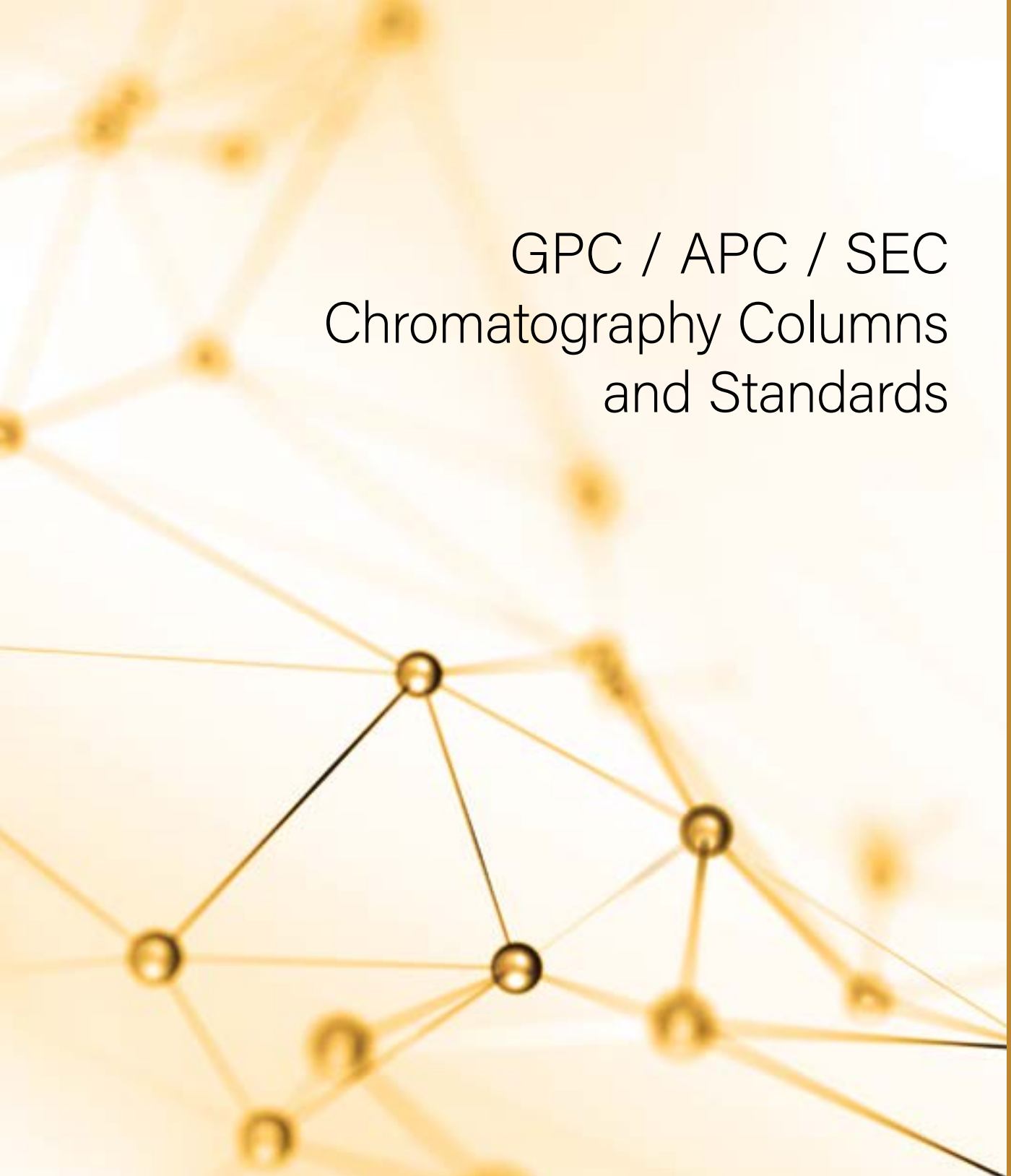
GPC / APC / SEC Chromatography Columns and Standards



GPC / APC / SEC Chromatography Columns and Standards

Contents

Size-Exclusion Chromatography Columns and Standards

For 60 years, Waters has continuously improved GPC (Gel Permeation Chromatography), and SEC (Size-Exclusion Chromatography), refining instrumentation, packing materials, and technology. Among the resultant innovations are size-exclusion techniques that expand beyond the original polymer analysis. These include applications for separating small and large molecules from interfering matrices such as those in foods, pharmaceutical preparations, and natural products.

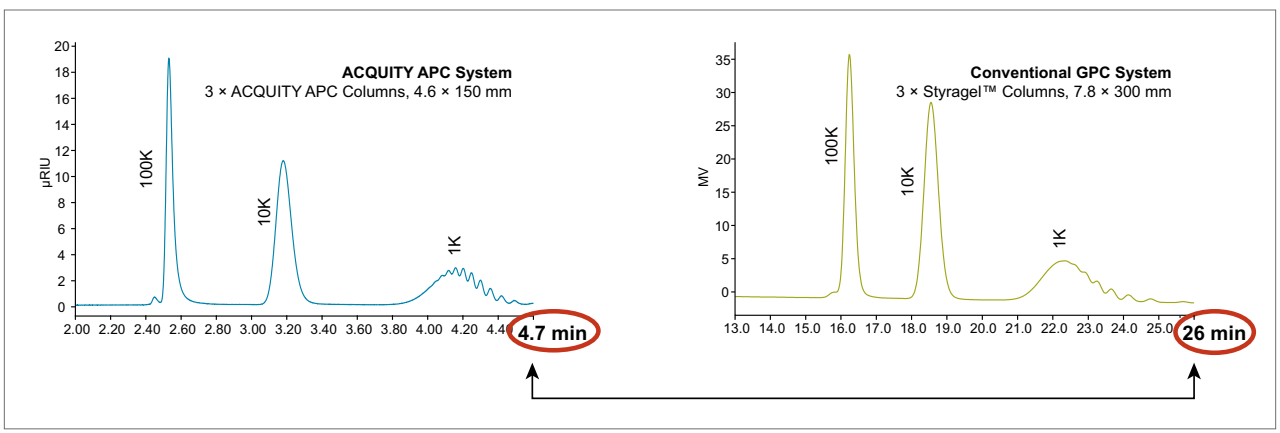
As a market leader and a primary manufacturer of chromatographic instrumentation and consumables, Waters will continue to influence the field of separation science, providing the highest quality products and expert applications support.

GPC Columns for Non-Aqueous Samples

The goals for a separation can range between maximum speed, for screening purposes, to maximum resolution, for quality control purposes. Each analysis type presents unique challenges. Waters' comprehensive line of GPC columns ensures that the column or column bank you select for an analysis will accommodate a particular temperature, solvent, and polymer type.

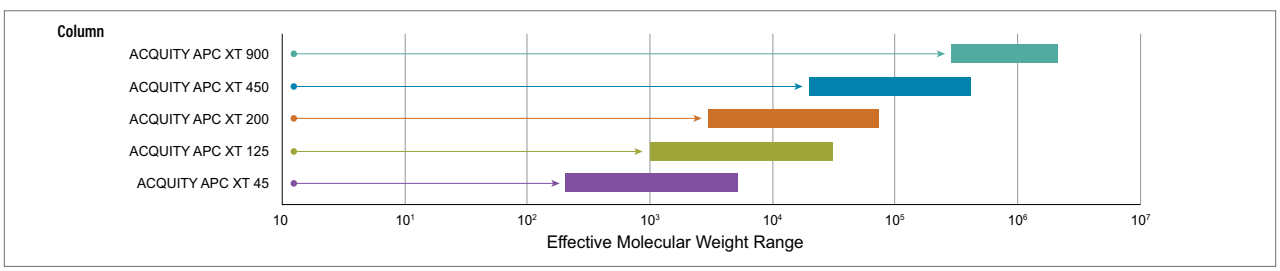
ACQUITY APC XT COLUMNS

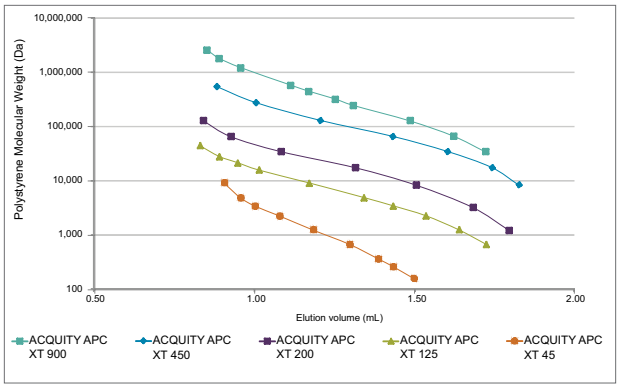
Using ACQUITY APC XT Columns, you can quantify and characterize polymer samples with accuracy and confidence while maximizing productivity. The high-performance chemistries contained in ACQUITY Advanced Polymer Chromatography (APC) Columns enable rapid and accurate chromatographic characterization of synthetic polymer and macromolecular species. The rigid hybrid particles used for ACQUITY APC XT Columns provide an unprecedented capability for rapid solvent switching, allowing you to use multiple conditions for the same column bank. This gives you the ability to quantify and characterize polymer samples with confidence and accuracy while maximizing productivity.



Compared with conventional columns, ACQUITY APC Columns provide faster analysis time and increase chromatographic resolution. Improving data quality enhances your ability to accurately characterize polymers and to do it with confidence. The conventional GPC separation was performed using three Styragel HR Columns (HR 0.5, HR 2, and HR 4E), all 7.8 × 300 mm. The same polystyrene sample was analyzed using a three column bank of 4.6 × 150 mm ACQUITY APC Columns (XT 45, XT 45, and XT 200). The separation used THF, and the flow rate was 1 mL/min.

ACQUITY APC XT Column Selection Guide





Polystyrene calibration curves for ACQUITY APC XT Columns.

Ordering Information

ACQUITY APC XT Columns

Pore Size	Effective MW Range*	Particle Size	P/N Column Length 30 mm	P/N Column Length 75 mm	P/N Column Length 150 mm
45 Å	200–5000	1.7 µm	186006992	186006993	186006995
125 Å	1000–30,000	2.5 µm	186006997	186006998	186007000
200 Å	3000–70,000	2.5 µm	186007002	186007003	186007005
450 Å	20,000–400,000	2.5 µm	186007007	186007008	186007010
900 Å	300,000–2,000,000	2.5 µm	186007252	186007253	186007254

All columns listed above are 4.6 mm I.D. and are shipped dry.
Maximum operating temperature limit 90 °C.
*The calibration range is based on well-characterized polystyrene standards.

ACQUITY APC XT Columns are shipped dry, with acetal compression plugs at the assembly's ends. If you are storing the columns wet using a strong solvating solvent, consider fitting compression plugs made of stainless steel.

ACQUITY APC XT Fitting Compression Plug

Description	P/N
Stainless Steel Pin Plug, 1/16 in., High Pressure, 5/pk	700002747

