3.0 x 150 mm	186004690	176001797
BEH Shield RP18	1.7 µm	1.0 x 50 mm	186002851	176000874
BEH Shield RP18	1.7 µm	1.0 x 100 mm	186002852	176000875
BEH Shield RP18	1.7 µm	1.0 x 150 mm	186003373	176001045
BEH Shield RP18	1.7 µm	2.1 x 30 mm	186003909	176001309
BEH Shield RP18	1.7 µm	2.1 x 50 mm	186002853	176000876
BEH Shield RP18	1.7 µm	2.1 x 75 mm	186005605	—
BEH Shield RP18	1.7 µm	2.1 x 100 mm	186002854	176000877
BEH Shield RP18	1.7 µm	2.1 x 150 mm	186003376	176001049
BEH Shield RP18	1.7 µm	3.0 x 30 mm	186004667	176001802
BEH Shield RP18	1.7 µm	3.0 x 50 mm	186004668	176001803
BEH Shield RP18	1.7 µm	3.0 x 75 mm	186005610	—
BEH Shield RP18	1.7 µm	3.0 x 100 mm	186004669	176001804
BEH Shield RP18	1.7 µm	3.0 x 150 mm	186004670	176001805
BEH C <sub>8</sub>	1.7 µm	1.0 x 50 mm	186002875	176000882
BEH C <sub>8</sub>	1.7 µm	1.0 x 100 mm	186002876	176000883
BEH C <sub>8</sub>	1.7 µm	1.0 x 150 mm	186003374	176001046
BEH C <sub>8</sub>	1.7 µm	2.1 x 30 mm	186003910	176001310
BEH C <sub>8</sub>	1.7 µm	2.1 x 50 mm	186002877	176000884
BEH C <sub>8</sub>	1.7 µm	2.1 x 75 mm	186005606	—
BEH C <sub>8</sub>	1.7 µm	2.1 x 100 mm	186002878	176000885
BEH C <sub>8</sub>	1.7 µm	2.1 x 150 mm	186003377	176001050
BEH C <sub>8</sub>	1.7 µm	3.0 x 30 mm	186004663	176001798
BEH C <sub>8</sub>	1.7 µm	3.0 x 50 mm	186004664	176001799
BEH C <sub>8</sub>	1.7 µm	3.0 x 75 mm	186005611	—
BEH C <sub>8</sub>	1.7 µm	3.0 x 100 mm	186004665	176001800
BEH C <sub>8</sub>	1.7 µm	3.0 x 150 mm	186004666	176001801
BEH Phenyl	1.7 µm	1.0 x 50 mm	186002882	176000905
BEH Phenyl	1.7 µm	1.0 x 100 mm	186002883	176000906
BEH Phenyl	1.7 µm	1.0 x 150 mm	186003375	176001047
BEH Phenyl	1.7 µm	2.1 x 30 mm	186003911	176001311
BEH Phenyl	1.7 µm	2.1 x 50 mm	186002884	176000907
BEH Phenyl	1.7 µm	2.1 x 75 mm	186005607	—
BEH Phenyl	1.7 µm	2.1 x 100 mm	186002885	176000908
BEH Phenyl	1.7 µm	2.1 x 150 mm	186003378	176001051
BEH Phenyl	1.7 µm	3.0 x 30 mm	186004671	176001806
BEH Phenyl	1.7 µm	3.0 x 50 mm	186004672	176001807
BEH Phenyl	1.7 µm	3.0 x 75 mm	186005612	—
BEH Phenyl	1.7 µm	3.0 x 100 mm	186004673	176001808
BEH Phenyl	1.7 µm	3.0 x 150 mm	186004674	176001809

**ACQUITY UPLC HSS Columns**

Chemistry	Particle Size	Dimensions	Part No. 1 pack	Part No. 3 pack	Chemistry	Particle Size	Dimensions	Part No. 1 pack	Part No. 3 pack
HSS T3	1.8 µm	1.0 x 50 mm	186003535	176001127	HSS C <sub>18</sub>	1.8 µm	2.1 x 150 mm	186003534	176001126
HSS T3	1.8 µm	1.0 x 100 mm	186003536	176001129	HSS C <sub>18</sub>	1.8 µm	3.0 x 30 mm	186004682	176001817
HSS T3	1.8 µm	1.0 x 150 mm	186003537	176001130	HSS C <sub>18</sub>	1.8 µm	3.0 x 50 mm	186004683	176001818
HSS T3	1.8 µm	2.1 x 30 mm	186003944	176001375	HSS C <sub>18</sub>	1.8 µm	3.0 x 75 mm	186005618	—
HSS T3	1.8 µm	2.1 x 50 mm	186003538	176001131	HSS C <sub>18</sub>	1.8 µm	3.0 x 100 mm	186004684	176001819
HSS T3	1.8 µm	2.1 x 75 mm	186005614	—	HSS C <sub>18</sub>	1.8 µm	3.0 x 150 mm	186004685	176001820
HSS T3	1.8 µm	2.1 x 100 mm	186003539	176001132	HSS C <sub>18</sub> SB	1.8 µm	1.0 x 50 mm	186004114	176001556
HSS T3	1.8 µm	2.1 x 150 mm	186003540	176001133	HSS C <sub>18</sub> SB	1.8 µm	1.0 x 100 mm	186004115	176001557
HSS T3	1.8 µm	3.0 x 30 mm	186004678	176001813	HSS C <sub>18</sub> SB	1.8 µm	1.0 x 150 mm	186004116	176001558
HSS T3	1.8 µm	3.0 x 50 mm	186004679	176001814	HSS C <sub>18</sub> SB	1.8 µm	2.1 x 30 mm	186004117	176001559
HSS T3	1.8 µm	3.0 x 75 mm	186005617	—	HSS C <sub>18</sub> SB	1.8 µm	2.1 x 50 mm	186004118	176001560
HSS T3	1.8 µm	3.0 x 100 mm	186004680	176001815	HSS C <sub>18</sub> SB	1.8 µm	2.1 x 75 mm	186005616	—
HSS T3	1.8 µm	3.0 x 150 mm	186004681	176001816	HSS C <sub>18</sub> SB	1.8 µm	2.1 x 100 mm	186004119	176001561
HSS C <sub>18</sub>	1.8 µm	1.0 x 50 mm	186003529	176001121	HSS C <sub>18</sub> SB	1.8 µm	2.1 x 150 mm	186004120	176001562
HSS C <sub>18</sub>	1.8 µm	1.0 x 100 mm	186003530	176001122	HSS C <sub>18</sub> SB	1.8 µm	3.0 x 30 mm	186004686	176001821
HSS C <sub>18</sub>	1.8 µm	1.0 x 150 mm	186003531	176001123	HSS C <sub>18</sub> SB	1.8 µm	3.0 x 50 mm	186004687	176001822
HSS C <sub>18</sub>	1.8 µm	2.1 x 30 mm	186003987	176001398	HSS C <sub>18</sub> SB	1.8 µm	3.0 x 75 mm	186005619	—
HSS C <sub>18</sub>	1.8 µm	2.1 x 50 mm	186003532	176001124	HSS C <sub>18</sub> SB	1.8 µm	3.0 x 100 mm	186004826	176001823
HSS C <sub>18</sub>	1.8 µm	2.1 x 75 mm	186005615	—	HSS C <sub>18</sub> SB	1.8 µm	3.0 x 150 mm	186004689	176001824
HSS C <sub>18</sub>	1.8 µm	2.1 x 100 mm	186003533	176001125					

