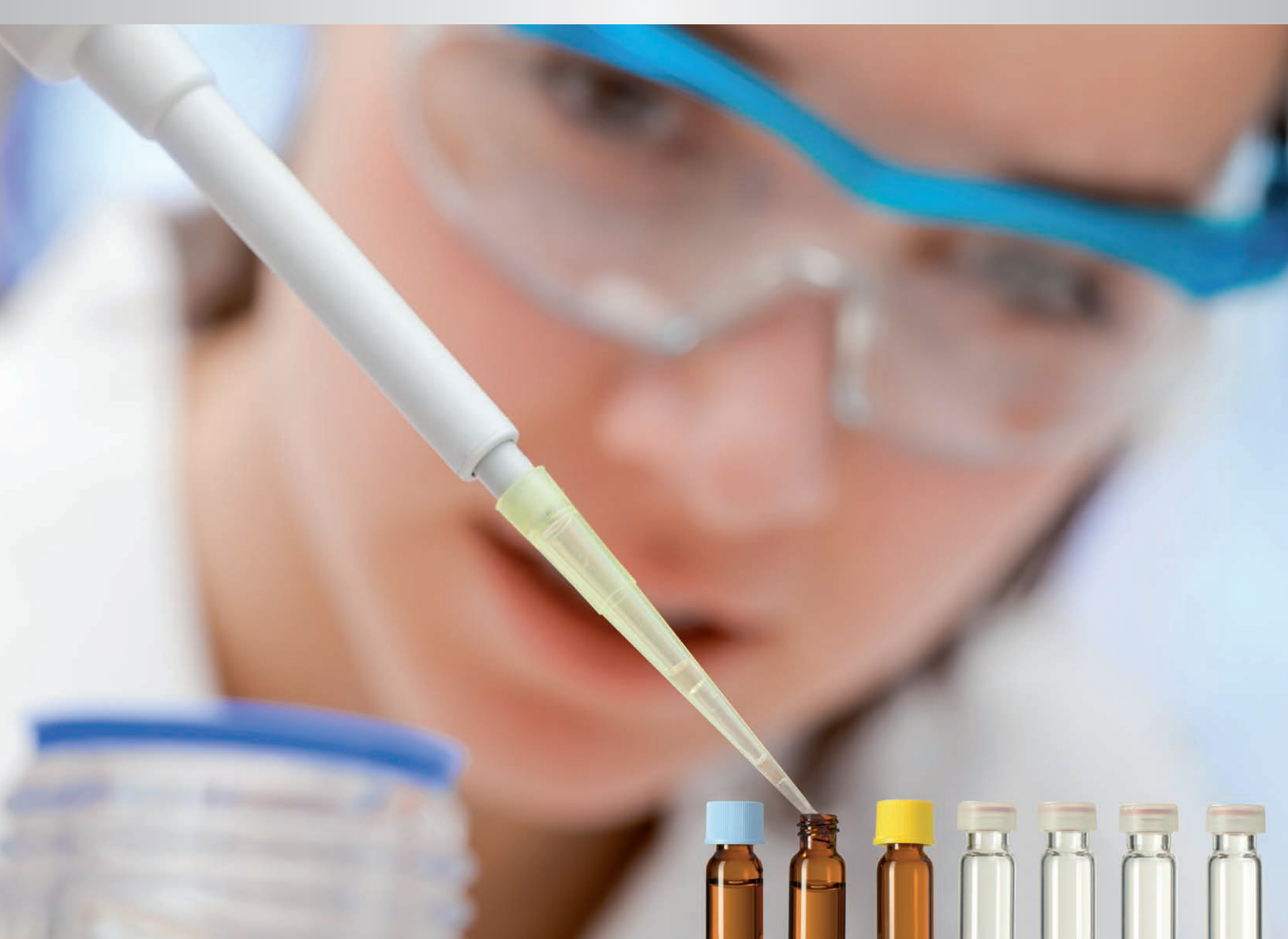




Driving GPC/SEC Forward



Reference Materials

About PSS

Driving GPC/SEC Forward

PSS GmbH was founded in 1985 by 2 PhD students at the Physical Chemistry Department, University of Mainz, Germany, producing polymer standards at the University facilities. During the following years PSS expanded staff and also products to include tailor-made polymers, organic and aqueous GPC/SEC columns, GPC/SEC software and moved in 2001 to its own facilities located in Mainz, Germany. PSS-USA opened its office in 1994, operates and serves North and South American customers from Amherst, Massachusetts. To date, PSS has successfully gained leadership in the overall GPC/SEC market, making innovative contributions not only in Germany and the USA, but around the world.

PSS is fully dedicated to the advancement of macromolecular liquid chromatography, by means of materials design, synthesis, manufacturing, consulting, service, and innovative research, applying the highest standard of expertise and reliability. Our close relationship with our customers has helped us to continuously improve the quality of our products and services. Our high caliber staff, mostly chemists, is experienced, creative and trained in problem solving. Corporations, universities, and organizations in more than 60 countries use our products and profit from our outstanding service and know-how.

Certified DIN ISO EN 9001

PSS is certified (DIN ISO EN 9001:2008) to produce high quality reference polymers, GPC/SEC columns and software for the characterization of polymers by their molecular weight and their structural characteristics. PSS employs the latest findings in polymer science for the synthesis and characterization of polymers, block copolymers and biopolymers. PSS operates a manufacturing facility equipped with a complete state-of-the-art characterization laboratory at the headquarters in Mainz, Germany, fully supporting customers working under stringent requirements i.e., GLP, DIN, ISO certifications.

About this catalog

This catalog contains the most frequently ordered consumables.
Please refer to the website for a comprehensive listing of our products.
Contact us to inquire about custom materials or services.

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1| High Quality Reference Materials

PSS is one of the world's largest manufacturers of organic and aqueous high quality reference materials. An unparalleled selection of polymer types in a wide range of molar masses is available regularly.

PSS performs synthesis ranging from small laboratory scale (1 g) to larger quantities (5 kg or more) to produce multiple kinds of macromolecular reference materials, specialty polymers, polymer particles and polymer networks.

A wide selection of

- Homopolymers with narrow or broad molar mass distribution
- Copolymers (e.g. block copolymers, random copolymers, terpolymers)
- Branched (co)polymers (e.g. stars, combs, graft copolymers, dendrimers, hyperbranched polymers)
- End-functionalized (co)polymers and macromonomers
- Deuterated (co)polymers
- Tactic polymers
- Polymer networks

is already available (see chapter 1.1 to 1.4 and www.pss-polymer.com); others can be produced on request.