Waters ACQUITY APC Column Selector

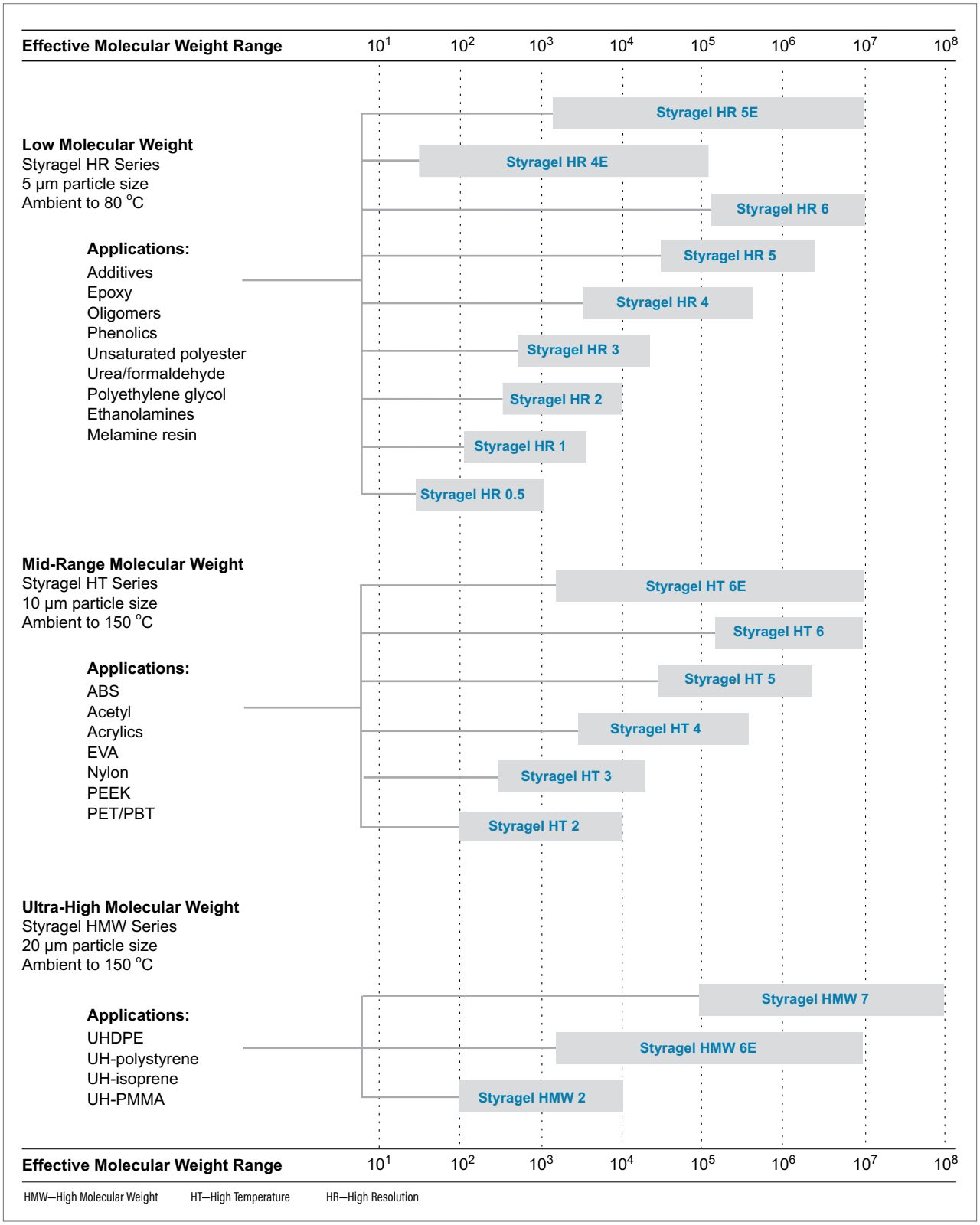
Easily find column and calibration kit recommendations that fit your polymer analysis requirements.

To try this tool, go to waters.com/APCselector

STYRAGEL COLUMNS SELECTION GUIDE

Waters offers a comprehensive selection of polymeric GPC columns. Select a column or column bank that is compatible with the temperature, solvent, and polymer type analyzed. Refer to the following charts to quickly compare the molecular weight ranges for the specified columns. By connecting two or more columns in series, you extend the effective molecular-weight range, which is necessary preparation for performing increasingly complex sample analyses.

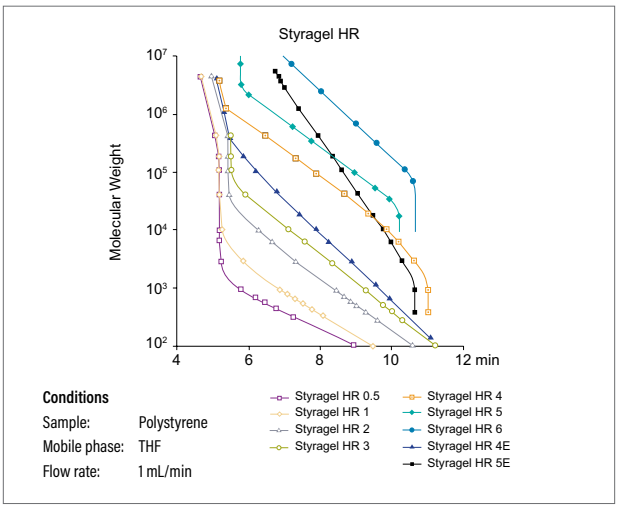
Selection Guide



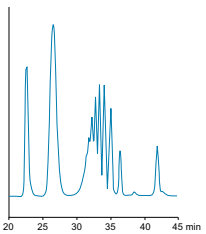
Styragel HR (High-Resolution) Columns

Designed especially for low-molecular-weight samples, Waters Styragel HR Columns are ideal for analyzing oligomers, epoxies, and polymer additives, where high resolution is critical. Packed with rigid 5 µm particles, these columns deliver unrivaled resolution and efficiency in the low-to-mid molecular-weight region.

Calibration Curves for the Waters Styragel HR Series of High-Resolution Columns

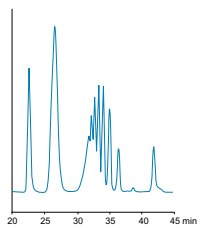


Styragel HR Columns for Unrivaled Resolution of Low-Molecular-Weight Samples



Conventional Styragel HR Columns, 7.8 × 300 mm

Column bank: Styragel HR 0.5, 1, 2, and 3
Part numbers: WAT044231, WAT044234, WAT044237, WAT044222
Mobile phase: THF
Column temp.: 35 °C
Flow rate: 1 mL/min
Sample: Polystyrene standards: 0.5 K, 5.05 K, 49.8 K



Solvent-Efficient Styragel HR Columns, 4.6 × 300 mm

Column bank: Styragel HR 0.5, 1, 2, and 3
Part numbers: WAT045835, WAT045850, WAT045865, WAT045880
Mobile phase: THF
Column temp.: 35 °C
Flow rate: 0.35 mL/min
Sample: Polystyrene standard mix 0.5 K, 5.05 K, 49.8 K

Ordering Information

Styragel HR Columns (7.8 × 300 mm)

		P/N	P/N	P/N
Description	**Effective MW Range**	**THF**	**DMF**	**Toluene**
Styragel HR 0.5, 50 Å	0–1000	WAT044231	WAT044232	WAT044230
Styragel HR 1, 100 Å	100–5000	WAT044234	WAT044235	WAT044233
Styragel HR 2, 500 Å	500–20,000	WAT044237	WAT044238	WAT044236
Styragel HR 3, 10^3 Å	500–30,000	WAT044222	WAT044223	WAT044221
Styragel HR 4, 10^4 Å	5000–600,000	WAT044225	WAT044226	WAT044224
Styragel HR 4E, mixed bed	50–100,000	WAT044240	WAT044241	WAT044239
Styragel HR 5, 10^5 Å	50,000–4,000,000	WAT054460	WAT054466	WAT054464
Styragel HR 5E, mixed bed	2000–4,000,000	WAT044228	WAT044229	WAT044227
Styragel HR 6, 10^6 Å	200,000–10,000,000	WAT054468	WAT054474	WAT054470
Styragel Guard Column, 4.6 × 30 mm	—	WAT054405	WAT054415	WAT054410

Styragel HR Columns (4.6 × 300 mm)*

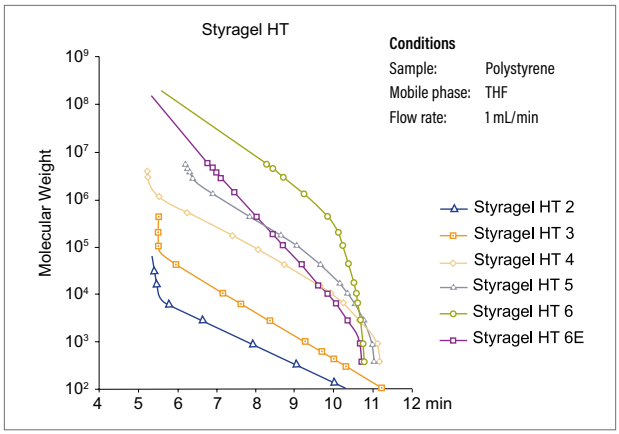
		P/N	P/N	P/N
Description	**Effective MW Range**	**THF**	**DMF**	**Toluene**
Styragel HR 0.5, 50 Å	0–1000	WAT045835	WAT045840	WAT045830
Styragel HR 1, 100 Å	100–5000	WAT045850	WAT045855	WAT045845
Styragel HR 2, 500 Å	500–20,000	WAT045865	WAT045870	WAT045860
Styragel HR 3, 10^3 Å	500–30,000	WAT045880	WAT045885	WAT045875
Styragel HR 4, 10^4 Å	5000–600,000	WAT045895	WAT045900	WAT045890
Styragel HR 4E, mixed bed	50–100,000	WAT045805	WAT045810	WAT045800
Styragel HR 5E, mixed bed	2000–4,000,000	WAT045820	WAT045825	WAT045815

*The same high performance as our conventional Styragel HMW Columns with the added advantage of reducing your solvent consumption by two-thirds.

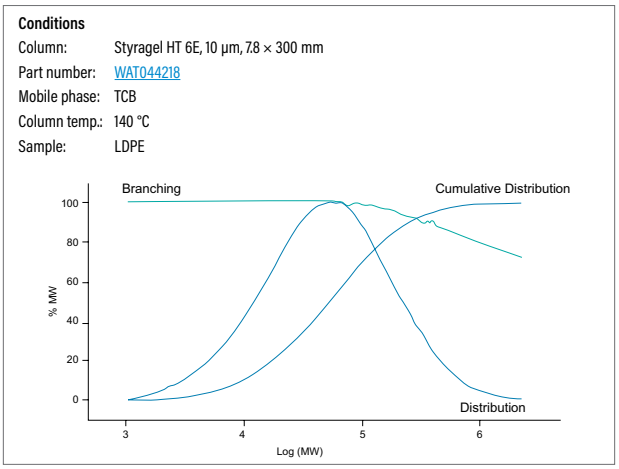
STYRAGEL HT (HIGH-TEMPERATURE) COLUMNS

You can use Styragel HT Columns with aggressive solvents at high temperatures without sacrificing resolution or column lifetime. Packed with rigid 10 µm particles, a typical plate count exceeds 10,000 plates per column. These columns are extremely durable because of a narrow, particle-size distribution that results in a stable column bed. Suitable for both ambient and high-temperature analysis, the Styragel HT Columns offer excellent resolution of polymers in the mid-to-high molecular-weight range.

Calibration Curves for the Waters Styragel HT Series of High-Temperature Columns



Styragel HT Columns Deliver Superior Performance—Even at High Temperatures



Ordering Information

Styragel HT Columns (7.8 × 300 mm)

		P/N	P/N	P/N
Description	**Effective MW Range**	**THF**	**DMF**	**Toluene**
Styragel HT 2, 500 Å	100–10,000	WAT054475	WAT054480	WAT054476
Styragel HT 3, 10^3 Å	500–30,000	WAT044207	WAT044208	WAT044206
Styragel HT 4, 10^4 Å	5000–600,000	WAT044210	WAT044211	WAT044209
Styragel HT 5, 10^5 Å	50,000–4,000,000	WAT044213	WAT044214	WAT044212
Styragel HT 6, 10^6 Å	200,000–10,000,000	WAT044216	WAT044217	WAT044215
Styragel HT 6E, mixed bed	5000–10,000,000	WAT044219	WAT044220	WAT044218
Styragel Guard Column, 4.6 × 30 mm	—	WAT054405	WAT054415	WAT054410

Styragel HT Columns (4.6 × 300 mm)*

		P/N	P/N	P/N
Description	**Effective MW Range**	**THF**	**DMF**	**Toluene**
Styragel HT 3, 10^3 Å	500–30,000	WAT045920	WAT045925	WAT045915
Styragel HT 4, 10^4 Å	5000–600,000	WAT045935	WAT045940	WAT045930
Styragel HT 5, 10^5 Å	50,000–4,000,000	WAT045950	WAT045955	WAT045945
Styragel HT 6, 10^6 Å	200,000–10,000,000	WAT045965	WAT045970	WAT045960
Styragel HT 6E, mixed bed	5000–10,000,000	WAT045980	WAT045985	WAT045975

*The same high performance as our conventional Styragel HT Columns with the added advantage of reducing your solvent consumption by two-thirds.

Styragel HMW (High-Molecular-Weight) Columns

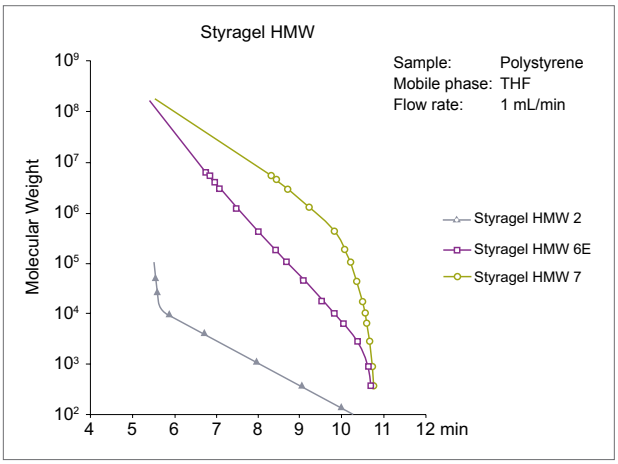
The Styragel HMW Columns are designed specifically to analyze polymers of ultra-high-molecular-weight, which are susceptible to shearing. Combining high-porosity, 10 µm frits and 20 µm particles, the Styragel HMW Columns minimize polymer shear effects. Usable at ambient or elevated temperatures, these state-of-the-art columns exhibit excellent lifetimes.