**ACQUITY UPLC Method Development Kits**

Package Name	Qty/Pk	Chemistries	Particle Size(s)	Dimensions	Part No.
Maximum Selectivity UPLC Method Development kit	4/pk	CSH C <sub>18</sub> , CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C <sub>18</sub> SB	CSH: 1.7 µm; HSS: 1.8 µm	2.1 x 50 mm	176002123
Maximum Selectivity UPLC Method Development kit	4/pk	CSH C <sub>18</sub> , CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C <sub>18</sub> SB	CSH: 1.7 µm; HSS: 1.8 µm	2.1 x 100 mm	176002124
Maximum Selectivity UPLC Method Development kit	4/pk	CSH C <sub>18</sub> , CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C <sub>18</sub> SB	CSH: 1.7 µm; HSS: 1.8 µm	3.0 x 50 mm	176002125
Maximum Selectivity UPLC Method Development kit	4/pk	CSH C <sub>18</sub> , CSH Phenyl-Hexyl, CSH Fluoro-Phenyl, HSS C <sub>18</sub> SB	CSH: 1.7 µm; HSS: 1.8 µm	3.0 x 100 mm	176002126
High & Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH C <sub>8</sub> , BEH Shield RP18, BEH Phenyl	BEH: 1.7 µm	2.1 x 50 mm	176001042
High & Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH C <sub>8</sub> , BEH Shield RP18, BEH Phenyl	BEH: 1.7 µm	2.1 x 100 mm	176001043
High & Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH C <sub>8</sub> , BEH Shield RP18, BEH Phenyl	BEH: 1.7 µm	3.0 x 50 mm	176001881
High & Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH C <sub>8</sub> , BEH Shield RP18, BEH Phenyl	BEH: 1.7 µm	3.0 x 100 mm	176001882
UPLC Method Development kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, BEH Phenyl, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 50 mm	176001603
UPLC Method Development kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, BEH Phenyl, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 100 mm	176001604
UPLC Method Development kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, BEH Phenyl, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 50 mm	176001883
UPLC Method Development kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, BEH Phenyl, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 100 mm	176001884
L1 UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, HSS C <sub>18</sub> , HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 50 mm	176001605
L1 UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, HSS C <sub>18</sub> , HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 100 mm	176001606
L1 UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, HSS C <sub>18</sub> , HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 50 mm	176001885
L1 UPLC Columns kit	4/pk	BEH C <sub>18</sub> , BEH Shield RP18, HSS C <sub>18</sub> , HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 100 mm	176001886
Mass Spec UPLC Columns kit	4/pk	BEH C <sub>18</sub> , HSS C <sub>18</sub> , HSS C <sub>18</sub> SB, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 50 mm	176001607
Mass Spec UPLC Columns kit	4/pk	BEH C <sub>18</sub> , HSS C <sub>18</sub> , HSS C <sub>18</sub> SB, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 100 mm	176001608
Mass Spec UPLC Columns kit	4/pk	BEH C <sub>18</sub> , HSS C <sub>18</sub> , HSS C <sub>18</sub> SB, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 50 mm	176001887
Mass Spec UPLC Columns kit	4/pk	BEH C <sub>18</sub> , HSS C <sub>18</sub> , HSS C <sub>18</sub> SB, HSS T3	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 100 mm	176001888
Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C <sub>18</sub> , HSS C <sub>18</sub> SB	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 50 mm	176001609
Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C <sub>18</sub> , HSS C <sub>18</sub> SB	BEH: 1.7 µm; HSS: 1.8 µm	2.1 x 100 mm	176001610
Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C <sub>18</sub> , HSS C <sub>18</sub> SB	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 50 mm	176001889
Low pH, Widest Selectivities UPLC Columns kit	4/pk	BEH Shield RP18, BEH Phenyl, HSS C <sub>18</sub> , HSS C <sub>18</sub> SB	BEH: 1.7 µm; HSS: 1.8 µm	3.0 x 100 mm	176001890