PSS uses all types of polymerization techniques including

- Controlled (living) ionic polymerization (anionic, cationic, GTP)
- Radical polymerization (ATRP, RAFT, conventional radical)
- Suspension polymerization
- Emulsion polymerization

PSS materials are used for a large variety of applications including

- Calibration of organic or aqueous GPC/SEC columns
- Calibration and validation of measuring instruments like light scattering detectors, MALDI-ToF-instruments
- GPC/SEC System suitability tests
- Investigation of macroscopic properties and application parameters that are influenced by molar mass, polydispersity, tacticity, end groups or branching
- Investigation of polymer degradation and its mechanism
- Experimental tests of model calculations
- Investigation of miscibility behavior of polymer blends

The PSS reference materials are characterized extensively by modern analytical methods as e.g. GPC/SEC, laser light scattering, viscometry, mass spectrometry, VPO and NMR. They are available in various characterization levels to address different carefully defined application goals. Each product comes with a Quality Certificate, which provides the characterization information. The signed Quality Certificates include important testing parameters, and at least the molecular weight values (M_n , M_w , M_p , PDI) and the chromatogram with the parameters (conditions) at which the data was obtained.

Overview of Reference Materials

Reference Standard	Solvent												Further Information		
	Water	Ethanol / Methanol	Trifluoroethanol	Hexafluoroisopropanol	Dimethylformamide	Dimethylacetamide	Dimethylsulfoxide	Tetrahydrofuran	Acetone	Chloroform	N-Methyl-2-pyrrolidone	Trichlorobenzene		Dichlorobenzene	Toluene
Dextran	✓						✓								page 19 / web
Hydroxyethyl starch	✓														page 21 / web
Nylon 6 broad			✓	✓	(✓)	(✓)									web
Poly(2-vinylpyridine)	(✓)						✓								page 17 / web
Poly(2-vinylpyridinium bromide)	✓														web
Poly(acrylamide) broad	✓														web
Poly(acrylic acid) sodium salt	✓														page 23 / web
Poly(alpha-methylstyrene)					✓	✓	✓		✓	✓	✓	✓	✓	✓	page 13 / web
Poly(butadiene-1.2)							✓					✓	✓		web
Poly(butadiene-1.4)							✓					✓	✓		page 16 / web
Poly(carbonate) broad							✓								web
Poly(DADMAC)	✓														web
Poly(dimethyl siloxane)							✓*		✓					✓	page 18 / web
Poly(ethyl methacrylate)					✓	✓	✓	✓	✓					✓	web
Poly(ethylene glycol)	✓				✓	✓	(✓)								page 21 / web
Poly(ethylene oxide)	✓				✓	✓									page 22 / web
Poly(ethylene terephthalate)				✓			(✓)								page 18 / web
Poly(ethylene)											(✓)	(✓)			page 17 / web
Poly(isobutylene)							✓		✓		✓	✓	✓		page 18 / web
Poly(isoprene-1.4)							✓							✓	page 16 / web
Poly(isoprene-3.4)							✓							✓	web
Poly(lactide)			✓	✓					✓						page 18 / web
Poly(methacrylic acid) sodium salt	✓														page 23 / web
Poly(methyl methacrylate)				✓	✓	✓	✓	✓	✓	✓				✓	page 13 / web
Poly(n-butyl methacrylate)					✓	✓	✓	✓	✓	✓				✓	page 15 / web
Poly(styrene sulfonate) sodium salt	✓														page 24 / web
Poly(styrene)					✓	✓	✓		✓	✓	✓	✓	✓	✓	page 11 / web
Poly(t-butyl acrylate)		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	web
Poly(t-butyl methacrylate)		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	page 15 / web
Poly(vinyl acetate) broad		✓			✓		✓	✓	✓					✓	web
Poly(vinyl alcohol) broad	✓				✓										page 24 / web
Poly(vinyl chloride)							✓				✓	✓			web
Poly(vinyl pyrrolidone) broad	✓				✓	✓	✓			✓					web
Proteins	✓														page 24 / web
Pullulan	✓						✓								page 20 / web

✓ : reference standard soluble in solvent

(✓) : reference standard soluble in solvent under special conditions
(higher temperature, additives to solvent, up to a certain molecular weight, etc.)

* : isorefractive, not visible with RI detection

Polymer Reference Standards – Classification and Applications

Reference polymers are available as individual standards or as carefully selected assembled kits with a variety of materials.

Reference Standard Class	Characterization Method	Applications	Available as:	
			Individual Standard	Kit
Standards (narrow and broad)	Comprehensive GPC/SEC	<ul style="list-style-type: none"> · Molar mass determination with GPC/SEC or GPC/SEC viscometry · Creation of calibration curves (e.g. conventional, universal, broad) · Pore size determination using inverse GPC/SEC · Model polymers for physical measurements · Light scattering detector normalization · Determination of inter detector delay for multi detection systems · Determination of sieve curves · Degradation and stability studies · Investigation of property-molar mass relationships · Determination of structure-property-function relationship 	✓	✓
Certified standards (narrow and broad)	GPC/SEC + Absolute method (depending on applicability of the absolute methods)	<ul style="list-style-type: none"> · See individual standards and kits · Certified standards are used in regulated labs or if extended certificates of analysis (CoA) are required 	✓	✓
European Reference Materials (ERM)	GPC/SEC + Light Scattering + Viscometry and physical constants (round robin test)	<ul style="list-style-type: none"> · See individual standards and kits and visco/light scattering standards · Round robin certified standards are used in regulated labs, for pharmaceutical applications and for product registration 	✓	
LS-Visco Validation Kits	GPC/SEC + Light Scattering + Viscometry	<ul style="list-style-type: none"> · Validation of GPC/SEC systems also with light scattering/viscometry/triple detection · Validation of light scattering instruments, viscometers, and osmometers 		✓
MALDI-ToF Validation Kits	GPC/SEC + MALDI-ToF + Absolute method	<ul style="list-style-type: none"> · Validation of MALDI-ToF instruments 		✓
Speciality polymers: Deuterated, Highly tactic, etc.	Depending on type	<ul style="list-style-type: none"> · Scattering experiments · NMR · Dielectric measurements · Spectroscopic methods · Viscometry · Light Scattering 	✓	

All molar masses in this catalog reflect the nominal “Weight Average Molecular Weight” of the polymer batch. Unless otherwise specified, the actual molecular weight of a delivered polymer may vary from the nominal value given in the catalog or on the website within a range of +/-10%. Exact molecular weight values are given on the label of the vial and the quality certificate.