Ordering Information

Styragel HMW Columns (7.8 × 300 mm)

		P/N	P/N	P/N
Description	**Effective MW Range**	**THF**	**DMF**	**Toluene**
Styragel HMW 2, 500 Å	100–10,000	WAT054488	WAT054494	WAT054490
Styragel HMW 6E, mixed bed	5000–1 × 107	WAT044204	WAT044205	WAT044203
Styragel HMW 7, 10^7 Å	500,000–1 × 108	WAT044201	WAT044202	WAT044200
Styragel Guard Column, 4.6 × 30 mm	—	WAT054405	WAT054415	WAT054410

Calibration Curves for Waters Styragel HMW Series of High-Molecular-Weight Columns



Styragel HMW Columns (4.6 × 300 mm)*

		P/N	P/N	P/N
Description	**Effective MW Range**	**THF**	**DMF**	**Toluene**
Styragel HMW 6E, mixed bed	5000–1 × 107	WAT046820	WAT046825	WAT046815
Styragel HMW 7, 10^7 Å	500,000–1 × 108	WAT046805	WAT046810	WAT046800

System dead volume must be minimized for maximum column performance.
*The same high performance as our conventional Styragel HMW Columns with the added advantage of reducing your solvent consumption by two-thirds.

ULTRASTYRAGEL COLUMNS

Ultrastyragel Preparative Columns provide high-efficiency GPC separations for compound isolation and sample cleanup. Closely related to Styragel GPC Columns, the family of Ultrastyragel Columns provides a two-to three-fold increase in efficiency (plates/meter) that improves separation speed and reduces solvent consumption for preparative isolation. Separations that once required several smaller Styragel Columns can be performed on a single, more efficient, Ultrastyragel Preparative Column.

Ordering Information

Ultrastyragel Columns (19 × 300 mm)

		(mL/min)	P/N	P/N
Pore Size	**Effective MW Range**	**Flow Rate**	**Toluene**	**THF**
100 Å	50–1500	4–10	WAT025866	WAT025859
500 Å	100–10,000	4–10	WAT025867	WAT025860
10^3 Å	200–30,000	4–10	WAT025868	WAT025861
10^4 Å	5000–600,000	4–10	WAT025869	WAT025862
10^5 Å	50,000–4 M	4–10	WAT025870	WAT025863
10^6 Å	200,000–10 M	4–10	WAT025871	WAT025864
Linear	2000–4 M	4–10	WAT025872	WAT025865

Ultrastyragel Columns (7.8 × 300 mm)

		P/N	P/N
Pore Size	**Effective MW Range**	**Toluene**	**THF**
100 Å	50–1500	WAT085500	WAT010570
500 Å	100–10,000	WAT085501	WAT010571

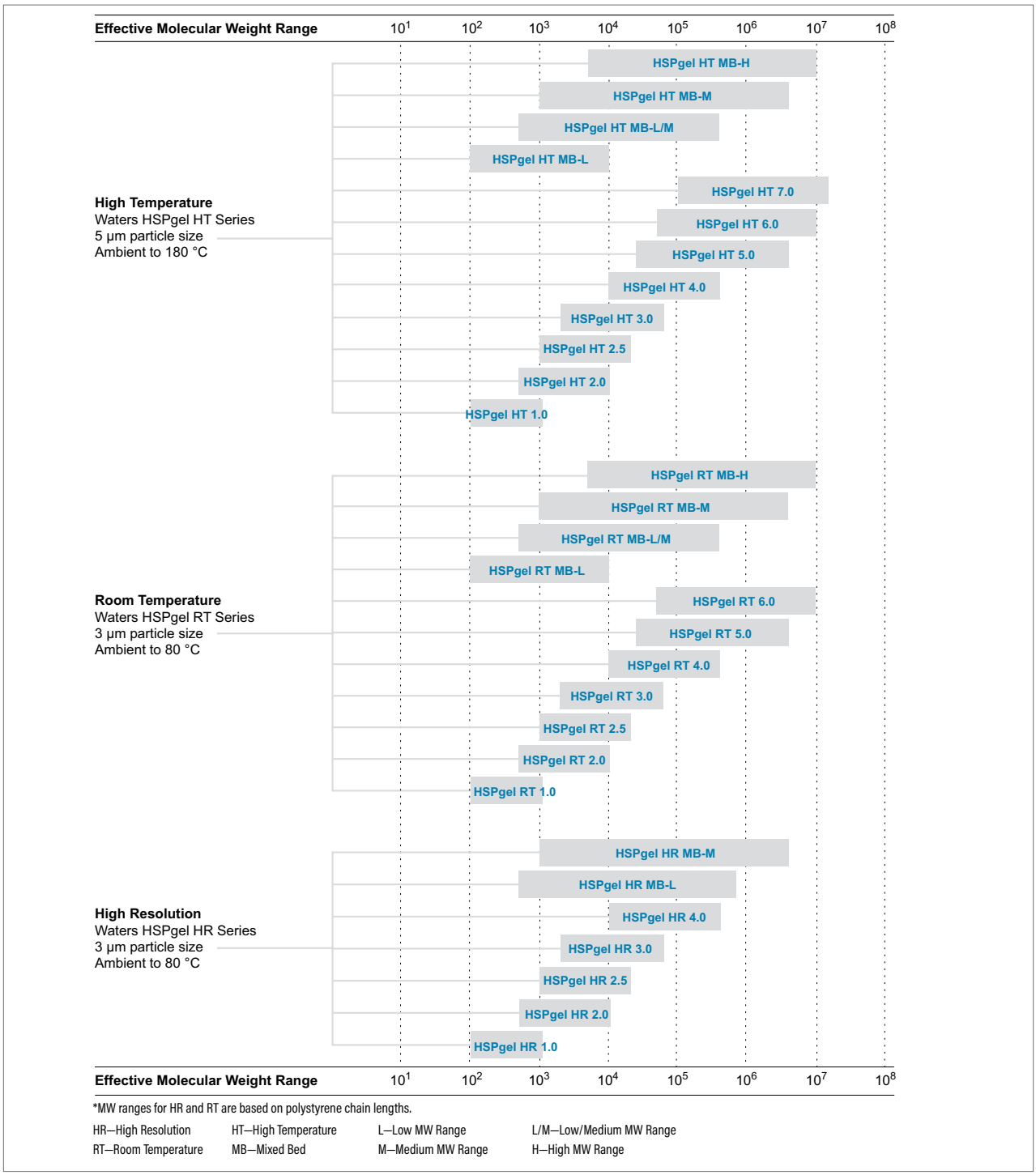
HSPgel COLUMNS

Designed for high-speed GPC analysis, the Waters HSPgel Column provides an accurate and precise determination of molecular weight, increased sample throughput, and greatly reduced solvent consumption and disposal.

Waters offers these 6.0 × 150 mm columns:

- HSPgel HR series, for high-resolution, room-temperature GPC
- HSPgel RT series, for routine room temperature GPC
- HSPgel HT series for high temperature GPC

HSPgel Columns Selection Guide*



*MW ranges for HR and RT are based on polystyrene chain lengths.

HR—High Resolution HT—High Temperature L—Low MW Range L/M—Low/Medium MW Range
RT—Room Temperature MB—Mixed Bed M—Medium MW Range H—High MW Range

HSPgel HR Column Series

The HSPgel HR columns are designed for high-resolution, room-temperature, organic polymer GPC. These columns are packed in THF and can be converted once to toluene, dichloromethane, or chloroform.

Ordering Information

HSPgel HR Columns in THF, 3 µm, 6.0 × 150 mm

Description	MW Range	P/N
HSPgel HR 1.0	100–1000	186001741
HSPgel HR 2.0	500–10,000	186001742
HSPgel HR 2.5	1000–20,000	186001743
HSPgel HR 3.0	2000–60,000	186001744
HSPgel HR 4.0	10,000–400,000	186001745
HSPgel HR MB-L	500–700,000	186001746
HSPgel HR MB-M	1000–4,000,000	186001747

HR—High Resolution, MB—Mixed Bed, L—Low MW Range, M—Medium MW Range.

HSPgel RT Column Series

The HSPgel RT columns are designed for the routine, room-temperature work of organic-polymer GPC. The columns, which are shipped packed in THF, can be converted multiple times, from THF to toluene, chloroform, dichloromethane, DMF, DMSO, etc.

Ordering Information

HSPgel RT Columns in THF, 3 µm, 6.0 × 150 mm

Description	MW Range	P/N
HSPgel RT 1.0	100–1000	186001749
HSPgel RT 2.0	500–10,000	186001750
HSPgel RT 2.5	1000–20,000	186001751
HSPgel RT 3.0	2000–60,000	186001752
HSPgel RT 4.0	10,000–400,000	186001753
HSPgel RT 5.0	25,000–4,000,000	186001754
HSPgel RT 6.0	50,000–10,000,000	186001755
HSPgel RT MB-L	100–10,000	186001757
HSPgel RT MB-L/M	500–400,000	186001758
HSPgel RT MB-M	1000–4,000,000	186001759
HSPgel RT MB-H	5000–10,000,000	186001760

RT—Room Temperature, MB—Mixed Bed, L—Low MW Range, M—Medium MW Range, L/M—Low/Medium MW Range, H—High MW Range.

HSPgel HT Column Series

The HSPgel HT columns are designed for organic GPC conducted at between room temperature and high temperature (180 °C). The columns are shipped packed in either THF or ODCB. The ODCB-packed column should be used for direct conversion to TCB. These columns can withstand multiple solvent switches.

Ordering Information

HSPgel HT Columns in THF, 5 µm, 6.0 × 150 mm

Description	MW Range	P/N
HSPgel HT 1.0	100–1000	186001761
HSPgel HT 2.0	500–10,000	186001762
HSPgel HT 2.5	1000–20,000	186001763
HSPgel HT 3.0	2000–60,000	186001764
HSPgel HT 4.0	10,000–400,000	186001765
HSPgel HT 5.0	25,000–4,000,000	186001766
HSPgel HT 6.0	50,000–10,000,000	186001767
HSPgel HT 7.0	100,000–15,000,000	186001768
HSPgel HT MB-L	100–1000	186001769
HSPgel HT MB-L/M	500–400,000	186001770
HSPgel HT MB-M	1000–4,000,000	186001771
HSPgel HT MB-H	5000–10,000,000	186001772

HT – High Temperature, MB – Mixed Bed, L – Low MW Range, M – Medium MW Range, L/M – Low/Medium MW Range, H – High MW Range.

HSPgel HT Columns in ODCB, 5 µm, 6.0 × 150 mm

Description	MW Range	P/N
HSPgel HT 1.0	100–1000	186001773
HSPgel HT 2.0	500–10,000	186001774
HSPgel HT 2.5	1000–20,000	186001775
HSPgel HT 3.0	2000–60,000	186001776
HSPgel HT 4.0	10,000–400,000	186001777
HSPgel HT 5.0	25,000–4,000,000	186001778
HSPgel HT 6.0	50,000–10,000,000	186001779
HSPgel HT 7.0	100,000–15,000,000	186001780
HSPgel HT MB-L	100–1000	186001781
HSPgel HT MB-L/M	500–400,000	186001782
HSPgel HT MB-M	1000–4,000,000	186001783
HSPgel HT MB-H	5000–10,000,000	186001784

HT – High Temperature, MB – Mixed Bed, L – Low MW Range, M – Medium MW Range, L/M – Low/Medium MW Range, H – High MW Range.

SHODEX COLUMNS

Waters is proud to distribute Shodex GPC Columns and accessories. For 30 years, Shodex GPC Columns have been used successfully by scientists worldwide. The following selection of highly-reproducible GPC columns contains styrene divinylbenzene resins.

K-800 Column Series (8 × 300 mm)

Ultra-high-efficiency columns designed for high-resolution performance, available in THF, DMF, or chloroform.