**XSelect Analytical Columns**

Dimension	Type	Particle Size	C <sub>18</sub>	Fluoro-Phenyl	Phenyl-Hexyl
1.0 x 50 mm	Column	3.5 µm	186005249	186005304	186005359
1.0 x 100 mm	Column	3.5 µm	186005250	186005305	186005360
1.0 x 150 mm	Column	3.5 µm	186005251	186005306	186005361
2.1 x 20 mm <i>IS</i> ™	Column	3.5 µm	186005253	186005308	186005363
2.1 x 30 mm	Column	3.5 µm	186005254	186005309	186005364
2.1 x 50 mm	Column	3.5 µm	186005255	186005310	186005365
2.1 x 100 mm	Column	3.5 µm	186005256	186005311	186005366
2.1 x 75 mm	Column	3.5 µm	186005644	186005646	186005645
2.1 x 150 mm	Column	3.5 µm	186005257	186005312	186005367
3.0 x 20 mm <i>IS</i>	Column	3.5 µm	186005259	186005314	186005369
3.0 x 30 mm	Column	3.5 µm	186005260	186005315	186005370
3.0 x 50 mm	Column	3.5 µm	186005261	186005316	186005371
3.0 x 75 mm	Column	3.5 µm	186005647	186005649	186005648
3.0 x 100 mm	Column	3.5 µm	186005262	186005317	186005372
3.0 x 150 mm	Column	3.5 µm	186005263	186005318	186005373
4.6 x 20 mm <i>IS</i>	Column	3.5 µm	186005265	186005320	186005375
4.6 x 30 mm	Column	3.5 µm	186005266	186005321	186005376
4.6 x 50 mm	Column	3.5 µm	186005267	186005322	186005377
4.6 x 75 mm	Column	3.5 µm	186005268	186005323	186005378
4.6 x 100 mm	Column	3.5 µm	186005269	186005324	186005379
4.6 x 150 mm	Column	3.5 µm	186005270	186005325	186005380
2.1 x 20 mm <i>IS</i>	Column	5 µm	186005272	186005327	186005382
2.1 x 30 mm	Column	5 µm	186005273	186005328	186005383
2.1 x 50 mm	Column	5 µm	186005274	186005329	186005384
2.1 x 100 mm	Column	5 µm	186005275	186005330	186005385
2.1 x 150 mm	Column	5 µm	186005276	186005331	186005386
3.0 x 20 mm <i>IS</i>	Column	5 µm	186005278	186005333	186005388
3.0 x 30 mm	Column	5 µm	186005279	186005334	186005389
3.0 x 50 mm	Column	5 µm	186005280	186005335	186005390
3.0 x 100 mm	Column	5 µm	186005281	186005336	186005391
3.0 x 150 mm	Column	5 µm	186005282	186005337	186005392
3.0 x 250 mm	Column	5 µm	186005283	186005338	186005393
4.6 x 20 mm <i>IS</i>	Column	5 µm	186005284	186005339	186005394
4.6 x 30 mm	Column	5 µm	186005286	186005341	186005396
4.6 x 50 mm	Column	5 µm	186005287	186005342	186005397
4.6 x 75 mm	Column	5 µm	186005288	186005343	186005398
4.6 x 100 mm	Column	5 µm	186005289	186005344	186005399
4.6 x 150 mm	Column	5 µm	186005290	186005345	186005400
4.6 x 250 mm	Column	5 µm	186005291	186005346	186005401

**XSelect Method Validation Kits**

Dimension	Particle Size	C <sub>18</sub>	Fluoro-Phenyl	Phenyl-Hexyl
2.1 x 100 mm	3.5 µm	186005538	186005549	186005560
3.0 x 100 mm	3.5 µm	186005539	186005550	186005561
3.0 x 150 mm	3.5 µm	186005540	186005551	186005562
4.6 x 100 mm	3.5 µm	186005541	186005552	186005563
4.6 x 150 mm	3.5 µm	186005542	186005553	186005564
2.1 x 150 mm	5 µm	186005543	186005554	186005565
3.0 x 100 mm	5 µm	186005544	186005555	186005566
3.0 x 150 mm	5 µm	186005545	186005556	186005567
4.6 x 100 mm	5 µm	186005546	186005557	186005568
4.6 x 150 mm	5 µm	186005547	186005558	186005569
4.6 x 250 mm	5 µm	186005548	186005559	186005570



**XBridge Analytical Columns**

Dimension	Type	Particle Size	C <sub>18</sub>	C <sub>8</sub>	Shield RP18	Phenyl
1.0 x 50 mm	Column	2.5 µm	186003118	186003164	186003136	186003306
2.1 x 20 mm <i>IS</i> *	Column	2.5 µm	186003201	186003167	186003139	186003307
2.1 x 30 mm	Column	2.5 µm	186003084	186003099	186003091	186003308
2.1 x 50 mm	Column	2.5 µm	186003085	186003101	186003092	186003309
2.1 x 75 mm	Column	2.5 µm	186005626	186005627	186005628	186005629
3.0 x 20 mm <i>IS</i>	Column	2.5 µm	186003087	186003168	186003140	186003310
3.0 x 30 mm	Column	2.5 µm	186003121	186003169	186003141	186003311
3.0 x 50 mm	Column	2.5 µm	186003122	186003170	186003142	186003312
3.0 x 75 mm	Column	2.5 µm	186005630	186005631	186005632	186005633
4.6 x 20 mm <i>IS</i>	Column	2.5 µm	186003088	186003172	186003144	186003313
4.6 x 30 mm	Column	2.5 µm	186003089	186003173	186003145	186003314
4.6 x 50 mm	Column	2.5 µm	186003090	186003174	186003096	186003315
4.6 x 75 mm	Column	2.5 µm	186003124	186003175	186003146	186003316
1.0 x 50 mm	Column	3.5 µm	186003126	186003177	186003148	186003317
1.0 x 100 mm	Column	3.5 µm	186003127	186003178	186003149	186003318
1.0 x 150 mm	Column	3.5 µm	186003128	186003179	186003150	186003319
2.1 x 20 mm <i>IS</i>	Column	3.5 µm	186003019	186003180	186003151	186003320
2.1 x 30 mm	Column	3.5 µm	186003020	186003046	186003035	186003321
2.1 x 50 mm	Column	3.5 µm	186003021	186003047	186003036	186003322
2.1 x 100 mm	Column	3.5 µm	186003022	186003048	186003037	186003323
2.1 x 150 mm	Column	3.5 µm	186003023	186003049	186003038	186003324
3.0 x 20 mm <i>IS</i>	Column	3.5 µm	186003024	186003181	186003152	186003325
3.0 x 30 mm	Column	3.5 µm	186003025	186003182	186003153	186003326
3.0 x 50 mm	Column	3.5 µm	186003026	186003050	186003039	186003327
3.0 x 100 mm	Column	3.5 µm	186003027	186003051	186003040	186003328
3.0 x 150 mm	Column	3.5 µm	186003028	186003052	186003041	186003329