Our goal is to provide the products you need:

Please contact us if you need specialty polymers or if you require material from a dedicated batch!

Individual Standards

A Narrow and Broad Standards

Narrow standards have narrow molar mass distributions with a low polydispersity index, $PDI = M_w/M_n$, and are defined by average molar mass values such as M_n (Number average molar mass) and M_w (Weight average molar mass). Due to their sharp and slim chromatogram profile, the M_p value is well defined and independent of the column resolution.

PSS narrow standards are analyzed via GPC/SEC, yielding M_n , M_w , M_p and the polydispersity ($PDI = M_w / M_n$).

Narrow polymer standards are made by controlled/living ionic polymerization techniques or by fractionation of very broad standards. They have a wide application range from calibration of a GPC/SEC system to measurement of physical properties.

Broad reference materials are made by radical polymerization, polycondensation or coordinative polymerization (polyolefins). The PDI of broad standards is usually >1.5 . For broad standards the M_p value is a function of the column resolution and therefore not defined. Broad standards are characterized by M_w and M_n .

Modern GPC/SEC software packages, such as PSS WinGPC, allow the construction of a calibration curve by the use of M_w , M_n or the intrinsic viscosity $[\eta]$ of broad standards. Up to 8 different broad standards can be used to cover a wide molar mass range. Only one of the M_n , M_w , or $[\eta]$ values is required to create the calibration curve.

Broad standards are used

- To validate a chromatographic system
- To determine physical constants such as the Mark-Houwink constants K and α .
- To construct a calibration curve
- To test for column mismatch
- For filtration experiments for sieve curve determination

B Certified Standards

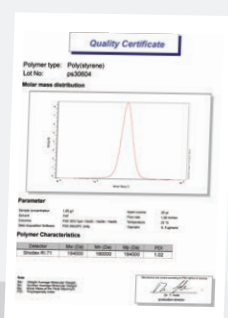
PSS supplies certified standards that meet the requirements of DIN 55672 and ISO/EN 13885. Also the PSS Quality Certificates fulfill all DIN and ASTM requirements.

PSS measures the molecular weight using GPC/SEC and additional methods such as light scattering, MALDI-ToF, NMR, viscometry, or VPO.

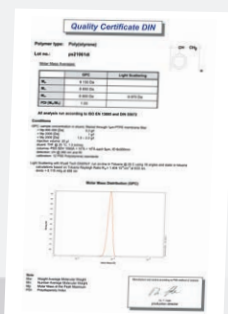
C Round Robin Tested Standards

European Reference Materials (ERM) are highly characterized polymers certified by the German Federal Institute for Material Research and Testing (BAM). The reported molar mass results from round robin experiments at certified laboratories. The ERM's quality certificates are full reports with the results of the different characterization methods: GPC/SEC, light scattering and viscometry. Further, the certificate includes additional non-certified data, (MALDI-ToF, NMR, DSC and in some instances rheology data) to provide the most sophisticated set of documentation for a particular polymer available worldwide.

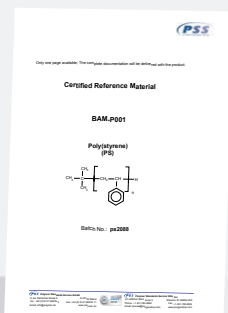
GPC/SEC
Standards



Certified
Standards

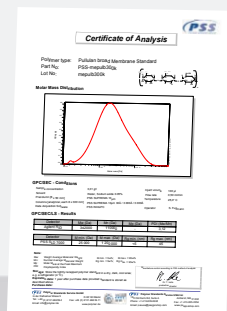


Certified
Reference
Materials
CRM



Individual Standards

Membrane Characterization Standards



D Standards for Membrane Characterization

GPC/SEC is a fast, robust and significant method for the characterization of membranes, especially in their native environment. PSS offers products and services to perform automated, fast and simple membrane characterization including cut-off and pore size distribution determination.

The GPC/SEC membrane characterization is accomplished by filtering the membrane standard through the membrane. Depending on the membrane type and quality some smaller molecules can pass through the pores of the membrane while others will be retained. The filtered and the unfiltered solution are then measured on a GPC/SEC system. The average pore size distribution and the cut-off of the membrane are determined automatically by comparing the elution profiles of the unfiltered sample to the filtered fraction.

The PSS membrane standards feature

- A broad molar mass distribution
- The molar mass average M_w and M_n
- The integral molar mass information M_{min} , M_{max}
- The corresponding radii of gyration R_{gmin} and R_{gmax} .

Assembled Kits of Molecular Weight Standards

A GPC/SEC Calibration Kits

A calibration kit consists of 8 to 12 well-characterized standards of one polymer type. The kits include a calibration report and quality certificates with all pertinent analytical parameters and molar mass information for every single standard.

The composition of a kit may change.

Please visit www.pss-polymer.com for an updated list.



B ReadyCal Kits

PSS ReadyCal Standards are polymer cocktails pre-weight into autosampler vials. Each kit contains 3 x 10 autosampler vials sufficient for at least 10 calibration curves. Each of the 3 different color coded vials contains three or four polymers of the same type with carefully selected different molar masses.

A ReadyCal Kit allows you to prepare quickly and reproducibly a 8 to 12 point calibration curve without the inconvenience of weighing samples. Just add solvent directly into the autosampler vial, let it stand for two hours, shake gently and inject. ReadyCals are available as 1.5 mL or 4.0 mL vials.

ReadyCals for high temperature GPC come in 10 mL vials (for 4 calibrations).



Validation Kits

A MALDI Validation Kits

PSS provides polymer standard kits that will help you to check, calibrate and validate a Matrix-Assisted-Laser-Desorption-Ionization-Time-of-Flight (MALDI-ToF) instrument. Standards with different molecular weight ranges and different polarities are included. The different molecular weights allow you to determine the resolution of the instrument as a function of the molecular weight, whereas different polymer polarities help you determine the compatibility of your matrix and polymer.

B Light Scattering/Viscometry Validation Kits

The kit is used to check the instrument performance and the delay volume between the concentration detector and the molar mass detector. This kit includes a mixture of well-defined light scattering (LS) and/or viscometry reference materials (narrow and broad distributed) with the relevant light scattering and/or viscometry data. The validation of your light scattering or viscometry instrument is simple, fast, and reliable.

C GPC/SEC System Suitability Test with PSS EasyValid Validation Kit

PSS has developed a dedicated GPC/SEC system suitability test that evaluates the entire system: equipment, electronics, and analytical operations. A passed validation with the PSS EasyValid Validation Kit ensures that the system can measure typical GPC/SEC results.