Ordering Information

Shodex GPC K-800 Columns in THF 5 µm, 8 × 300 mm

Description	Polystyrene Exclusion Limit	P/N
Shodex KF-801	1500	WAT030697
Shodex KF-802	5000	WAT030698
Shodex KF-802.5	20,000	WAT030699
Shodex KF-803	70,000	WAT034100
Shodex KF-804	400,000	WAT034101
Shodex KF-805	4,000,000	WAT034102
Shodex KF-807	200,000,000	WAT034104
Shodex KF-806M (linear)	40,000,000	WAT034105
Shodex KF-G Guard (5 µm, 4.6 × 10 mm)		WAT034106

Shodex GPC K-800 Columns in Chloroform, 5 µm, 8 × 300 mm

Description	Polystyrene Exclusion Limit	P/N
Shodex K-802.5	20,000	WAT030699
Shodex K-803	70,000	WAT034100
Shodex K-804	400,000	WAT034101
Shodex K-805	4,000,000	WAT034102
Shodex K-G Guard (5 µm, 4.6 × 10 mm)		WAT035524

Shodex GPC K-800 Columns in DMF, 5 µm, 8 × 300 mm

Description	Polystyrene Exclusion Limit	P/N
Shodex KD-801	2500	WAT034116
Shodex KD-802	5000	WAT034117
Shodex KD-802.5	20,000	WAT034118
Shodex KD-803	70,000	WAT034119
Shodex KD-804	400,000	WAT034120
Shodex KD-806	40,000,000	WAT034122
Shodex KD-807	200,000,000	WAT034123
Shodex KD-806 M (linear)	40,000,000	WAT034124
Shodex KD-G Guard (5 µm, 4.6 × 10 mm)		WAT034125

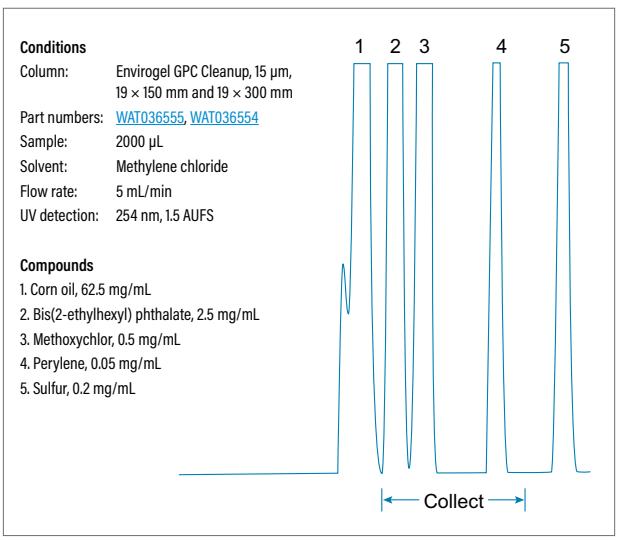
HFIP-800 Column Series

These columns have the same high efficiency as the K-series columns shipped in HFIP.

ENVIROGEL HIGH-RESOLUTION GPC CLEANUP COLUMNS

The Envirogel High-Efficiency GPC Cleanup Columns remove low volatility, high-molecular-weight interferences, such as lipids and natural resins, from environmental samples, as specified in EPA Method 3640A. In the past, the cleanup procedure for environmental samples was performed on low-efficiency GPC Columns based on packing particle diameters of 37–75 µm (200–400 mesh) Bio-Beads S-X resins. The high-efficiency Envirogel GPC Cleanup Columns increase the speed of this process, and simultaneously reduce solvent consumption. For optimum capacity and resolution, a 150 mm column is used in series with the 300 mm column. The use of both the 150 mm and 300 mm column provides maximum loading capacity, while the 300 mm column provides maximum throughput when used alone, plus reduced solvent consumption.

Column Optimization



Ordering Information

Envirogel High-Resolution GPC Cleanup Columns

Description	Solvent	Dimension	P/N
Envirogel GPC Cleanup	Methylene chloride	19 × 150 mm	WAT036555
Envirogel GPC Cleanup	Cyclohexane/ethyl acetate	19 × 150 mm	186001915
Envirogel GPC Cleanup	Methylene chloride	19 × 300 mm	WAT036554
Envirogel GPC Cleanup	Cyclohexane/ethyl acetate	19 × 300 mm	186001916
Envirogel GPC Guard	Methylene chloride	4.6 × 30 mm	186001913
Envirogel GPC Guard	Cyclohexane/ethyl acetate	4.6 × 30 mm	186001914

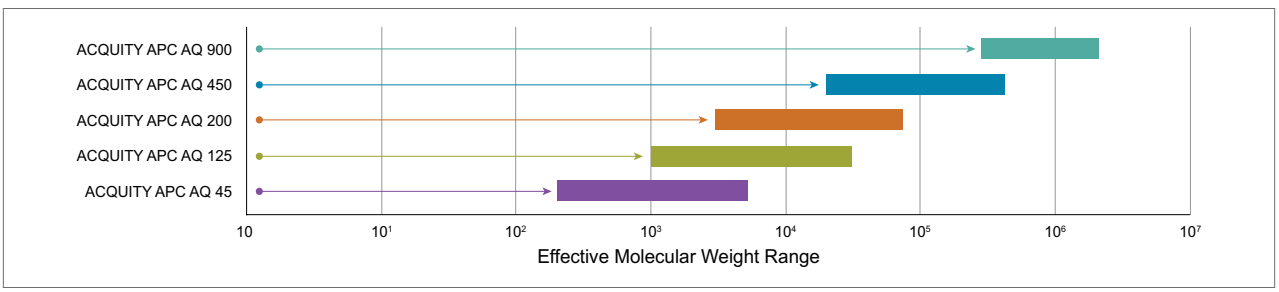
SEC Columns

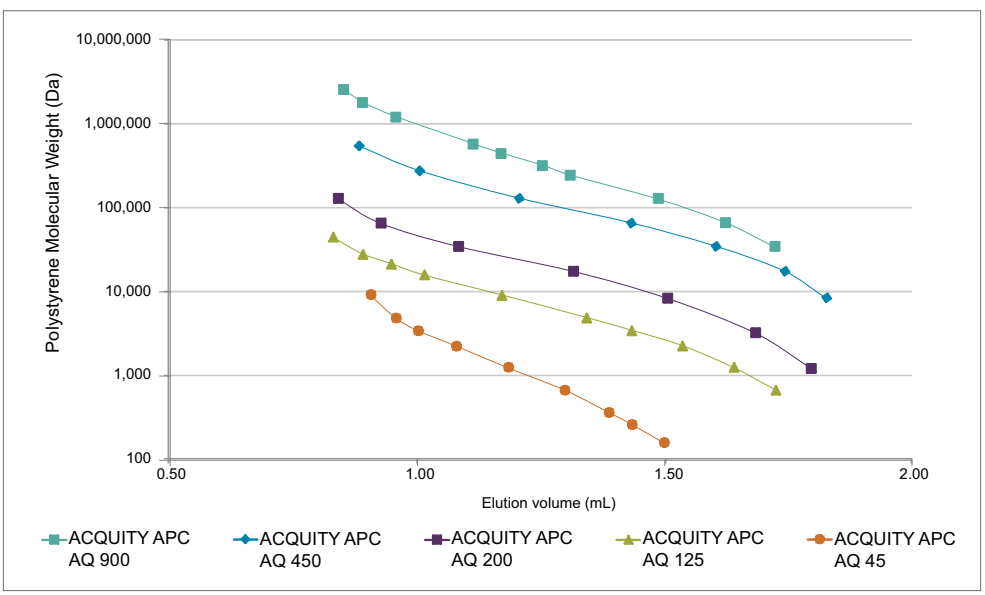
Size-exclusion chromatography (SEC) and gel-filtration chromatography (GFC) are synonymous terms for techniques used to separate macromolecules in aqueous environments according to their hydrodynamic volume. Waters SEC Columns efficiently separate cationic, anionic, and non-ionic macromolecules in many physical, chemical, and biological applications.

ACQUITY APC AQ COLUMNS

Designed for aqueous samples, ACQUITY APC AQ Columns are based on hybrid-polymer sub-3-µm particle technology. The advantages of this technology, detailed in the ACQUITY APC XT section on page 403, apply as well to the AQ columns.

ACQUITY APC AQ Column Selection Guide





Polystyrene calibration curves for ACQUITY APC AQ Columns.

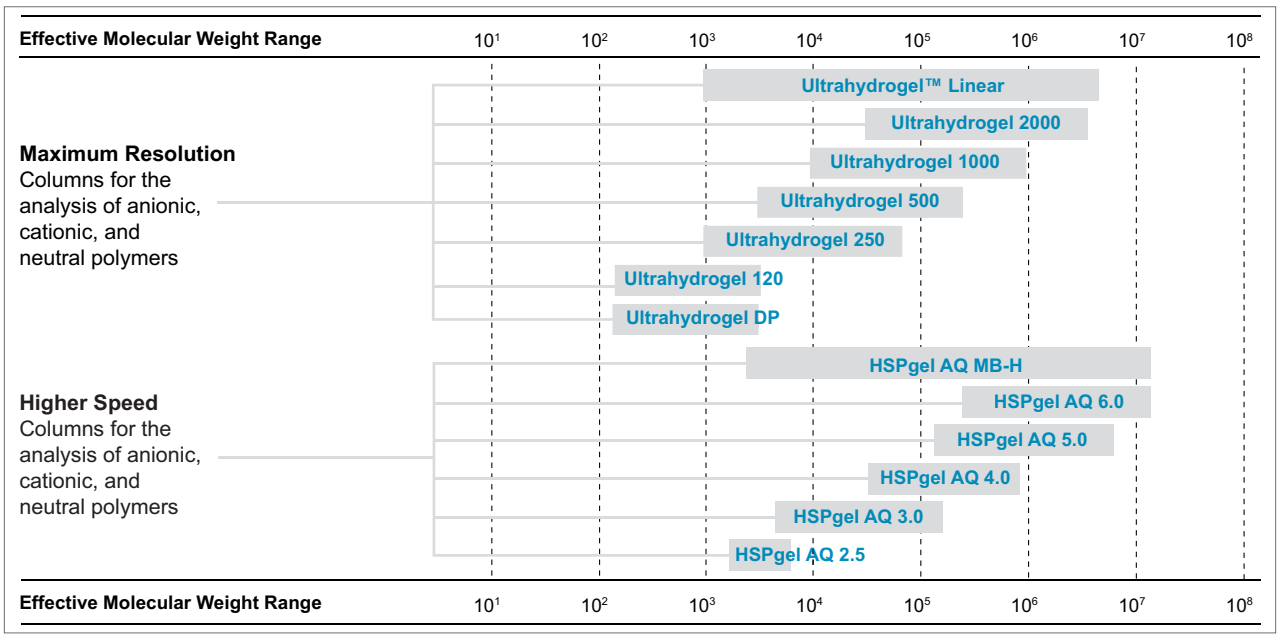
Ordering Information

ACQUITY APC AQ Columns

Pore Size	Effective MW Range*	Particle Size	P/N	P/N	P/N
			Column Length		
			30 mm	75 mm	150 mm
45 Å	200–5000	1.7 µm	186006972	186006973	186006975
125 Å	1000–30,000	2.5 µm	186006977	186006978	186006980
200 Å	3000–70,000	2.5 µm	186006982	186006983	186006985
450 Å	20,000–400,000	2.5 µm	186006987	186006988	186006990
900 Å	300,000–2,000,000	2.5 µm	186007249	186007250	186007251

*All columns are 4.6 mm I.D., maximum temperature limit is 45 °C, columns are shipped dry.

Aqueous SEC Column Selection Guide



This chart compares the molecular weight ranges for the specified columns. By connecting two or more columns in series, the effective molecular weight range can be extended to provide coverage for more complex sample analysis.

SelectScience TRUSTED REVIEWS

APPLICATION AREA: Analyzed Polymers

"These high quality SEC columns can be used for cationic or anionic polymers."

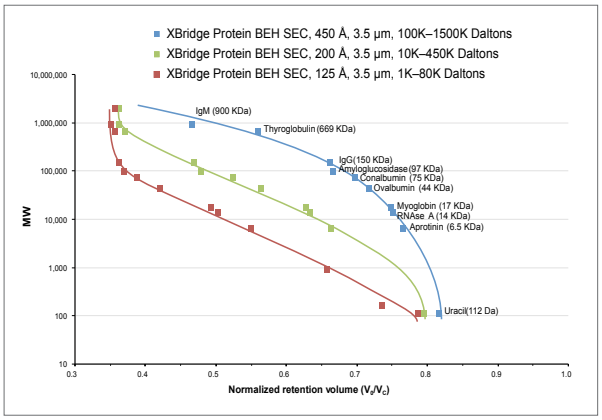
REVIEWER: Jang Shing Chiou

ORGANIZATION: Alcon Research Ltd.

XBRIDGE PROTEIN BEH SEC COLUMNS

XBridge Protein BEH SEC Columns containing 3.5 µm are primarily designed for use on HPLC instrumentation. These 3.5 µm guards and columns are available in 125, 200, and 450 Å pore sizes using the same ethylene-bridged hybrid (BEH) particle technology and diol-bonded coating used in Waters' UPLC based SEC columns. This allows you to transfer methods based on laboratory instrumentation and component resolution or sample throughput needs.

Calibration curves on XBridge Protein BEH SEC, 125 Å, 200 Å, and 450 Å Columns.