**SunFire 2.5 µm Analytical Columns**

Dimension	Particle Size	C <sub>18</sub>	C <sub>8</sub>
1.0 x 50 mm	2.5 µm	186003392	186003394
2.1 x 20 mm <i>IS</i>	2.5 µm	186003397	186003398
2.1 x 30 mm	2.5 µm	186003399	186003400
2.1 x 50 mm	2.5 µm	186003401	186003402
2.1 x 75 mm	2.5 µm	186005634	186005635
3.0 x 20 mm <i>IS</i>	2.5 µm	186003403	186003404
3.0 x 30 mm	2.5 µm	186003407	186003408
3.0 x 50 mm	2.5 µm	186003409	186003410
3.0 x 75 mm	2.5 µm	186005636	186005637
4.6 x 20 mm <i>IS</i>	2.5 µm	186003411	186003412
4.6 x 30 mm	2.5 µm	186003415	186003416
4.6 x 50 mm	2.5 µm	186003417	186003418
4.6 x 75 mm	2.5 µm	186003419	186003420

**SunFire 3.5 µm Analytical Columns**

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

**SunFire 5 µm Analytical Columns**

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

**SunFire Method Validation Kits**

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

**Atlantis Analytical Columns**

Dimension	Type	Particle Size	T3	dC <sub>18</sub>
1.0 x 50 mm	Column	3 µm	186003713	186001279
1.0 x 150 mm	Column	3 µm	186003714	186001283
2.1 x 15 mm	Direct Connect	3 µm	—	186002064
2.1 x 20 mm <i>IS</i>	Column	3 µm	186003715	186002058
2.1 x 30 mm	Column	3 µm	186003716	186001287
2.1 x 50 mm	Column	3 µm	186003717	186001291
2.1 x 75 mm	Column	3 µm	186005652	—
2.1 x 100 mm	Column	3 µm	186003718	186001295
2.1 x 150 mm	Column	3 µm	186003719	186001299
3.0 x 20 mm <i>IS</i>	Column	3 µm	186003720	186002060
3.0 x 50 mm	Column	3 µm	186003721	186001389
3.0 x 75 mm	Column	3 µm	186005653	—
3.0 x 100 mm	Column	3 µm	186003722	186001303
3.0 x 150 mm	Column	3 µm	186003723	186001307
3.9 x 50 mm	Cartridge	3 µm	—	186001385 <sup>1</sup>
3.9 x 100 mm	Column	3 µm	—	186001393
3.9 x 150 mm	Column	3 µm	—	186001317
4.6 x 20 mm <i>IS</i>	Column	3 µm	186003724	186002062
4.6 x 30 mm	Column	3 µm	186003725	186001325
4.6 x 50 mm	Column	3 µm	186003726	186001329
4.6 x 75 mm	Column	3 µm	186003727	186001333
4.6 x 100 mm	Column	3 µm	186003728	186001337
4.6 x 150 mm	Column	3 µm	186003729	186001342
1.0 x 50 mm	Column	5 µm	186003730	186001281
1.0 x 150 mm	Column	5 µm	186003731	186001285
2.1 x 15 mm	Direct Connect	5 µm	—	186002065
2.1 x 20 mm <i>IS</i>	Column	5 µm	186003732	186002059
2.1 x 30 mm	Column	5 µm	186003733	186001289
2.1 x 50 mm	Column	5 µm	186003734	186001293
2.1 x 100 mm	Column	5 µm	186003735	186001297
2.1 x 150 mm	Column	5 µm	186003736	186001301
3.0 x 20 mm <i>IS</i>	Column	5 µm	186003737	186002061
3.0 x 50 mm	Column	5 µm	186003738	186001391
3.0 x 100 mm	Column	5 µm	186003739	186001305
3.0 x 150 mm	Column	5 µm	186003740	186001309
3.0 x 250 mm	Column	5 µm	186003741	186001311
3.9 x 50 mm	Cartridge	5 µm	—	186001387 <sup>1</sup>
3.9 x 100 mm	Column	5 µm	—	186001395
3.9 x 150 mm	Column	5 µm	—	186001319
4.6 x 20 mm <i>IS</i>	Column	5 µm	186003742	186002063
4.6 x 30 mm	Column	5 µm	186003743	186001327
4.6 x 50 mm	Column	5 µm	186003744	186001331
4.6 x 75 mm	Column	5 µm	186003745	186001335
4.6 x 100 mm	Column	5 µm	186003746	186001340
4.6 x 150 mm	Column	5 µm	186003747	186001344
4.6 x 250 mm	Column	5 µm	186003748	186001346

<sup>1</sup> Requires Cartridge Fittings, Part No. WAT037525

**Atlantis Columns Method Validation Kits**

Dimension	Particle Size	T3	dC <sub>18</sub>
4.6 x 150 mm	3 µm	186003751	186002312
4.6 x 150 mm	5 µm	186003754	186002311
4.6 x 250 mm	5 µm	186003755	186002313

### High-Strength-Silica (HSS) HPLC Analytical Columns

Dimension	Type	Particle Size	HSS C <sub>18</sub>	HSS C <sub>18</sub> SB	HSS T3
3.0 x 30 mm	Column	3.5 µm	186004765	186004746	186004783
3.0 x 50 mm	Column	3.5 µm	186004766	186004747	186004784
3.0 x 75 mm	Column	3.5 µm	186005642	186005643	186005641
3.0 x 100 mm	Column	3.5 µm	186004762	186004743	186004780
3.0 x 150 mm	Column	3.5 µm	186004763	186004744	186004781
4.6 x 30 mm	Column	3.5 µm	186004771	186004752	186004789
4.6 x 50 mm	Column	3.5 µm	186004772	186004753	186004790
4.6 x 100 mm	Column	3.5 µm	186004767	186004748	186004785
4.6 x 150 mm	Column	3.5 µm	186004768	186004749	186004786
4.6 x 250 mm	Column	3.5 µm	186004770	186004751	186004788
4.6 x 50 mm	Column	5 µm	186004852	186004757	186004794
4.6 x 150 mm	Column	5 µm	186004773	186004754	186004791
4.6 x 250 mm	Column	5 µm	186004775	186004756	186004793