The PSS EasyValid Validation Kit is designed for the validation of GPC/SEC instrumentation with concentration detectors independent of brand.

It consists of

- A validation column
- Calibration standards
- Certified reference materials
- WinGPC report layouts
- WinGPC import files
- A comprehensive user documentation.

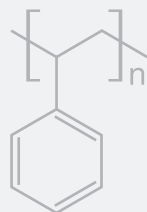
The Validation Kit EasyValid is ideal

- For checking the system performance after installation as part of the OQ/PV (Operational Qualification/Performance Verification)
- For performance review after maintenance
- For inter-laboratory consistence checks
- For identifying systematic errors
- For training new employees



Polymer Standards and Reference Materials

1.1| Organic standards



Poly(styrene) and derivatives

Poly(styrene)

a) Individual Standards

Poly(styrene) narrow

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-ps162	162	1.00
PSS-ps266	266	1.00
PSS-ps370	370	1.00
PSS-ps560	560	<1.50
PSS-ps1k	1 000	<1.50
PSS-ps1.8k	1 800	<1.50
PSS-ps3.2k	3 200	<1.15
PSS-ps5.6k	5 600	<1.15
PSS-ps10k	10 000	<1.15
PSS-ps18k	18 000	<1.15
PSS-ps33k	33 000	<1.15
PSS-ps56k	56 000	<1.15
PSS-ps100k	100 000	<1.15
PSS-ps180k	180 000	<1.15
PSS-ps320k	320 000	<1.15
PSS-ps560k	560 000	<1.15
PSS-ps1m	1 000 000	<1.50
PSS-ps1.8m	1 800 000	<1.50
PSS-ps3.2m	3 200 000	<1.50
PSS-ps5m	5 000 000	<1.50
PSS-ps10m	10 000 000	<1.50
PSS-ps15m	15 000 000	<1.50

Poly(styrene) broad

Pack Size 1000 mg

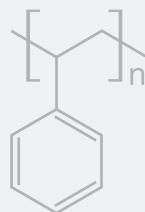
Part Number	Molar Mass [Da]	PDI
PSS-psb45k	45 000	>1.50
PSS-psb100k	100 000	>1.50
PSS-psb250k	250 000	>1.50
PSS-psb450k	450 000	>1.50

Poly(styrene) Membrane Characterization Standard

Pack Sizes
50 g, 100 g, 250 g, 500 g

Part Number	Molar Mass [Da]	PDI
PSS-mepsb200k	200 000	<2.00

1.1| Organic standards



Poly(styrene)

a) Individual Standards

DIN-Poly(styrene)		Pack Size 1000 mg
Part Number	Molar Mass [Da]	PDI
PSS-dps162	162	1.00
PSS-dps700	700	<1.20
PSS-dps1.4k	1 400	<1.20
PSS-dps4.7k	4 700	<1.05
PSS-dps9k	9 000	<1.05
PSS-dps18k	18 000	<1.05
PSS-dps32k	32 000	<1.05
PSS-dps100k	100 000	<1.05
PSS-dps250k	250 000	<1.05
PSS-dps560k	560 000	<1.05
PSS-dps800k	800 000	<1.05
PSS-dps1.8m	1 800 000	<1.20

ERM-Poly(styrene)		Pack Size 1000 mg
Part Number	Molar Mass [Da]	PDI
PSS-eps80k	79 600	1.08

ERM-Poly(styrene) broad		Pack Size 1000 mg
Part Number	Molar Mass [Da]	PDI
PSS-epsb180k	181 200	2.26
PSS-epsb330k	311 800	2.25

b) Assembled Kits of Molecular Weight Standards of Poly(styrene)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(styrene) low	162 to 62 000	8 x 1000 mg	PSS-pskitl
PSS GPC/SEC Calibration Kit Poly(styrene) high	560 to 2 500 000	12 x 1000 mg	PSS-pskith
PSS ReadyCal Kit Poly(styrene) low	266 to 62 000	3 x 10 Vials-4.0mL 3 x 10 Vials-1.5mL	PSS-pskitr4l PSS-pskitr1l
PSS ReadyCal Kit Poly(styrene)	560 to 2 500 000	3 x 10 Vials-4.0mL 3 x 10 Vials-1.5mL	PSS-pskitr4 PSS-pskitr1
PSS ReadyCal Kit Poly(styrene) high	1 600 to 6 500 000	3 x 10 Vials-4.0mL 3 x 10 Vials-1.5mL	PSS-pskitr4h PSS-pskitr1h
PSS ReadyCal Kit Poly(styrene) for HT-GPC	560 - 2 500 000	3 x 10 Vials-1.5mL	PSS-pskitr1ht
PSS ReadyCal Kit Poly(styrene) for HT-GPC	266 - 12 000 000	4 x 5 Vials-10mL	PSS-pskitr10ht
PSS DIN Kit Poly(styrene)	162 to 1 800 000	12 x 1000 mg	PSS-pskitd
PSS MALDI Kit Poly(styrene)	700 to 65 000	6 x 500 mg	PSS-pskitm
PSS LS-Visco Kit Poly(styrene)	9 000 to 560 000	4 x 500 mg	PSS-pskitv



1.1| Organic standards



Poly(alpha-methylstyrene)

a) Individual Standards

Poly(alpha-methylstyrene)

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-ams1.5k	1 500	<1.50
PSS-ams4k	4 000	<1.15
PSS-ams8k	8 000	<1.15
PSS-ams16k	16 000	<1.15
PSS-ams29k	29 000	<1.15
PSS-ams60k	60 000	<1.15
PSS-ams110k	110 000	<1.15
PSS-ams230k	230 000	<1.15
PSS-ams430k	430 000	<1.15
PSS-ams850k	850 000	<1.15

b) Assembled Kits of Molecular Weight Standards of Poly(alpha-methylstyrene)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(alpha-methylstyrene)	1 500 to 850 000	10 x 1000 mg	PSS-amskit

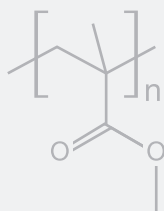
Poly(alkyl methacrylates)