Four-Step Guide for Successful SEC Column Selection

What is the molecular weight of what you are trying to separate?			
NEED:	**MW 1–8 K Da**	**MW 10–450 / 650 K Da**	**MW 100–1500 K Da**
Recommended column specifications	125 Å	200 Å / 250 Å	400 Å

What type of LC system dispersion* are you using?			
NEED:	**<20 µL (UPLC)**	**>20–<35 µL (UHPLC)**	**>35 µL (HPLC)**
Recommended column specifications	1.7 µm or 2.5 µm	2.5 µm	2.5 µm or 3.5 µm

Do you need to resolve something that is less than 2-fold difference in MW?**			
NEED:	**2.5 µm**	**2.5 µm**	**2.5 µm or 3.5 µm**
REC. Recommended column specifications SPEC:	4.6 × 300 mm or 7.8 × 300 mm	7.8 × 300 mm	7.8 × 300 mm

Do you need maximum speed on a MW greater than two-fold?			
NEED:	**<9 min**	**<12 min**	**<18 min**
REC. Recommended column specifications SPEC:	1.7 µm 4.6 × 150 mm	2.5 µm 4.6 × 150 mm	2.5 µm 7.8 × 150 mm

**For guidance on measuring system dispersion, download the SEC Optimization Guide (720006067EN) on waters.com.*
*** To understand the "why" behind these recommendations, read the Application Note (720006336EN) on waters.com.*

Ordering Information

XBridge Protein BEH SEC Columns for HPLC System, 3.5 µm

Pore Size	Effective MW Range*	Particle Size	P/N Column Length 30 mm Guard w/Standard	P/N Column Length 150 mm w/Standard	P/N Column Length 300 m w/Standard
125 Å	1 K–80 K	3.5 µm	176003591	176003592	176003593
200 Å	10 K–450 K	3.5 µm	176003594	176003595	176003596
450 Å	100 K–1500 K	3.5 µm	176003597	176003598	176003599

Straight Connection Tubing and End-fittings	WAT022681
U-Bend Connection Tubing and End-fittings	WAT084080

SEC Protein Standards are matched to the pore size of the column.

XBRIDGE PROTEIN BEH SEC COLUMNS FOR UHPLC-BASED SEPARATIONS

XBridge Protein BEH SEC Columns containing 2.5 µm are primarily designed for use on UHPLC instrumentation. These 2.5 µm guards and columns are available in 125, 200, and 450 Å pore sizes using the same ethylene-bridged hybrid (BEH) particle technology and diol-bonded coating used in Waters' UPLC based SEC columns. This allows you to transfer methods based on laboratory instrumentation and component resolution or sample throughput needs.

Ordering Information

XBridge Protein BEH SEC Columns, 2.5 µm, UHPLC

Pore Size	MW Range	Particle Size	P/N	P/N	P/N	P/N	P/N	P/N
			4.6 mm ID × Column Length					
			30 mm Guard	150 mm No Standard	300 mm No Standard	30 mm Guard w/ Std	150 mm w/Standard	300 mm w/Standard
125 Å	1 K–80 K	2.5 µm	186009170	186009171	186009172	176004331	176004332	176004333
200 Å	10 K–450 K	2.5 µm	186009174	186009175	186009176	176004334	176004335	176004336
450 Å	100 K–1500 k	2.5 µm	186006850	186009179	186009180	176002995	176002996	176002997

Pore Size	MW Range	Particle Size						
			7.8 mm ID × Column Length					
			30 mm Guard No Std	150 mm No Standard	300 mm No Standard	30 mm Guard w/Std	150 mm w/Standard	300 mm w/Standard
125 Å	1 K–80 K	2.5 µm	186009158	186009159	186009160	176004322	176004323	176004324
200 Å	10 K–450 K	2.5 µm	186009162	186009163	186009164	176004325	176004326	176004327

Straight Connection Tubing and End-fittings	WAT022681
U-Bend Connection Tubing and End-fittings	WAT084080

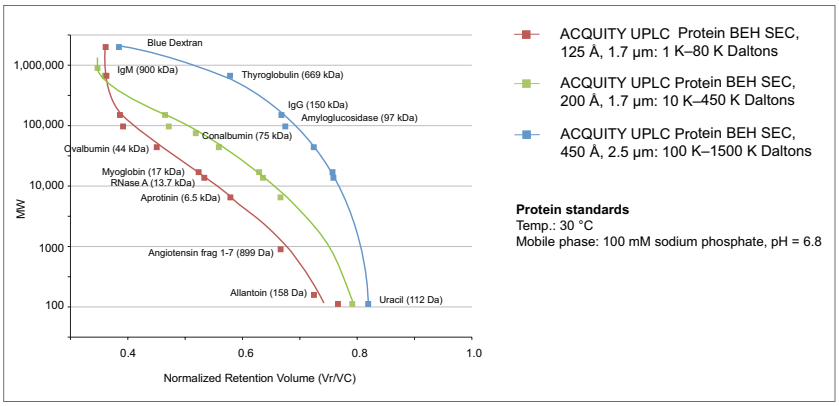
SEC Protein Standards are matched to the pore size of the column.

ACQUITY UPLC PROTEIN SEC COLUMNS

ACQUITY UPLC Protein SEC Columns are packed with ethylene-bridged hybrid (BEH), diol-coated particles. Manufacturers of biotherapeutics and biosimilars can choose the most effective pore size for their application: 125, 200, and 450 Å.

NOTE: These columns were designed for use on low dispersion LC Systems in order to maintain the separation performance obtain on Columns containing these sub 2 micron SEC particles.

Calibration Curves on ACQUITY UPLC Protein BEH SEC, 125 Å, 200 Å, and 450 Å Columns



Ordering Information

ACQUITY UPLC Protein BEH SEC Columns, 1.7 and 2.5 µm

Pore Size	MW Range	Particle Size	P/N	P/N	P/N	P/N	P/N	P/N	P/N
			4.6 mm ID × Column Length						2.1 mm ID × CL
			30 mm Guard*	50 mm No Standard	150 mm No Standard	300 mm No Standard	150 mm w/Standard	300 mm w/Standard	50 mm No Standard
125 Å	1 K–80 K	1.7 µm	186006504	—	186006505	186006506	176003906	176003907	—
200 Å	10 K–450 K	1.7 µm	186005793	186009082	186005225	186005226	176003904	176003905	186008471
450 Å	100 K–1500 k	2.5 µm	186006850	—	186006851	186006852	176002996	176002997	—

Straight Connection Tubing and End-fittings	WAT022681
U-Bend Connection Tubing and End-fittings	WAT084080

SEC Protein Standards are matched to the pore size of the column.

*Size-exclusion chromatography may require modifications to an existing ACQUITY UPLC System. Please reference "Size-Exclusion and Ion-Exchange Chromatography of Proteins using the ACQUITY UPLC System" (p/n: 715002147) or "Size Exclusion and Ion-Exchange Chromatography of Proteins using the ACQUITY UPLC H-Class System" (p/n: 715002909) for specific recommendations.

*To connect two UPLC SEC Columns together in series, we recommend using a Waters Sample Loop (p/n: 430001516).

APPLICATION AREA: Size Characterisation of Proteins

"We use the BEH columns for all our SEC runs. They are UPLC compliant and take around six minutes a run. This means they work fantastically well for high throughput screening and at least for our application they last much longer than other columns – we get >1000 runs per column. The only complaint is that they are expensive, but you get what you pay for and the speed alone means we only need to run one UPLC for 5x the samples on a HPLC."

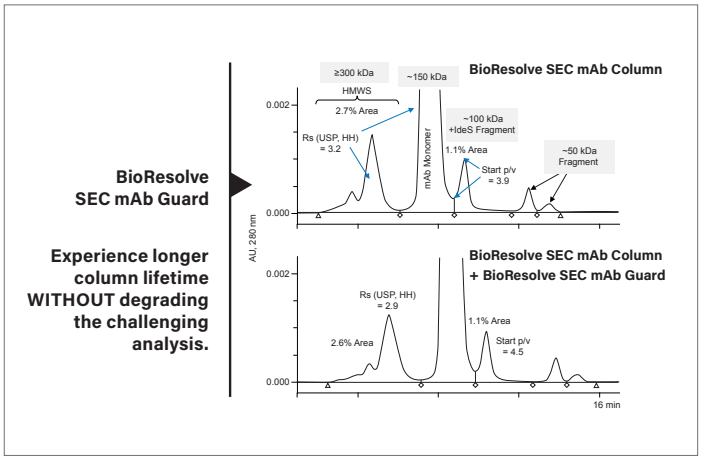
REVIEWER: Nikki Royle

ORGANIZATION: Small Biotech

BIORESOLVE SEC MAB FOR MONOCLONAL AGGREGATE, MONOMER, AND FRAGMENT ANALYSES

The BioResolve SEC mAb Guards and Columns contain 2.5 µm BEH particle technology and is application specifically tested with the mAb Size Variant Standard to help ensure accurate and highly reproducible quantitation of monoclonal antibody (mAb) monomers from frequently associated high molecular weight aggregates (≥300,000 Da) and lower molecular weight fragments (e.g., ≤100,000 Da). Use of 2.5 µm particles in with 4.6 mm or 7.8 mm ID make them well suited for use on Waters ACQUITY UPLCs, UHPLC, or HPLC platforms.

BioResolve mAb SEC Separation of mAb Size Variant



Ordering Information

BioResolve SEC mAb Columns, Guards, and Method Validation Kits

Pore Size	MW Range	Particle Size	P/N	P/N	P/N	P/N	P/N	P/N	
			4.6 mm ID × Column Length						
			30 mm Guard	150 mm No Standard	300 mm No Standard	150 mm w/Standard	300 mm w/Standard	150 mm Guard w/Std	300 mm Guard w/Std
200 Å	10 K–450 K	2.5 µm	186009443	186009435	186009437	176004592	176004593	176004596	176004597
Pore Size	MW Range	Particle Size	7.8 mm ID × Column Length						
			30 mm Guard	150 mm No Standard	300 mm No Standard	150 mm w/Standard	300 mm w/Standard	150 mm Guard w/Std	300 mm Guard w/Std
200 Å	10 K–450 K	2.5 µm	—	186009439	186009441	176004594	176004595	176004598	176004599

BioResolve SEC mAb Method Validation Kit – 200 Å, 2.5 µm, 4.6 × 150 mm Columns**	176004639
BioResolve SEC mAb Method Validation Kit – 200 Å, 2.5 µm, 4.6 × 300 mm Columns**	176004640
BioResolve SEC mAb Method Validation Kit – 200 Å, 2.5 µm, 7.8 × 150 mm Columns**	176004641
BioResolve SEC mAb Method Validation Kit – 200 Å, 2.5 µm, 7.8 × 300 mm Columns**	176004642
mAb Size Variant Standard, 160 g *	186009429

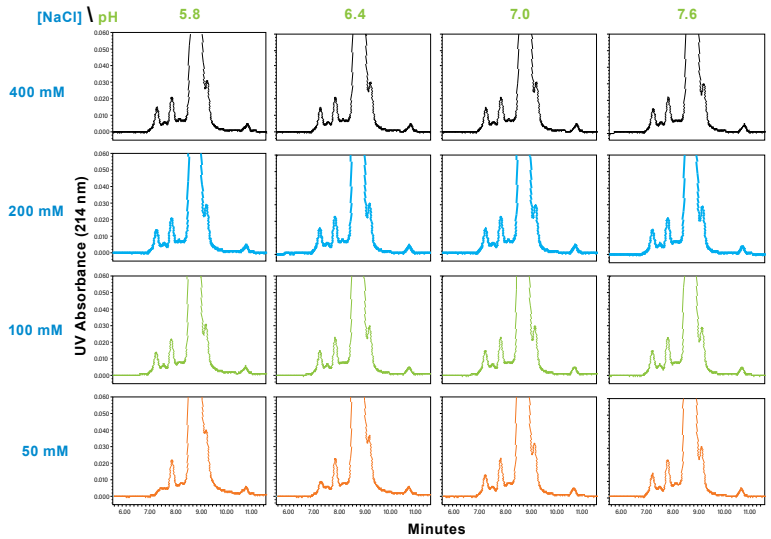
Straight Connection Tubing and End-fittings	WAT022681
U-Bend Connection Tubing and End-fittings	WAT084080

SEC Protein Standards are matched to the pore size of the column.
** Method Validation Kit (MVK) contains three columns from three dierent batches.

ACQUITY AND XBRIDGE PREMIER PROTEIN SEC 250 Å COLUMNS

Waters advancements in MaxPeak PREMIER guard and column hardware as well as SEC BEH-PEO particle technology synergistically work to minimize non-desired secondary ionic or hydrophobic interactions between proteins and the SEC offering. This allows chromatographers to obtain reliable protein aggregate, monomer, and fragment analyses using a "generic" or "platform-type" method for LC or LC/MS applications. In addition, a cost and performance effective MaxPeak PREMIER Protein SEC 250 Å Guard column is available to effectively trap insoluble sample or eluent related particulates that can degrade column performance and shorten column life.