**XTerra Capillary and Narrowbore Columns**

Dimension	Type	Particle Size	MS C <sub>18</sub>	MS C <sub>8</sub>	RP18	RP8	Phenyl
1.0 mm x 50 mm	Column	2.5 µm	186000979	—	—	—	—
1.0 mm x 50 mm	Column	3.5 µm	186000386	186000387	186000388	186000389	—
1.0 mm x 100 mm	Column	3.5 µm	186000390	186000391	186000392	186000393	—
1.0 mm x 150 mm	Column	3.5 µm	186000394	186000395	186000396	186000397	—
2.1 mm x 15 mm	Direct Connect Column	2.5 µm	186000900	—	—	—	—
2.1 mm x 15 mm	Direct Connect Column	3.5 µm	186001908	—	—	—	—
2.1 mm x 15 mm	Direct Connect Column	5 µm	186001907	—	—	—	—
2.1 mm x 15 mm	Direct Connect Column	10 µm	186001906	—	—	—	—
2.1 mm x 20 mm	IS Column	2.5 µm	186001921	186001922	—	—	—
2.1 mm x 20 mm	IS Column	3.5 µm	186001923	186001924	186001925	186001926	—
2.1 mm x 20 mm	IS Column	5 µm	186001979	186001980	186001982	186001983	—
2.1 mm x 30 mm	Column	2.5 µm	186000592	186000593	—	—	—
2.1 mm x 30 mm	Column	3.5 µm	186000398	186000399	—	—	—
2.1 mm x 50 mm	Column	2.5 µm	186000594	186000595	—	—	—
2.1 mm x 50 mm	Column	3.5 µm	186000400	186000401	186000402	186000403	186001179
2.1 mm x 50 mm	Cartridge	3.5 µm	186000498 <sup>1</sup>	186000499 <sup>1</sup>	186000500 <sup>1</sup>	186000501 <sup>1</sup>	—
2.1 mm x 50 mm	Column	5 µm	186000446	186000447	186000448	186000449	186001185
2.1 mm x 50 mm	Cartridge	5 µm	186000538 <sup>1</sup>	186000539 <sup>1</sup>	186000540 <sup>1</sup>	186000541 <sup>1</sup>	—
2.1 mm x 100 mm	Column	3.5 µm	186000404	186000405	186000406	186000407	186001180
2.1 mm x 100 mm	Cartridge	3.5 µm	186000502 <sup>1</sup>	186000503 <sup>1</sup>	186000504 <sup>1</sup>	186000505 <sup>1</sup>	—
2.1 mm x 100 mm	Column	5 µm	186000450	186000451	186000452	186000453	186001186
2.1 mm x 100 mm	Cartridge	5 µm	186000542 <sup>1</sup>	186000543 <sup>1</sup>	186000544 <sup>1</sup>	186000545 <sup>1</sup>	—
2.1 mm x 150 mm	Column	3.5 µm	186000408	186000409	186000410	186000411	186001181
2.1 mm x 150 mm	Cartridge	3.5 µm	186000506 <sup>3</sup>	186000507 <sup>1</sup>	186000508 <sup>1</sup>	186000509 <sup>1</sup>	—
2.1 mm x 150 mm	Column	5 µm	186000454	186000455	186000456	186000457	186001187
2.1 mm x 150 mm	Cartridge	5 µm	186000546 <sup>1</sup>	186000547 <sup>1</sup>	186000548 <sup>1</sup>	186000549 <sup>1</sup>	—
2.1 mm x 250 mm	Column	5 µm	186000458	186000459	186000460	186000461	—
2.1 mm x 250 mm	Cartridge	5 µm	186000550 <sup>3</sup>	186000551 <sup>3</sup>	186000552 <sup>1</sup>	186000553 <sup>1</sup>	—

<sup>1</sup> Requires Cartridge Column End Connector Kit, Part No. 700000117

**XTerra Method Validation Kits**

Dimension	Type	Particle Size	MS C <sub>18</sub>	MS C <sub>8</sub>	RP18	RP8	Phenyl
2.1 x 100 mm	MV Kit	3.5 µm	—	186000831	—	186000834	—
2.1 x 150 mm	MV Kit	5 µm	186000827	—	—	—	—
3.9 x 150 mm	MV Kit	5 µm	186000828	—	—	186000836	—
4.6 x 100 mm	MV Kit	3.5 µm	—	186000832	—	186000835	—
4.6 x 150 mm	MV Kit	3.5 µm	186000826	—	186000861	—	186002234
4.6 x 150 mm	MV Kit	5 µm	186000829	—	186000862	—	186002235
4.6 x 250 mm	MV Kit	5 µm	186000830	186000833	186000863	—	186002236

All other Method Validation kits are custom made on request.