Poly(methyl methacrylate)

a) Individual Standards

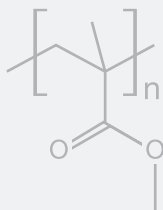
Poly(methyl methacrylate) narrow

Pack Size 1000 mg



Part Number	Molar Mass [Da]	PDI
PSS-mm102	102	1.00
PSS-mm202	202	1.00
PSS-mm600	600	<1.50
PSS-mm1k	1 000	<1.50
PSS-mm2.1k	2 100	<1.15
PSS-mm4.7k	4 700	<1.15
PSS-mm10k	10 000	<1.15
PSS-mm21k	21 000	<1.15
PSS-mm47k	47 000	<1.15
PSS-mm100k	100 000	<1.15
PSS-mm210k	210 000	<1.15
PSS-mm470k	470 000	<1.15
PSS-mm1m	1 000 000	<1.50
PSS-mm2m	2 000 000	<1.50
PSS-mm3m	3 000 000	<1.50

1.1| Organic standards



Poly(methyl methacrylate) broad

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-mmb20k	20 000	>1.50
PSS-mmb60k	60 000	>1.50
PSS-mmb100k	100 000	>1.50
PSS-mmb2.2m	2 200 000	>1.50

DIN-Poly(methyl methacrylate)

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-dmm450	450	<1.30
PSS-dmm3.5k	3 500	<1.10
PSS-dmm5k	5 000	<1.10
PSS-dmm14k	14 000	<1.05
PSS-dmm23k	23 000	<1.05
PSS-dmm45k	45 000	<1.05
PSS-dmm65k	65 000	<1.05
PSS-dmm90k	90 000	<1.05
PSS-dmm170k	170 000	<1.05
PSS-dmm350k	350 000	<1.05
PSS-dmm600k	600 000	<1.05
PSS-dmm850k	850 000	<1.10

ERM-Poly(methyl methacrylate)

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-emm350k	365 900	1.25

ERM-Poly(methyl methacrylate) broad

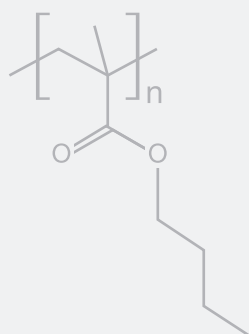
Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-emmb100k	101 100	2.15
PSS-emmb350k	366 400	2.23

b) Assembled Kits of Molecular Weight Standards of Poly(methyl methacrylate)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(methyl methacrylate) low	102 to 60 000	8 x 500 mg	PSS-mmkitl
PSS GPC/SEC Calibration Kit Poly(methyl methacrylate) high	600 to 2 500 000	12 x 500 mg	PSS-mmkith
PSS ReadyCal Kit Poly(methyl methacrylate) low	200 to 70 000	3 x 10 Vials-1.5mL	PSS-mmkitr1l
PSS ReadyCal Kit Poly(methyl methacrylate)	600 to 1 600 000	3 x 10 Vials-4.0mL 3 x 10 Vials-1.5mL	PSS-mmkitr4 PSS-mmkitr1
PSS DIN Kit Poly(methyl methacrylate)	450 to 850 000	12 x 500 mg	PSS-mmkitd
PSS MALDI Kit Poly(methyl methacrylate)	450 to 60 000	6 x 500 mg	PSS-mmkitm
PSS LS-Visco Kit Poly(methyl methacrylate)	8 000 to 850 000	4 x 500 mg	PSS-mmkitv

1.1| Organic standards



Poly(n-butyl methacrylate)

a) Individual Standards

Poly(n-butyl methacrylate) narrow

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-nb1k	1 000	<1.15
PSS-nb2.8k	2 800	<1.15
PSS-nb5.5k	5 500	<1.15
PSS-nb12k	12 000	<1.15
PSS-nb20k	20 000	<1.15
PSS-nb47k	47 000	<1.15
PSS-nb100k	100 000	<1.15
PSS-nb210k	210 000	<1.15
PSS-nb470k	470 000	<1.15
PSS-nb750k	750 000	<1.15

b) Assembled Kits of Molecular Weight Standards of Poly(n-butyl methacrylate)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(n-butyl methacrylate)	1 500 to 700 000	9 x 1000 mg	PSS-nbkit

Poly(t-butyl methacrylate)

a) Individual Standards

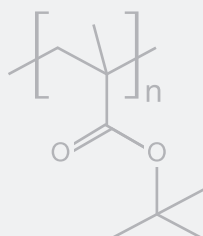
Poly(t-butyl methacrylate) narrow

Pack Size 1000 mg

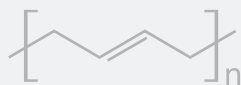
Part Number	Molar Mass [Da]	PDI
PSS-tbma1.5k	1 500	<1.50
PSS-tbma2.1k	2 100	<1.15
PSS-tbma4.7k	4 700	<1.15
PSS-tbma10k	10 000	<1.15
PSS-tbma21k	21 000	<1.15
PSS-tbma47k	47 000	<1.15
PSS-tbma100k	100 000	<1.15
PSS-tbma210k	210 000	<1.15
PSS-tbma470k	470 000	<1.15
PSS-tbma1m	1 000 000	<1.50

b) Assembled Kits of Molecular Weight Standards of Poly(t-butyl methacrylate)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(t-butyl methacrylate)	1 500 to 1 000 000	10 x 1000 mg	PSS-tbmakit



1.1| Organic standards



Polydiene

Poly(butadiene-1.4)

a) Individual Standards

Poly(butadiene-1.4) narrow

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-bdf110	110	1.00
PSS-bdf470	470	<1.50
PSS-bdf1k	1 000	<1.50
PSS-bdf2.1k	2 100	<1.15
PSS-bdf4.7k	4 700	<1.15
PSS-bdf10k	10 000	<1.15
PSS-bdf21k	21 000	<1.15
PSS-bdf47k	47 000	<1.15
PSS-bdf100k	100 000	<1.15
PSS-bdf210k	210 000	<1.15
PSS-bdf470k	470 000	<1.15
PSS-bdf1m	1 000 000	<1.15

b) Assembled Kits of Molecular Weight Standards of Poly(butadiene-1.4)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(butadiene-1.4)	1 000 to 1 000 000	10 x 1000 mg	PSS-bdfkit

Poly(isoprene-1.4)

a) Individual Standards

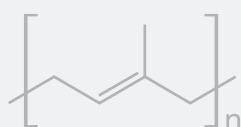
Poly(isoprene-1.4) narrow

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-pio800	800	<1.50
PSS-pio1k	1 000	<1.50
PSS-pio2.1k	2 100	<1.15
PSS-pio4.7k	4 700	<1.15
PSS-pio10k	10 000	<1.15
PSS-pio21k	21 000	<1.15
PSS-pio47k	47 000	<1.15
PSS-pio100k	100 000	<1.15
PSS-pio210k	210 000	<1.15
PSS-pio470k	470 000	<1.15
PSS-pio1m	1 000 000	<1.50

b) Assembled Kits of Molecular Weight Standards of Poly(isoprene-1.4)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(isoprene-1.4)	1 000 to 1 000 000	10 x 1000 mg	PSS-piokit