Universality of Method



Conditions

Column:	XBridge™ Premier SEC 250 Å, 2.5 µm, 7.8 × 300 mm
Mobile phase:	AutoBlend™ Plus (phosphate, NaCl, Empirical)
Flow rate:	0.75 mL/min
Column temp.:	25 °C
Sample:	Rituximab @ 10 mg/mL
Injection volume:	10 µL
LC system dispersion:	<10 µL

Ordering Information

MaxPeak Premier SEC 1.7 and 2.5 µm

Pore Size	MW Range	Particle Size	P/N	P/N	P/N	P/N	P/N	P/N	P/N	P/N	P/N
			4.6 mm ID × Column Length								
			30 mm Guard	150 mm No Standard	300 mm No Standard	150 mm w/Standard	300 mm w/Standard	150 mm w/Guard	300 mm w/Guard	150 mm Guard w/Std	300 mm Guard w/Std
250 Å	10 K–650 K	1.7 µm	—	186009963	186009964	176005071	176005072	176004783	176004784	176004794	176004795
250 Å	10 K–650 K	2.5 µm	186009969	186009959[5]	186009960	176005067	176005068	176004779	176004780	176004790	176004791

Pore Size	MW Range	Particle Size	P/N	P/N	P/N	P/N	P/N	P/N	P/N	P/N	P/N
			7.8 mm ID × Column Length								
			30 mm Guard	150 mm No Standard	300 mm No Standard	150 mm w/Standard	300 mm w/Standard	150 mm Guard w/Std	300 mm Guard w/Std	150 mm Guard w/Std	300 mm Guard w/Std
250 Å	10 K–650 K	1.7 µm	—	—	—	—	—	—	—	—	—
250 Å	10 K–650 K	2.5 µm	—	186009961	186009962	176005069	176005070	176004781	176004782	176004792	176004793

mAb Size Variant Standard, 160 g *	186009429
XBridge™ Premier Protein SEC 250 Å, 2.5 µm, 4.6 × 150 mm Column MVK	176004801
XBridge Premier Protein SEC 250 Å, 2.5 µm, 4.6 × 300 mm Column MVK	176004802
XBridge Premier Protein SEC 250 Å, 2.5 µm, 7.8 × 150 mm Column MVK	176004803
XBridge Premier Protein SEC 250 Å, 2.5 µm, 7.8 × 300 mm Column MVK	176004804
ACQUITY Premier Protein SEC 250 Å, 1.7 µm, 4.6 × 150 mm Column MVK	176004805
ACQUITY Premier Protein SEC 250 Å, 1.7 µm, 4.6 × 300 mm Column MVK	176004806

Straight Connection Tubing and End-fittings	WAT022681
U-Bend Connection Tubing and End-fittings	WAT084080

** Method Validation Kit (MVK) contains three columns from three dierent batches.

PROTEIN-PAK SIZE-EXCLUSION HPLC COLUMNS

Protein-Pak packings are based on a 10 µm, diol-bonded silica and are available in a selection of pore sizes and column configurations.

The Protein-Pak Size-Exclusion Columns can be expected to resolve proteins that differ in molecular weight by a factor of two and to distinguish proteins differing by as little as 15% in molecular weight. The degree of resolution is more dependent on the sample mass and volume than the interaction between the sample and the stationary phase. Ideally, there should be no interaction between the stationary phase and the sample molecules. Secondary interactions are most often ionic and can, therefore, be reduced by increasing the ionic strength of thee mobile phase. Typical, salt concentrations range to 0.2–0.5 M NaCl. It may also be useful in some cases to consider adding 10–20% methanol to eliminate hydrophobic and other hydrogen-bonding interactions.

Ordering Information

Protein-Pak SEC HPLC Columns and Guards

Steel Column	Dimension	MW Range	P/N
Protein-Pak 60	7.8 × 300 mm	1000–20,000	WAT085250
Protein-Pak 60	19 × 300 mm	1000–20,000	WAT025830
Protein-Pak 125	7.8 × 300 mm	2000–80,000	WAT084601
Protein-Pak 125	19 × 300 mm	2000–80,000	WAT025831
Protein-Pak 300SW	7.5 × 300 mm	10,000–300,000	WAT080013
Protein-Pak 125 Sentry Guard Column, 3.9 × 20 mm, 2/pk (requires holder)			186000926
Sentry Universal Guard Column Holder			WAT046910

mAB SIZE VARIANT STANDARD

Waters mAb Size Variant Standard (p/n: 186009429) contains the NIST humanized monoclonal antibody (Reference Material 8671) and non-reduced IdeS digested NIST mAb fragments F(ab')2 (~100,000 Da) and (Fc/2)2 (~50,000 Da). By aliquoting small, standard amounts of IdeS fragments, Waters mAb size variant standard can be effectively used to test column and LC System ability to separate mAb aggregates, monomer, and fragments/clips via SEC.

Ordering Information

mAb Size Variant Standard

Description	P/N
mAb Size Variant Standard	186009429

PROTEIN STANDARDS

Each standard contains proteins selected for ACQUITY UPLC and XBridge Protein BEH SEC Columns. Use these standards for purposes of quality control, to test an HPLC or UPLC column, and to monitor column performance over time.

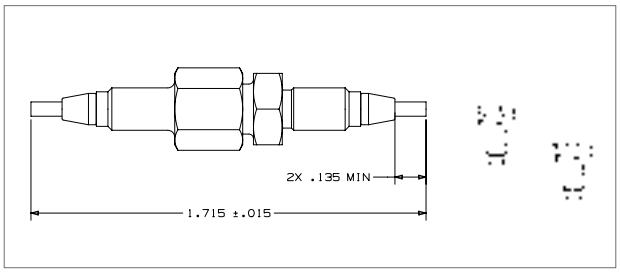
Ordering Information

BEH SEC Column Protein Standards

Description	P/N
BEH125 SEC Protein Standard Mix	186006519
A mix of four proteins: thyroglobulin, ovalbumin, ribonuclease A and uracil	
BEH200 SEC Protein Standard Mix	186006518
A mix of five proteins: thyroglobulin, IgG, BSA, myoglobin, uracil	
BEH450 SEC Protein Standard Mix	186006842
A mix of five proteins: thyroglobulin, IgG, BSA, myoglobin, uracil	

SEC COLUMN CONNECTORS AND CONNECTOR KITS

Connectors to attach BEH SEC columns in series and/or BEH SEC guards to BEH SEC columns.



Ordering Information

UPLC Column Connectors

Description	P/N
ACQUITY APC CM-S Column Connector, U, .004" I.D.*	700009535
ACQUITY APC CM-S Column Connector, Offset U, .004" I.D.*	700009534
ACQUITY APC CM-S Column Connector Tube, Long, .004" I.D.	700009560
ACQUITY APC CM-S Inline Column Connection, .005" I.D.	700009524
0.005 × 1.75 UPLC SEC Connection Tubing, 2/pk	186006613

* Ferrules are not staked on tubing upon receipt. The two-piece ferrule is permanently seated upon installation once the fitting is tightened into the column.

HPLC Column Connectors

Description	P/N
Column Joining Tube Assembly*	WAT084080
Rigid Connector Package*	WAT022681

*The ferrules are permanently seated to Waters' depth setting upon receipt.

Connector Kits

Description	P/N
ACQUITY CM-S 4-Column Bank Connection Kit Kit contains: Two ACQUITY APC CM-S Inline Column Connector, .005" I.D. (p/n: 700009524) Two ACQUITY APC CM-S Column Connector, U, .004" I.D. (p/n: 700009535) One ACQUITY APC CM-S Column Connector, Offset U, .004" I.D. (p/n: 700009534)	205001172
ACQUITY CM-S 3-Column Bank Connection Kit Kit contains: One ACQUITY APC CM-S Inline Column Connector, .005" I.D. (p/n: 700009524) Two ACQUITY APC CM-S Column Connector, U, .004" I.D. (p/n: 700009535)	205001171
ACQUITY CM-S 2-Column Bank Connection Kit Kit contains: One ACQUITY APC CM-S Inline Column Connector, .005" I.D. (p/n: 700009524) One ACQUITY APC CM-S Column Connector, U, .004" I.D. (p/n: 700009535)	205001169

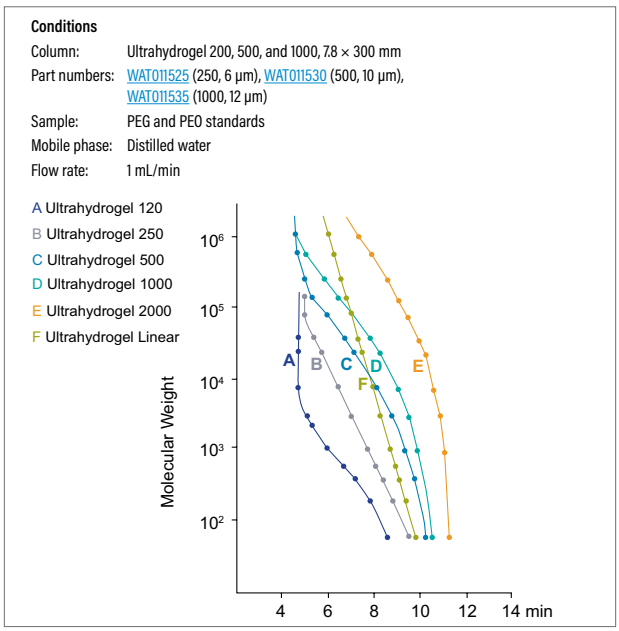
ULTRAHYDROGEL COLUMNS

Packed with hydroxylated, polymethacrylate-based gel, Waters Ultrahydrogel SEC Columns are ideal for analyzing aqueous-soluble samples such as oligomers, oligosaccharides, and polysaccharides. They are likewise well suited to analyze cationic, anionic, and amphoteric polymers.

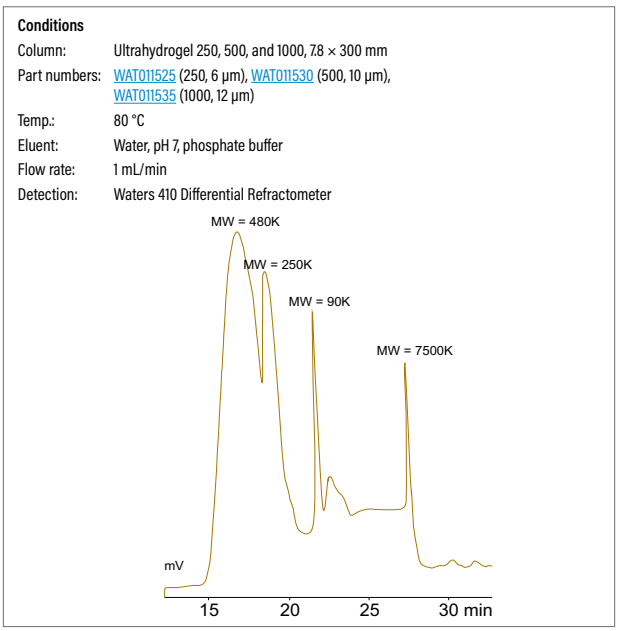
These 7.8 × 300 mm, high-resolution columns offer many advantages over conventional aqueous SEC columns:

- Wide-pH range (2–12)
- Compatibility with high concentrations of organic solvents, as much as 20% organic and 50% organic for mobile phases introduced by gradient
- Greater flexibility for the mobile phase
- Minimal non-size-exclusion effects