**XTerra Analytical Columns**

Dimension	Type	Particle Size	MS C <sub>18</sub>	MS C <sub>8</sub>	RP18	RP8	Phenyl
3.0 x 20 mm	Cartridge	2.5 µm	186000588 <sup>4</sup>	186000589 <sup>4</sup>	—	—	—
3.0 x 30 mm	Column	2.5 µm	186000596	186000597	—	—	—
3.0 x 30 mm	Column	3.5 µm	186000412	186000413	—	—	—
3.0 x 50 mm	Column	2.5 µm	186000598	186000599	—	—	—
3.0 x 50 mm	Column	3.5 µm	186000414	186000415	186000416	186000417	186001141
3.0 x 50 mm	Cartridge	3.5 µm	186000510 <sup>5</sup>	186000511 <sup>5</sup>	186000512 <sup>5</sup>	186000513 <sup>5</sup>	—
3.0 x 50 mm	Column	5 µm	186000462	186000463	186000464	186000465	186001148
3.0 x 50 mm	Cartridge	5 µm	186000554 <sup>5</sup>	186000555 <sup>5</sup>	186000556 <sup>5</sup>	186000557 <sup>5</sup>	—
3.0 x 100 mm	Column	3.5 µm	186000418	186000419	186000420	186000421	186001142
3.0 x 100 mm	Cartridge	3.5 µm	186000514 <sup>5</sup>	186000515 <sup>5</sup>	186000516 <sup>5</sup>	186000517 <sup>5</sup>	—
3.0 x 100 mm	Column	5 µm	186000466	186000467	186000468	186000469	186001149
3.0 x 100 mm	Cartridge	5 µm	186000558 <sup>5</sup>	186000559 <sup>5</sup>	186000560 <sup>5</sup>	186000561 <sup>5</sup>	—
3.0 x 150 mm	Column	3.5 µm	186000422	186000423	186000424	186000425	186001143
3.0 x 150 mm	Cartridge	3.5 µm	186000518 <sup>5</sup>	186000519 <sup>5</sup>	186000520 <sup>5</sup>	186000521 <sup>5</sup>	—
3.0 x 150 mm	Column	5 µm	186000470	186000471	186000472	186000473	186001150
3.0 x 150 mm	Cartridge	5 µm	186000562 <sup>5</sup>	186000563 <sup>5</sup>	186000564 <sup>5</sup>	186000565 <sup>5</sup>	—
3.0 x 250 mm	Column	5 µm	186000474	186000475	186000476	186000477	186001151
3.0 x 250 mm	Cartridge	5 µm	186000566 <sup>5</sup>	186000567 <sup>5</sup>	186000568 <sup>5</sup>	186000569 <sup>5</sup>	—
3.9 x 50 mm	Cartridge	3.5 µm	186000817 <sup>5</sup>	186000818 <sup>5</sup>	—	—	186001204
3.9 x 50 mm	Cartridge	5 µm	186000815 <sup>5</sup>	186000816 <sup>5</sup>	—	—	186001203
3.9 x 100 mm	Column	3.5 µm	186000426	186000427	186000428	186000429	186001177
3.9 x 100 mm	Cartridge	3.5 µm	186000522 <sup>5</sup>	186000523 <sup>5</sup>	186000524 <sup>5</sup>	186000525 <sup>5</sup>	—
3.9 x 100 mm	Column	5 µm	—	—	—	—	186001183
3.9 x 150 mm	Column	3.5 µm	—	—	—	—	186001178
3.9 x 150 mm	Column	5 µm	186000478	186000479	186000480	186000481	186001184
3.9 x 150 mm	Cartridge	5 µm	186000570 <sup>5</sup>	186000571 <sup>5</sup>	186000572 <sup>5</sup>	186000573 <sup>5</sup>	—
4.6 x 20 mm	Cartridge	2.5 µm	186000590 <sup>4</sup>	186000591 <sup>4</sup>	—	—	—
4.6 x 30 mm	Column	2.5 µm	186000600	186000601	—	—	—
4.6 x 30 mm	Column	3.5 µm	186000430	186000431	186001910	186001912	—
4.6 x 30 mm	Column	5 µm	186000878	186000879	186001909	186001911	—
4.6 x 50 mm	Column	2.5 µm	186000602	186000603	—	—	—
4.6 x 50 mm	Column	3.5 µm	186000432	186000433	186000434	186000435	—
4.6 x 50 mm	Cartridge	3.5 µm	186000526 <sup>5</sup>	186000527 <sup>5</sup>	186000528 <sup>5</sup>	186000529 <sup>5</sup>	—
4.6 x 50 mm	Column	5 µm	186000482	186000483	186000484	186000485	186001144
4.6 x 50 mm	Cartridge	5 µm	186000574 <sup>5</sup>	186000575 <sup>5</sup>	186000576 <sup>5</sup>	186000577 <sup>5</sup>	—
4.6 x 100 mm	Column	3.5 µm	186000436	186000437	186000438	186000439	186001139
4.6 x 100 mm	Cartridge	3.5 µm	186000530 <sup>5</sup>	186000531 <sup>5</sup>	186000532 <sup>5</sup>	186000533 <sup>5</sup>	—
4.6 x 100 mm	Column	5 µm	186000486	186000487	186000488	186000489	186001145
4.6 x 150 mm	Column	3.5 µm	186000440	186000441	186000442	186000443	186001140
4.6 x 150 mm	Cartridge	3.5 µm	186000534 <sup>5</sup>	186000535 <sup>5</sup>	186000536 <sup>5</sup>	186000537 <sup>5</sup>	—
4.6 x 150 mm	Column	5 µm	186000490	186000491	186000492	186000493	186001146
4.6 x 150 mm	Cartridge	5 µm	186000578 <sup>5</sup>	186000579 <sup>5</sup>	186000580 <sup>5</sup>	186000581 <sup>5</sup>	—
4.6 x 250 mm	Column	3.5 µm	186001470	186001471	186001472	186001473	186001474
4.6 x 250 mm	Column	5 µm	186000494	186000495	186000496	186000497	186001147
4.6 x 250 mm	Cartridge	5 µm	186000582 <sup>5</sup>	186000583 <sup>5</sup>	186000584 <sup>5</sup>	186000585 <sup>5</sup>	—

<sup>4</sup> Requires Part No. WAT046910 (universal, use with standard columns) or Part No. WAT046905 (integrated into cartridge column)

<sup>5</sup> Requires End Connector Kit, Part No. WAT037525

### Symmetry Analytical Columns

Dimension	Particle Size	C <sub>18</sub>	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 50 mm	3.5 µm	186002612	186002613
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 100 mm	5 µm	186002608	186002609
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 100 mm	5 µm	186002616	186002617
4.6 x 150 mm	5 µm	WAT045905	WAT045995
4.6 x 250 mm	5 µm	WAT054275	WAT054270

### Symmetry Cartridge Columns

(Requires endfittings)

Dimension	Particle Size	C <sub>18</sub>	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 Column and Cartridge Column Method Validation Kits

Three columns from three different batches to test reproducibility.