1.1| Organic standards



Poly(olefins)

Poly(ethylene)

a) Individual Standards

Poly(ethylene)		Pack Size 250 mg
Part Number	Molar Mass [Da]	PDI
PSS-pe800	800	<2.00
PSS-pe2k	2 000	<2.00
PSS-pe13k	13 000	<2.00
PSS-pe28k	28 000	<2.00
PSS-pe56k	56 000	<2.00
PSS-pe100k	100 000	<2.00
PSS-pe120k	120 000	<2.00

b) Assembled Kits of Molecular Weight Standards of Poly(ethylene)

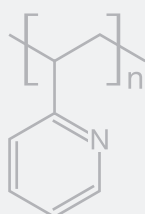
Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(ethylene)	340 to 120 000	10 x 250 mg	PSS-pekit

Further Standards

Poly(2-vinylpyridine)

a) Individual Standards

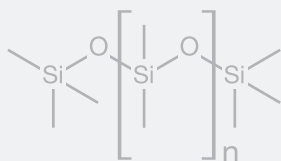
Poly(2-vinylpyridine) narrow		Pack Size 1000 mg
Part Number	Molar Mass [Da]	PDI
PSS-pvp1k	1 000	<1.50
PSS-pvp2.1k	2 100	<1.50
PSS-pvp4.7k	4 700	<1.50
PSS-pvp10k	10 000	<1.15
PSS-pvp21k	21 000	<1.15
PSS-pvp47k	47 000	<1.15
PSS-pvp110k	110 000	<1.15
PSS-pvp265k	265 000	<1.15
PSS-pvp470k	470 000	<1.15
PSS-pvp1m	1 000 000	<1.50



b) Assembled Kits of Molecular Weight Standards of Poly(2-vinylpyridine)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(2-vinylpyridine)	1 000 to 1 000 000	8 x 1000 mg	PSS-pvpokit

Poly(dimethylsiloxane)



Assembled Kits of Molecular Weight Standards of Poly(dimethylsiloxane)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(dimethylsiloxane)	311 to 200 000	8 x 500 mg	PSS-pdmkit

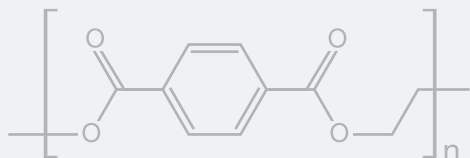
Poly(ethylene terephthalate)

a) Individual Standards

Poly(ethylene terephthalate)

Pack Size 250 mg

Part Number	Molar Mass [Da]	PDI
PSS-pet3.5k	3 500	<2.10
PSS-pet10k	10 000	<2.10
PSS-pet18k	18 000	<2.10
PSS-pet25k	25 000	<2.10
PSS-pet35k	35 000	<2.10
PSS-pet40k	40 000	<2.10
PSS-pet50k	50 000	<2.10
PSS-pet75k	75 000	<2.10
PSS-pet120k	120 000	<2.10



Poly(isobutylene)

Assembled Kits of Molecular Weight Standards of Poly(isobutylene)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(isobutylene)	350 to 700 000	10 x 250 mg	PSS-pibkit

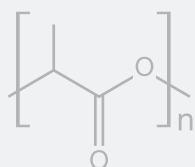
Poly(lactide)

a) Individual Standards

CRM-Poly(lactide)

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-cpla230k	249 400	1.98



b) Assembled Kits of Molecular Weight Standards of Poly(L-lactide)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(L-lactide)	150 to 75 000	8 x 200 mg	PSS-plakit
PSS GPC/SEC Calibration Kit Poly(L-lactide) high	150 to 100 000	8 x 200 mg + 1 (broad) x 500 mg	PSS-plakith



1.2| Aqueous standards

Poly(saccharides)

Dextran

a) Individual Standards

Dextran narrow

Pack Size 500 mg

Part Number	Molar Mass [Da]	PDI
PSS-dxt180	180	1.00
PSS-dxt342	342	1.00
PSS-dxt504	504	1.00
PSS-dxt1.3k	1 300	<1.50
PSS-dxt5k	5 000	<2.00
PSS-dxt12k	12 000	<1.50
PSS-dxt25k	25 000	<1.50
PSS-dxt50k	50 000	<1.50
PSS-dxt80k	80 000	<1.50
PSS-dxt150k	150 000	<1.50
PSS-dxt270k	270 000	<2.00
PSS-dxt410k	410 000	<2.00
PSS-dxt670k	670 000	<2.50

Dextran broad/branched

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-dxtb4k	4 000	>1.50
PSS-dxtb10k	10 000	>1.50
PSS-dxtb40k	40 000	>1.50
PSS-dxtb70k	70 000	>1.50
PSS-dxtb500k	500 000	>1.70
PSS-dxtb1.5m	1 500 000	>1.70
PSS-dxtb3m	3 000 000	>1.70

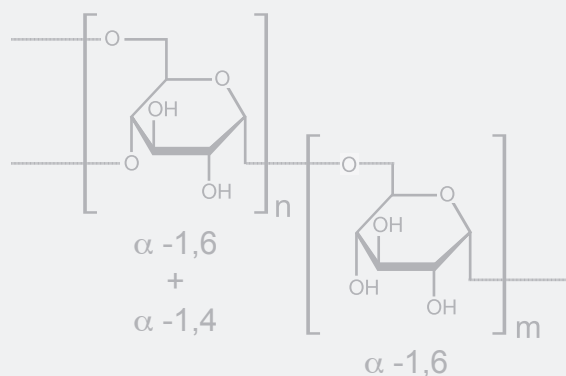
DIN-Dextran

Pack Size 500 mg

Part Number	Molar Mass [Da]	PDI
PSS-ddxt180	180	1.00
PSS-ddxt342	342	1.00
PSS-ddxt1.3k	1 300	<1.50
PSS-ddxt5k	5 000	<2.00
PSS-ddxt12k	12 000	<1.50
PSS-ddxt25k	25 000	<1.50
PSS-ddxt50k	50 000	<1.50
PSS-ddxt80k	80 000	<1.50
PSS-ddxt150k	150 000	<1.50
PSS-ddxt270k	270 000	<2.00
PSS-ddxt410k	410 000	<2.00