Ultrahydrogel Columns Calibration Curves



Gelatin Sample



Ordering Information

Ultrahydrogel Columns (7.8 × 300 mm)*

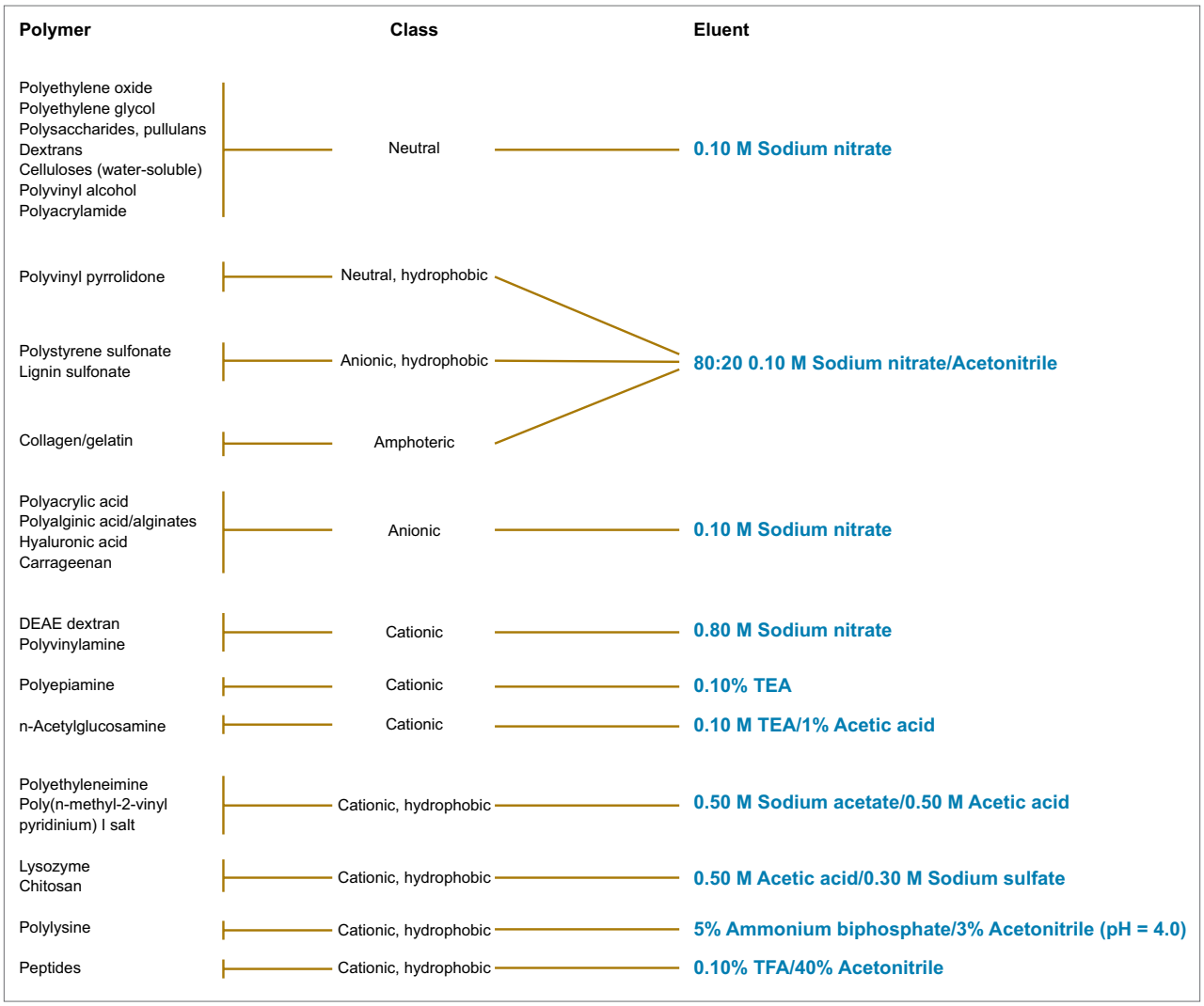
Description	Pore Size	Particle Size	Exclusion Limit	P/N
Ultrahydrogel 120	120 Å	6 µm	5000	WAT011520
Ultrahydrogel 250	250 Å	6 µm	80,000	WAT011525
Ultrahydrogel 500	500 Å	10 µm	400,000	WAT011530
Ultrahydrogel 1000	1000 Å	12 µm	1,000,000	WAT011535
Ultrahydrogel 2000	2000 Å	12 µm	7,000,000	WAT011540
Ultrahydrogel Linear	Blend	10 µm	7,000,000	WAT011545
Ultrahydrogel DP*	120 Å	6 µm	5000	WAT011550
Ultrahydrogel DNA	>2000 Å	10 µm	10,000,000	WAT011560
Ultrahydrogel Guard Column	N/A	6 µm	N/A	WAT011565
Ultrahydrogel Guard Column DP*	N/A	6 µm	N/A	WAT011570

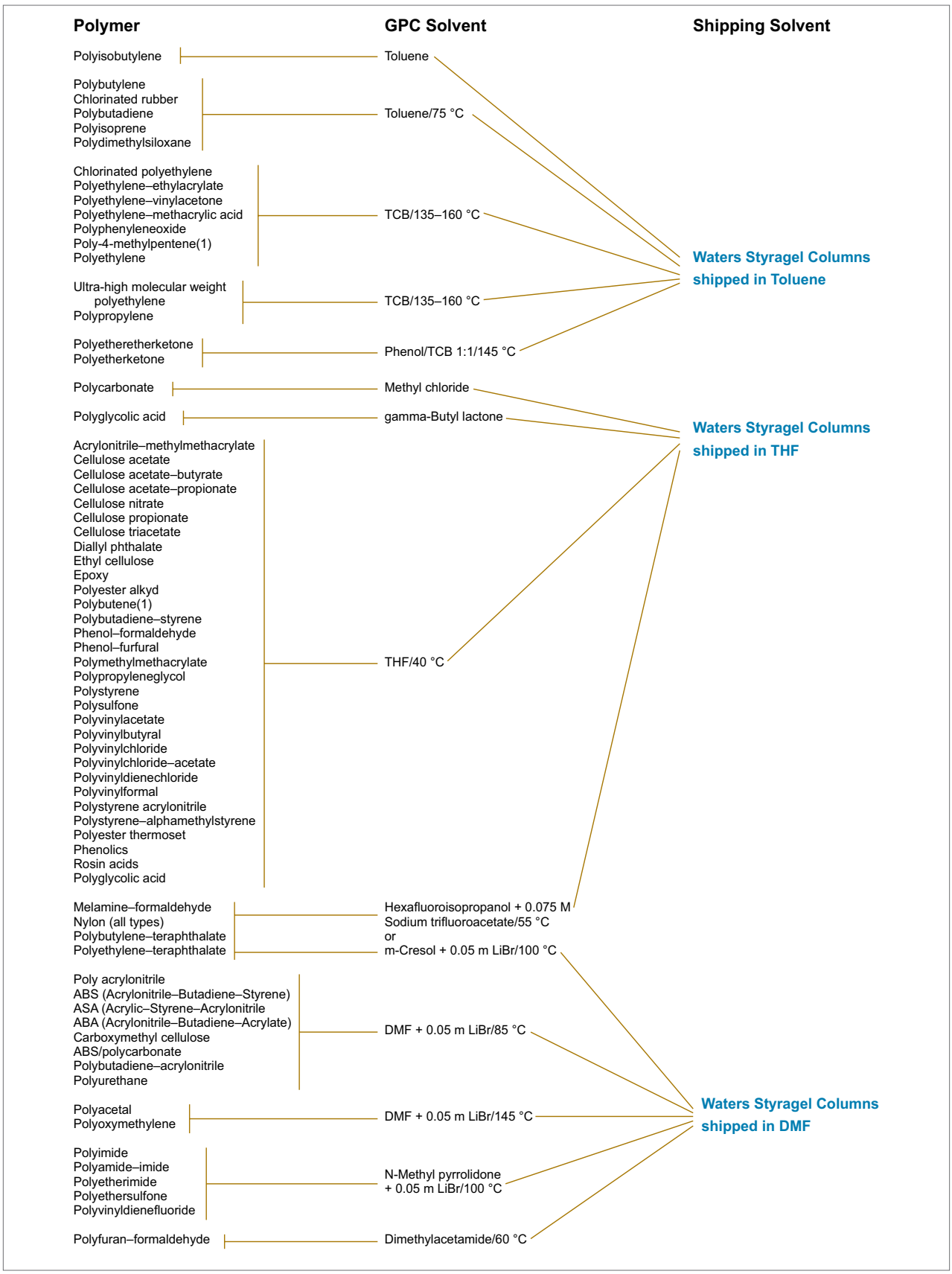
*DP = Degree of Polymerization, choice of column when working with glucose oligomers.

Solvent Guide

The following graphic is a guide for eluents.

Aqueous SEC Solvent Selection Guide



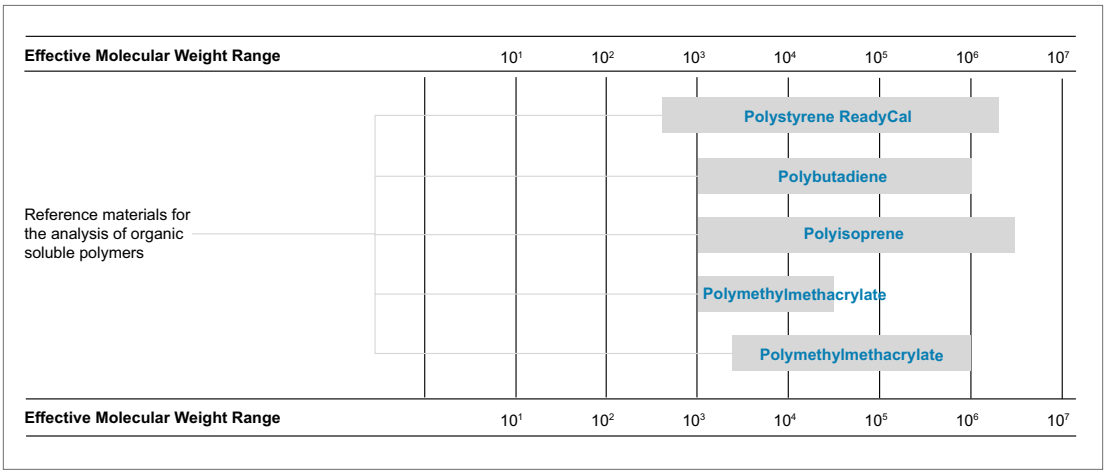


For more information on XBridge Protein BEH SEC Columns, refer to page 428.

Calibration Standards

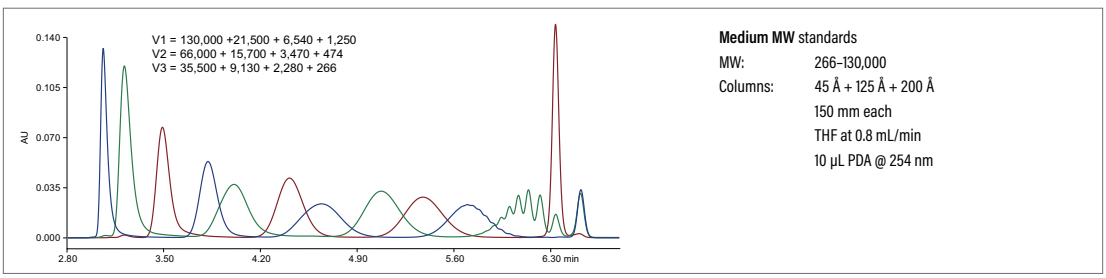
Waters offers a selection of well-characterized polymer standards for calibration. The offering includes kits as well as individual standards. The standards are available for aqueous and non-aqueous applications.

Non-Aqueous GPC Standards Guide



ACQUITY APC CALIBRATION STANDARDS

ACQUITY APC Calibration Standards match the molecular-weight range of the ACQUITY APC XT Columns. These kits eliminate the need to manually prepare custom calibration mixes because they provide the correct number of data points for the targeted molecular-weight range. In addition, they reduce, by 3–5 times, the ACQUITY APC System's calibration time. With reduced calibration time, calibrations can be carried out on a more frequent basis, increasing confidence in the accuracy of results.



The ACQUITY APC Calibration Standards are available in both polystyrene and polymethyl methacrylate, configured as low-, middle-, and high-molecular-weight calibration kits. Also available are method development kits, which include the full separation range of the three kits combined.