Dimension	Type	Particle Size	C <sub>18</sub>	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

\* Requires endfittings



**SymmetryShield Columns**

Dimension	Particle Size	RP18	RP8
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 50 mm	3.5 µm	186002614	186002615
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 100 mm	5 µm	186000998	186002611
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 100 mm	5 µm	186002618	186002619
4.6 x 150 mm	5 µm	186000109	WAT200662
4.6 x 250 mm	5 µm	186000112	WAT200670

**SymmetryShield Cartridge Columns**

(Requires endfittings)

Dimension	Particle Size	RP18	RP8
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/pk)**

(Requires Sentry Guard Holders)

Dimension	Particle Size	RP18	RP8
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 Column and Cartridge  
Column Method Validation Kits**

Three columns from three different batches to test reproducibility.

Dimension	Type	Particle Size	RP18	RP8
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

\* Requires endfittings

**Nova-Pak Analytical Columns**

Description	Particle Size	Dimension	Part No.
Nova-Pak C <sub>18</sub>	4 µm	2.1 x 150 mm	WAT023655
		3.9 x 75 mm	WAT011670
		3.9 x 150 mm	WAT086344
Nova-Pak C <sub>8</sub>	4 µm	3.9 x 300 mm	WAT011695
		4.6 x 150 mm	WAT044375
		2.1 x 150 mm	WAT052735
Nova-Pak Phenyl	4 µm	3.9 x 75 mm	WAT035877
		3.9 x 150 mm	WAT035876
		2.1 x 150 mm	WAT052740
Nova-Pak CN HP	4 µm	3.9 x 75 mm	WAT011675
		3.9 x 150 mm	WAT010656
		3.9 x 300 mm	WAT056920
Nova-Pak Silica	4 µm	2.1 x 150 mm	WAT052745
		3.9 x 75 mm	WAT011680
		3.9 x 150 mm	WAT010025

**Nova-Pak Cartridge Columns**

(Requires endfittings, Part No. WAT037525)

Description	Particle Size	Qty.	Dimension	Part No.
Nova-Pak C <sub>18</sub>	4 µm	1/box	3.9 x 50 mm	WAT052780
		3/box	3.9 x 50 mm	WAT052834
		1/box	3.9 x 100 mm	WAT052810
Nova-Pak C <sub>8</sub>	4 µm	1/box	3.9 x 150 mm	WAT036975
		3/box	3.9 x 150 mm	WAT037520
		1/box	4.6 x 150 mm	WAT052845
Nova-Pak Phenyl	4 µm	1/box	4.6 x 250 mm	WAT052840
		1/box	3.9 x 50 mm	WAT052775
		1/box	3.9 x 100 mm	WAT052805
Nova-Pak CN HP	4 µm	1/box	3.9 x 150 mm	WAT036985
		3/box	3.9 x 150 mm	WAT054870
		1/box	4.6 x 150 mm	WAT052855
Nova-Pak Silica	4 µm	1/box	4.6 x 250 mm	WAT052850
		1/box	3.9 x 50 mm	WAT052790
		1/box	3.9 x 100 mm	WAT052800
Nova-Pak Silica	4 µm	1/box	3.9 x 150 mm	WAT036970
		3/box	3.9 x 150 mm	WAT054890
		1/box	3.9 x 50 mm	WAT052785
Nova-Pak Silica	4 µm	1/box	3.9 x 100 mm	WAT052795
		1/box	3.9 x 150 mm	WAT044243
		3/box	3.9 x 150 mm	WAT044445
Nova-Pak Silica	4 µm	1/box	4.6 x 150 mm	WAT044455
		1/box	4.6 x 250 mm	WAT044460
		1/box	3.9 x 150 mm	WAT036980
		3/box	3.9 x 150 mm	WAT054880

Endfittings (includes 1 pair of reusable endfittings, 2 c-clips and coupling)

WAT037525

**Nova-Pak Analytical Method Validation Kit**

Description	Particle Size	Dimension	Part No.
Method Validation Kit (includes 3 Nova-Pak C <sub>18</sub> columns)	4 µm	3.9 x 150 mm	WAT052770

## Analytical Kits

Description	Dimension	Part No.
Waters Reversed-Phase Scouting Kit (includes 1 each Nova-Pak C <sub>18</sub> , C <sub>8</sub> , and Phenyl cartridge column)	3.9 x 50 mm	WAT044360
Waters Method Development Scouting Kit (includes 1 each Nova-Pak C <sub>8</sub> , Phenyl, and CN HP cartridge column)	3.9 x 50 mm	WAT044255
Waters Method Validation Kit (includes 3 Nova-Pak C <sub>18</sub> columns representing 2 different bonded-silica bulk packing batches)	3.9 x 150 mm	WAT052770

## Prep Nova-Pak HR Analytical and Preparative Columns

Semipreparative and preparative columns for predictable scale-up from lab scale to process chromatography.

Description	Particle Size	Pore Size	Dimension	Part No.
Prep Nova-Pak HR C <sub>18</sub>	6 µm	60Å	3.9 x 300 mm	WAT038500
			7.8 x 300 mm	WAT025820
			19 x 300 mm	WAT025822
Prep Nova-Pak HR Silica	6 µm	60Å	3.9 x 300 mm	WAT038501
			7.8 x 300 mm	WAT025821
			19 x 300 mm	WAT025823

## Waters Spherisorb Columns (10 µm packing)

Chemistry	4.6 mm x 100 mm	4.6 mm x 150 mm	4.6 mm x 200 mm	4.6 mm x 250 mm
S10 ODS2	—	PSS832513	PSS832514	PSS832515
S10 ODS1	PSS830712	PSS830713	PSS830714	PSS830715
S10 C8	—	PSS832813	—	PSS832815
S10 C6	—	PSS833213	—	PSS833215
S10 C1	—	PSS833013	—	PSS833015
S10 NH2	PSS833612	PSS833613	—	PSS833615
S10 P (Phenyl)	—	PSS833813	—	PSS833815
S10 CN	PSS833512	PSS833513	PSS832514	PSS833515
S10 W (Silica)	PSS830212	PSS830213	PSS830214	PSS830215
Ion Exchange				
S10 SAX	PSS833912	PSS833913	—	PSS833915
S10 SCX	—	PSS837613	—	PSS837615