Dextran (Branched Poly(saccharide))
Membrane Characterization StandardsPack Sizes
50 g, 100 g, 250 g, 500 g

Part Number	Molar Mass [Da]	PDI
PSS-medxtb70k	70 000	<2.00
PSS-medxtb2m	2 000 000	>2.00



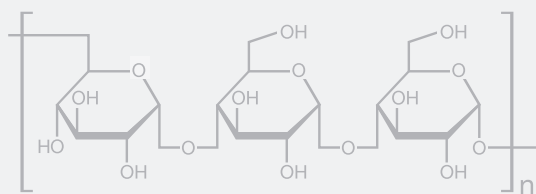
1.2| Aqueous standards

b) Assembled Kits of Molecular Weight Standards of Dextran

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Dextran	180 to 410 000	10 x 250 mg	PSS-dxtkit
PSS DIN Kit Dextran	180 to 410 000	10 x 250 mg	PSS-dxtkitd
PSS LS-Visco Kit Dextran	12 000 to 410 000	4 x 500 mg	PSS-dxtkitv

Pullulan

a) Individual Standards



DIN-Pullulan

Pack Size 100 mg

Part Number	Molar Mass [Da]	PDI
PSS-dpul342	342	1.00
PSS-dpul1.3k	1 300	<1.30
PSS-dpul6k	6 000	<1.20
PSS-dpul12k	12 000	<1.20
PSS-dpul22k	22 000	<1.20
PSS-dpul50k	50 000	<1.20
PSS-dpul110k	110 000	<1.20
PSS-dpul200k	200 000	<1.20
PSS-dpul400k	400 000	<1.20
PSS-dpul800k	800 000	<1.20

Pullulan (Linear Poly(saccharide)) Membrane Characterization Standard

Pack Sizes
50 g, 100 g, 250 g, 500 g

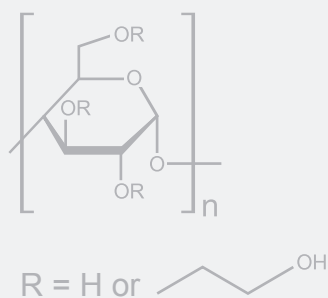
Part Number	Molar Mass [Da]	PDI
PSS-mepulb300k	300 000	>2.00

b) Assembled Kits of Molecular Weight Standards of Pullulan

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Pullulan	342 to 800 000	10 x 100 mg	PSS-pulkit
PSS ReadyCal Kit Pullulan	342 to 800 000	3 x 5 vials 1.5 ml	PSS-pulkitr1
PSS ReadyCal Kit Pullulan high	342 to 1 220 000	3 x 5 vials 1.5 ml	PSS-pulkitr1h



1.2| Aqueous standards



Hydroxyethyl starch

a) Individual Standards

Hydroxyethyl starch

Pack Size 250 mg

Part Number	Molar Mass [Da]	PDI
PSS-hes24k	24 000	<2.50
PSS-hes40k	40 000	<2.50
PSS-hes90k	90 000	<2.50
PSS-hes300k	300 000	<2.50
PSS-hes550k	550 000	<2.50
PSS-hes1.3m	1 300 000	<2.50
PSS-hes1.4m	1 400 000	<2.50
PSS-hes2m	2 000 000	<2.50

b) Assembled Kits of Molecular Weight Standards of Hydroxyethyl starch

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Hydroxyethyl starch	24 000 to 2 000 000	7 x 250 mg	PSS-heskit

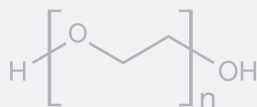
Poly(ethylene glycol) and Poly(ethylene oxide)

Poly(ethylene glycol)

a) Individual Standards

Poly(ethylene glycol)

Pack Size 1000 mg



Part Number	Molar Mass [Da]	PDI
PSS-peg106	106	1.00
PSS-peg194	194	1.00
PSS-peg238	238	1.00
PSS-peg330	330	<1.25
PSS-peg400	400	<1.25
PSS-peg600	600	<1.25
PSS-peg1k	1 000	<1.25
PSS-peg1.5k	1 500	<1.25
PSS-peg2k	2 000	<1.25
PSS-peg3k	3 000	<1.25
PSS-peg4k	4 000	<1.25
PSS-peg6k	6 000	<1.25
PSS-peg10k	10 000	<1.25
PSS-peg12k	12 000	<1.25
PSS-peg18k	18 000	<1.25
PSS-peg26k	26 000	<1.25
PSS-peg42k	42 000	<1.25

1.2| Aqueous standards



DIN-Poly(ethylene glycol)

Pack Size 1000 mg

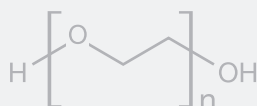
Part Number	Molar Mass [Da]	PDI
PSS-dpeg106	106	1.00
PSS-dpeg194	194	1.00
PSS-dpeg400	400	<1.25
PSS-dpeg1k	1 000	<1.25
PSS-dpeg2k	2 000	<1.25
PSS-dpeg3k	3 000	<1.25
PSS-dpeg6k	6 000	<1.25
PSS-dpeg12k	12 000	<1.25
PSS-dpeg26k	26 000	<1.25
PSS-dpeg42k	42 000	<1.25

b) Assembled Kits of Molecular Weight Standards of Poly(ethylene glycol)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(ethylene glycol)	106 to 42 000	10 x 500 mg	PSS-pegkit
PSS ReadyCal Kit Poly(ethylene glycol)	232 to 42 000	3 x 10 Vials-1.5mL	PSS-pegkitr1
PSS DIN Kit Poly(ethylene glycol)	106 to 42 000	10 x 500 mg	PSS-pegkitd
PSS MALDI Kit Poly(ethylene glycol)	400 to 26 000	6 x 500 mg	PSS-pegkitm

Poly(ethylene oxide)

a) Individual Standards



Poly(ethylene oxide)

Pack Size 1000 mg

Part Number	Molar Mass [Da]	PDI
PSS-peo42k	42 000	<1.25
PSS-peo110k	110 000	<1.25
PSS-peo220k	220 000	<1.25
PSS-peo500k	500 000	<1.25
PSS-peo1m	1 000 000	<1.25

ERM-Poly(ethylene oxide)

Pack Size 1000 mg

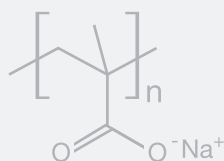
Part Number	Molar Mass [Da]	PDI
PSS-epeo6k	6 200	1.06
PSS-epeo11k	11 350	1.11

b) Assembled Kits of Molecular Weight Standards of Poly(ethylene oxide)