Ordering Information

ACQUITY APC Calibration Standards

Description	MW Range	P/N
ACQUITY APC Polystyrene Low MW Calibration Kit Three sets of 10 vials containing 1.5 mg each of the following: Vial 1: MW 15.5 K, 4.71 K, 1.25 K Vial 2: MW 8.90 K, 3.46 K, 0.570 K Vial 3: MW 6.67 K, 2.25 K, 0.266 K	266–15,000	186007539
ACQUITY APC Polystyrene Middle MW Calibration Kit Three sets of 10 vials containing 1.5 mg each of the following: Vial 1: MW 125 K, 21.2 K, 6.67 K, 1.25 K Vial 2: MW 62.5 K, 15.5 K, 3.46 K, 0.570 K Vial 3: MW 35.4 K, 8.90 K, 2.25 K, 0.266 K	266–130,000	186007540
ACQUITY APC Polystyrene High MW Calibration Kit Three sets of 10 vials containing the following: Vial 1: 0.75 mg MW 1760 K; and 1.5 mg 271 K, 34. 0 K, 3.46 K Vial 2: 0.75 mg MW 1170 K; and 1.5 mg 125 K, 17. 3 K, 0.570 K Vial 3: 1.5 mg MW 554 K, 62.5 K, 8.9 0 K, 0.266 K	266–2,500,000	186007541
ACQUITY APC Polystyrene Method Development MW Calibration Kit Three vials containing the following: Vial 1: 0.75 mg Mp 1210 K; and 1.5 mg 130 K, 17.6 K, 0.474 K Vial 2: 0.75 mg Mp 1800 K; and 1.5 mg 277 K, 34.8 K, 3.47 K Vial 3: 1.5 mg Mp 552 K, 66.0 K, 9.13 K, 0.266 K Vial 4: 1.5 mg Mp 66.0 K, 15.7 K, 3.47 K, 0.474 K Vial 5: 1.5 mg Mp 130 K, 21.5 K, 6.54 K, 1.25 K Vial 6: 1.5 mg Mp 35.5 K, 9.13 K, 2.28 K, 0.266 K Vial 7: 1.5 mg Mp 15.7 K, 4.92 K, 1.25 K Vial 8: 1.5 mg Mp 9.13 K, 3.47 K, 0.474 K Vial 9: 1.5 mg Mp 6.54 K, 2.28 K, 0.266 K Vial 10: 1.5 mg BHT	266–2,500,000	186007542
ACQUITY APC Polymethyl Methacrylate Low MW Calibration Kit Three sets of 10 vials containing 1.5 mg each of the following: Vials 1: MW 12.5 K, 4.14 K, 0.997 K Vials 2: MW 9.59 K, 3.15 K, 0.573 K Vials 3: MW 6.27 K, 2.26 K, 0.202 K	202–12,000	186007543
ACQUITY APC Polymethyl Methacrylate Middle MW Calibration Kit Three sets of 10 vials containing 1.5 mg each of the following: Vials 1: MW 199 K, 40.3 K, 6.27 K, 0.997 K Vials 2: MW 107 K, 23.2 K, 4.14 K, 0.573 K Vials 3: MW 69.0 K, 12.5 K, 2.26 K, 0.202 K	202–200,000	186007544
ACQUITY APC Polymethyl Methacrylate High MW Calibration Kit Three sets of 10 vials containing the following: Vial 1: 0.75 mg MW 1430; and 1.5 mg MW 199 K, 23.2 K, 6.37 K Vial 2: 1.5 mg MW 592 K, 86.7 K, 12.5 K, 0.573 K Vial 3: 1.5 mg MW 335 K, 40.3 K, 6.27 K, 0.202 K	202–1,600,000	186007545
ACQUITY APC Polymethyl Methacrylate Method Development MW Calibration Kit Three vials containing the following: Vial 1: 0.75 mg Mp 1600 K; and 1.5 mg Mp 201 K, 23.5 K, 2.38 K Vial 2: 1.5 mg Mp 608 K, 88.5 K, 12.6 K, 0.602 K Vial 3: 1.5 mg Mp 340 K, 41.4 K, 6.37 K, 0.202 K Vial 4: 1.5 mg Mp 108 K, 23.5 K, 4.23 K, 0.602 K Vial 5: 1.5 mg Mp 201 K, 41.4 K, 6.37 K, 1.102 K Vial 6: 1.5 mg Mp 71.8 K, 12.6 K, 2.38 K, 0.202 K Vial 7: 1.5 mg Mp 12.6 K, 4.23 K, 1.102 K Vial 8: 1.5 mg Mp 9.68 K, 3.21 K, 0.602 K Vial 9: 1.5 mg Mp 6.37 K, 2.38 K, 0.202 K Vial 10: 1.5 mg BHT	202–1,600,000	186007546

**Values listed are approximate molecular weights.*

READYCAL STANDARDS

A ReadyCal Kit allows quick and accurate preparation of a multi-point calibration curve without the need to weigh chemicals. Each vial contains a polymer mix that spans a molecular-weight range, to provide baseline resolution of each component. Simply add solvent directly to the vial and mix.

Ordering Information

ReadyCal Standards

Description*	P/N
Polystyrene ReadyCal Standards 4 mL Kit A complete kit of ready-to-use polystyrene calibration standards. Kit contains 30 autosampler vials, 4 mL each, which contain four polystyrene standards per vial. There are three separate molecular weight ranges in each kit, ten units of each range. Range is from 400 to 2,000,000 Da.	WAT058930
Polystyrene ReadyCal Standards 2 mL Kit A complete kit of ready-to-use polystyrene calibration standards. Kit contains 30 autosampler vials, 2 mL each, which contain four polystyrene standards per vial. There are three separate molecular weight ranges in each kit, ten units of each range. Range is from 400 to 2,000,000 Da.	WAT058931

*Values listed are approximate molecular weights.

POLYMER-SPECIFIC CALIBRATION STANDARDS

Tailored specifically for different types of polymer analysis, these calibration standards provide a quick and reliable references to known molecular-weight ranges. Polymer type and MW ranges appear in the table.

Ordering Information

Polymer-Specific Calibration Standards

Description*	P/N
Polybutadiene Standards Kit 0.5 g/vial polybutadiene at each molecular weight: 1000, 3000, 7000, 10,000, 30,000, 70,000, 100,000, 300,000, 700,000, 1,000,000	WAT035709
Polyisoprene Standards Kit 0.5 g/vial polyisoprene at each molecular weight: 1000, 3000, 10,000, 30,000, 70,000, 100,000, 300,000, 500,000, 1,000,000, 3,000,000	WAT035708
Polymethylmethacrylate Low MW Standards Kit 0.5 g/vial polymethylmethacrylate at each molecular weight: 1000, 1700, 2500, 3500, 5000, 7000, 10,000, 13,000, 20,000, 30,000	WAT035707
Polymethylmethacrylate Mid MW Standards Kit 0.5 g/vial polymethylmethacrylate at each molecular weight: 2400, 9500, 31,000, 52,000, 100,000, 170,000, 270,000, 490,000, 730,000, 1,000,000	WAT035706
Polystyrene Low-Mid MW Standards Kit 10 g/vial polystyrene at each molecular weight: 400, 530, 950 5 g/vial polystyrene at each molecular weight: 2800, 6400, 10,000, 17,000, 43,000, 110,000, 180,000	WAT011588
Polystyrene Mid-High MW Standards Kit 5 g/vial polystyrene at each molecular weight: 430,000, 780,000 1 g/vial polystyrene at each molecular weight: 1,300,000, 2,800,000, 3,600,000, 4,300,000, 5,200,000, 6,200,000, 8,400,000, 20,000,000	WAT011610
Polystyrene Low MW Standards Kit 0.5 g/vial polystyrene at each molecular weight: 580, 950, 1200, 1800, 2470, 3770, 5100, 7600, 12,500, 17,000	WAT034208
Polystyrene Mid MW Standards Kit 0.5 g/vial polystyrene at each molecular weight: 1200, 3250, 10,200, 28,000, 68,000, 195,000, 490,000, 1,080,000, 1,750,000, 2,750,000	WAT034209
Polystyrene High MW Standards Kit 0.5 g/vial polystyrene at each molecular weight: 45,000, 1,270,000, 2,300,000, 3,260,000, 4,340,000, 8,000,000, 15,000,000	WAT034210

*Values listed are approximate molecular weights.

INDIVIDUAL MW STANDARDS

In many cases, a single calibration standard can verify the molecular weight of a sample-mixture component, making its identification simple and straightforward.

Ordering Information

Individual MW Standards

Description*	P/N
Polystyrene Standard 400 10 g/vial polystyrene, 400 MW	WAT011590
Polystyrene Standard 530 10 g/vial polystyrene, 530 MW	WAT011592
Polystyrene Standard 950 10 g/vial polystyrene, 950 MW	WAT011594
Polystyrene Standard 2800 5 g/vial polystyrene, 2800 MW	WAT011596
Polystyrene Standard 6400 5 g/vial polystyrene, 6400 MW	WAT011598
Polystyrene Standard 10,100 5 g/vial polystyrene, 10,100 MW	WAT011600
Polystyrene Standard 17,000 5 g/vial polystyrene, 17,000 MW	WAT011602
Polystyrene Standard 43,000 5 g/vial polystyrene, 43,000 MW	WAT011604
Polystyrene Standard 110,000 5 g/vial polystyrene, 110,000 MW	WAT011606
Polystyrene Standard 180,000 5 g/vial polystyrene, 180,000 MW	WAT011608

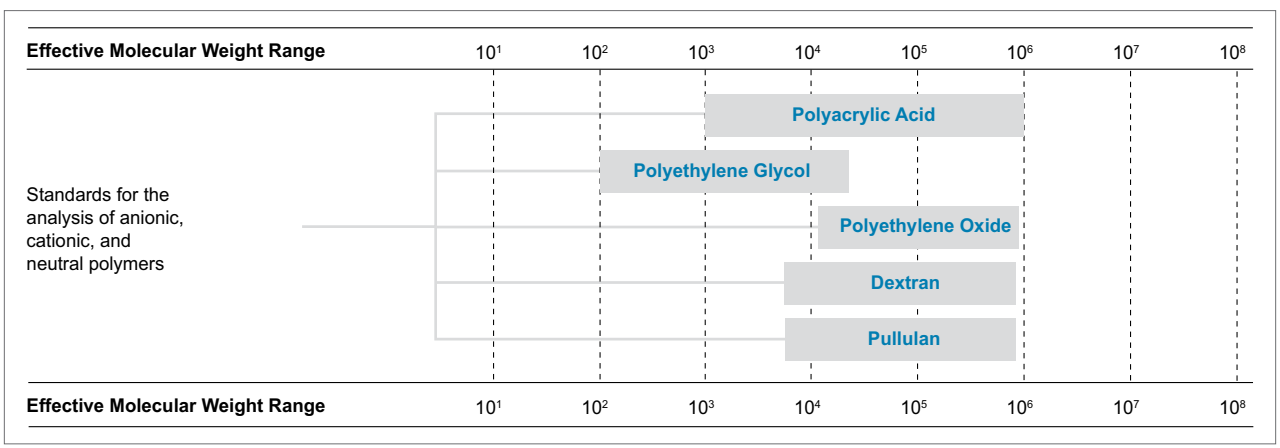
Description*	P/N
Polystyrene Standard 430,000 5 g/vial polystyrene, 430,000 MW	WAT011612
Polystyrene Standard 780,000 5 g/vial polystyrene, 780,000 MW	WAT011614
Polystyrene Standard 1,300,000 1 g/vial polystyrene, 1,300,000 MW	WAT011616
Polystyrene Standard 2,800,000 1 g/vial polystyrene, 2,800,000 MW	WAT011618
Polystyrene Standard 3,600,000 1 g/vial polystyrene, 3,600,000 MW	WAT011620
Polystyrene Standard 4,300,000 1 g/vial polystyrene, 4,300,000 MW	WAT011622
Polystyrene Standard 5,200,000 1 g/vial polystyrene, 5,200,000 MW	WAT011624
Polystyrene Standard 6,200,000 1 g/vial polystyrene, 6,200,000 MW	WAT011626
Polystyrene Standard 8,400,000 1 g/vial polystyrene, 8,400,000 MW	WAT011628
Polystyrene Standard 20,000,000 1 g/vial polystyrene, 20,000,000 MW	WAT011630

*Values listed are approximate molecular weights.

SEC CALIBRATION STANDARDS

Waters SEC Calibration Standards are precisely formulated to determine accurate molecular weight and conveniently packaged to minimize errors in SEC calibration methods. The fully traceable aqueous-based polymer kits simplify routine calibration procedures that improve workflow and increase productivity.

Aqueous SEC Standards Guide



This chart may be used to determine the appropriate component standard and corresponding molecular weight range.

Full-Range Calibration Standards

These standards kits provide an accurate calibration range for determining the molecular weight of common water-soluble polymers. The kits contain a series of well-characterized standards of a specified polymer type and include certificates that list component ranges and concentrations.

Ordering Information

Full-Range Calibration Standards for SEC

Description*	P/N
Polyacrylic Acid Standards Kit 250 mg/vial polyacrylic acid at each molecular weight: 1000, 3000, 7000, 15,000, 30,000, 70,000, 100,000, 300,000, 700,000, and 1,000,000	WAT035714
Polyethylene Glycol Standards Kit 1.0 g/vial polyethylene glycol at each molecular weight: 100, 200, 400, 600, 1000, 1500, 4300, 7000, 13,000, and 22,000	WAT035711
Polyethylene Oxide Kit 500 mg/vial polyethylene oxide at each molecular weight: 24,000, 40,000, 79,000, 160,000, 340,000, 570,000, and 850,000	WAT011572
Dextrans Standard 500 mg/vial dextrans at each molecular weight: 1000, 4400, 8500, 15,400, 30,000, 50,400, 87,000, and 225,000	WAT054392
Pullulan Kit 200 mg/vial pullulan at each molecular weight: 5000, 10,000, 20,000, 50,000, 100,000, 200,000, 400,000, and 800,000	WAT034207

*Values listed are approximate molecular weights.

Individual Calibration Standards

In many cases, a single calibration standard can verify the molecular weight of a sample-mixture component, making its identification simple and straightforward.

Ordering Information

Individual Calibration Standards for SEC

Description*	P/N
Polyethylene Oxide Standard 24,000	WAT011574
Polyethylene Oxide Standard 40,000	WAT011576
Polyethylene Oxide Standard 79,000	WAT011578
Polyethylene Oxide Standard 160,000	WAT011580
Polyethylene Oxide Standard 340,000	WAT011582
Polyethylene Oxide Standard 570,000	WAT011584
Polyethylene Oxide Standard 850,000	WAT011586

*Values listed are approximate molecular weights.