## Waters Spherisorb 5 µm Columns and Cartridges

Chemistry	Columns						Cartridge Columns			
	4.0 mm x 125 mm	4.0 mm x 250 mm	4.6 mm x 50 mm	4.6 mm x 100 mm	4.6 mm x 150 mm	4.6 mm x 250 mm	4.6 mm x 50 mm	4.6 mm x 100 mm	4.6 mm x 150 mm	4.6 mm x 250 mm
S5 ODS2	PSS845543	PSS845277	PSS831911	PSS831912	PSS831913	PSS831915	PSS839536	PSS839537	PSS839538	PSS839540
S5 ODS1	PSS845541	PSS845542	PSS830611	PSS830612	PSS830613	PSS830615	PSS839506	PSS839507	PSS839508	PSS839510
S5 ODS B	—	—	—	—	—	—	—	—	PSS839613	PSS839615
S5 C8	PSS845280	PSS845281	PSS831811	PSS831812	PSS831813	PSS831815	PSS839531	PSS839532	PSS839533	PSS839535
S5 C6	PSS845284	PSS845285	PSS831011	PSS831012	PSS831013	PSS831015	PSS839521	PSS839522	PSS839523	PSS839525
S5 C1	PSS845288	PSS845289	PSS832611	PSS832612	PSS832613	PSS832615	PSS839566	PSS839567	PSS839568	PSS839570
S5 NH2	PSS845300	PSS845301	PSS831111	PSS831112	PSS831113	PSS831115	PSS839526	PSS839527	PSS839528	PSS839530
S5 P (Phenyl)	PSS845292	PSS845293	—	PSS830812	PSS830813	PSS830815	PSS839511	PSS839512	PSS839513	PSS839515
S5 CN Normal Phase	PSS845296	PSS845297	PSS830911	PSS830912	PSS830913	PSS830915	PSS839516	PSS839517	PSS839518	PSS839520
S5 CN Reversed Phase	—	—	—	—	PSS830908	PSS830909	—	—	—	—
S5 W (Silica)	PSS845539	PSS845540	PSS830111	PSS830112	PSS830113	PSS830115	—	PSS839502	PSS839503	PSS839505
Ion Exchange										
S5 SAX	PSS845304	PSS845305	PSS832711	PSS832712	PSS832713	PSS832715	PSS839571	PSS839572	PSS839573	PSS839575
S5 SCX	PSS845308	PSS845309	PSS837511	PSS837512	PSS837513	PSS837515	PSS839651	PSS839652	PSS839653	PSS839655
Mixed Mode										
S5 OD/CN	—	—	—	PSS837812	PSS837813	PSS837815	—	—	PSS839643	PSS839645

**Waters Spherisorb 3 µm Columns and Cartridges**

Chemistry	Columns				Cartridge Columns			
	4.6 mm x 50 mm	4.6 mm x 60 mm	4.6 mm x 100 mm	4.6 mm x 150 mm	4.6 mm x 30 mm	4.6 mm x 50 mm	4.6 mm x 100 mm	4.6 mm x 150 mm
S3 ODS2	PSS832111	PSS839853	PSS832112	PSS832113	PSS830065	PSS839546	PSS839547	PSS839548
S3 ODS1	PSS833411	—	PSS833412	PSS833413	—	—	PSS839587	PSS839588
S3 C8	PSS832211	PSS839852	PSS832212	PSS832213	—	PSS839551	PSS839552	PSS839553
S3 C6	PSS833111	—	PSS833112	PSS833113	—	PSS839581	PSS839582	PSS839583
S3 C1	PSS832911	—	PSS832912	PSS832913	—	PSS839576	PSS839577	PSS839578
S3 W (Silica)	PSS832011	—	PSS832012	PSS832013	PSS830068	PSS839541	PSS839542	PSS839543

**Waters Spherisorb 5 µm Cartridge Columns**

Chemistry	3.0 mm	3.0 mm	4.0 mm	4.0 mm
	x 125 mm	x 250 mm	x 125 mm	x 250 mm
S5 ODS2	PSS838529	PSS838522	PSS845553	PSS845554
S5 ODS1	PSS838530	PSS838523	PSS845551	PSS845552
S5 C8	PSS838533	PSS838525	PSS845555	PSS845556
S5 C6	—	—	PSS845557	PSS845558
S5 C1	—	—	PSS845559	PSS845560
S5 NH2	PSS838535	PSS838526	PSS845565	PSS845566
S5 P (Phenyl)	—	—	PSS845561	PSS845562
S5 CN Normal Phase	PSS838531	PSS838524	PSS845563	PSS845564
S5 CN Reversed Phase	—	—	—	—
S5 W (Silica)	PSS838534	PSS838521	PSS845549	PSS845550
Ion Exchange				
S5 SAX	—	—	PSS845567	PSS845568
S5 SCX	—	—	PSS845569	PSS845570

**Waters Spherisorb Semiprep Columns**

5 µm Chemistry	10 mm	20 mm	10 µm Chemistry	10 mm	20 mm
	x 250 mm	x 250 mm		x 250 mm	x 250 mm
S5 ODS2	PSS831985	PSS831995	S10 ODS2	PSS832585	PSS832595
S5 ODS1	PSS830685	PSS830695	S10 ODS1	PSS830785	PSS830795
S5 C8	PSS831885	PSS831895	S10 C8	PSS832885	PSS832895
S5 C6	PSS831085	PSS831095	S10 C6	PSS833285	PSS833295
S5 C1	PSS832685	PSS832695	S10 C1	PSS833085	PSS833095
S5 W (Silica)	PSS830185	PSS830195	S10 W (Silica)	PSS830285	PSS830295
Ion Exchange					
S5 SAX	PSS832785	PSS832795	S10 SAX	PSS833985	PSS833995
S5 SCX	PSS837585	PSS837595	S10 SCX	PSS837685	PSS837695

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