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(ethylene oxide)	25 000 to 1 000 000	8 x 500 mg	PSS-peokit
PSS ReadyCal Kit Poly(ethylene oxide)/Poly(ethylene glycol)	232 to 1 000 000	3 x 10 Vials-4.0mL 3 x 10 Vials-1.5mL	PSS-peokit4 PSS-peokit1



1.2| Aqueous standards



Poly((meth)acrylic acids)

Poly(methacrylic acid) sodium salt

a) Individual Standards

Poly(methacrylic acid) sodium salt

Pack Size 500 mg

Part Number	Molar Mass [Da]	PDI
PSS-pma1.2k	1 200	<1.20
PSS-pma3.5k	3 500	<1.20
PSS-pma7.6k	7 600	<1.20
PSS-pma18k	18 000	<1.20
PSS-pma36k	36 000	<1.20
PSS-pma76k	76 000	<1.20
PSS-pma160k	160 000	<1.20
PSS-pma340k	340 000	<1.20
PSS-pma500k	500 000	<1.20

b) Assembled Kits of Molecular Weight Standards of Poly(methacrylic acid) sodium salt

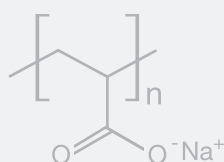
Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(methacrylic acid) sodium salt	1 200 to 500 000	8 x 500 mg	PSS-pmakit

Poly(acrylic acid) sodium salt

a) Individual Standards

Poly(acrylic acid) sodium salt

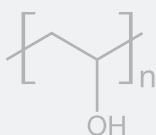
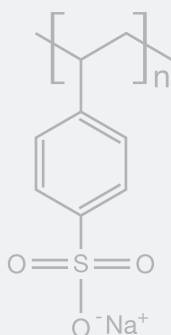
Pack Size 250 mg



b) Assembled Kits of Molecular Weight Standards of Poly(acrylic acid) sodium salt

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(acrylic acid) sodium salt	2 000 to 1 300 000	10 x 250 mg	PSS-paakit

1.2| Aqueous standards



Further Standards

Poly(styrene sulfonate) sodium salt

a) Individual Standards

Poly(styrene sulfonate) sodium salt		Pack Size 500 mg
Part Number	Molar Mass [Da]	PDI
PSS-pss1k	1 000	<1.20
PSS-pss3.4k	3 400	<1.20
PSS-pss6k	6 000	<1.20
PSS-pss15k	15 000	<1.20
PSS-pss30k	30 000	<1.20
PSS-pss67k	67 000	<1.20
PSS-pss140k	140 000	<1.20
PSS-pss280k	280 000	<1.20
PSS-pss600k	600 000	<1.20
PSS-pss1m	1 000 000	<1.20
PSS-pss2m	2 000 000	<1.20

b) Assembled Kits of Molecular Weight Standards of Poly(styrene sulfonate) sodium salt

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Poly(styrene sulfonate) sodium salt	1 000 to 1 000 000	10 x 500 mg	PSS-psskit

Poly(vinyl alcohol)

Individual Standards

Poly(vinyl alcohol) broad		Pack Size 1000 mg
Part Number	Molar Mass [Da]	PDI
PSS-pvo5k	5 000	<2.50
PSS-pvo12k	12 000	<3.50
PSS-pvo30k	30 000	<2.50
PSS-pvo40k	40 000	<2.50
PSS-pvo75k	75 000	<2.50
PSS-pvo100k	100 000	<2.50
PSS-pvo120k	120 000	<2.50
PSS-pvo160k	160 000	<2.50

Proteins

Description	MW Range [Da]	Number of standards	Part Number
PSS GPC/SEC Calibration Kit Protein	243 to 670 000	10 x 100 mg	PSS-prokit

1.3| Validation Kits

a) MALDI Validation Kits

Description	MW Range [Da]	Number of standards	Part Number
PSS MALDI Kit Poly(methyl methacrylate)	450 to 60 000	6 x 500 mg	PSS-mmkitm
PSS MALDI Kit Poly(styrene)	700 to 65 000	6 x 500 mg	PSS-pskitm
PSS MALDI Kit Poly(ethylene glycol)	400 to 26 000	6 x 500 mg	PSS-pegkitm
PSS MALDI mixed Kit (PS, PMMA, PDMS, PEG, PSS)	4 500 to 6 000	5 x 500 mg	PSS-mixkitm

b) Light Scattering/Viscometry Validation Kits

Description	MW Range [Da]	Number of standards	Part Number
PSS LS-Visco Kit Poly(methyl methacrylate)	8 000 to 850 000	4 x 500 mg	PSS-mmkitv
PSS LS-Visco Kit Poly(styrene)	9 000 to 560 000	4 x 500 mg	PSS-pskitv
PSS LS-Visco Kit Dextran	12 000 to 410 000	4 x 500 mg	PSS-dxtkitv

c) EasyValid Validation Kit

Description	Number of standards	Part Number
PSS EasyValid Validation Kit for organic systems	6 x 5 Vials-1.5mL	PSS-pskitval
PSS EasyValid Validation Kit for aqueous systems	6 x 5 Vials-1.5mL	PSS-dxtkitval



1.4| Custom Request Polymerizations, Specialty Polymers and Polymer Networks

This catalog shows some examples for specialty polymers, which have not been manufactured as “classical reference materials” with just a defined molar mass distribution. The term “Specialty Polymers” includes all different kinds of copolymers and functionalized or deuterated polymers.

Please visit our website www.pss-polymer.com for an extended list. Contact us to request tailor-made polymers.

Deuterated Polymers

Polymer	Molar Mass range [Da]	
	min.	max.
Poly(butadiene-1,4-d6)		23 000
Poly(carbonate-d4) broad		50 000
Poly(methyl methacrylate-d8)	4 000	580 000
Poly(para-methylstyrene-d10)		100 000
Poly(styrene-d3)		160 000
Poly(styrene-d8)	2 000	1 280 000
Poly(styrenesulfonate-d8) sodium salt	3 500	1 500 000

Deuterated Block Copolymers

Excerpt of the available Copolymers

Poly(styrene-d8-b-methyl methacrylate-d8)
Poly(styrene-d8-b-n-butyl methacrylate)
Poly(styrene-d8-b-methyl methacrylate)
Poly(styrene-d8-b-isoprene-1.4)
Poly(styrene-d8-b-dimethyl siloxane)
Poly(styrene-d8-b-2-vinylpyridine)
Poly(alpha-methylstyrene-b-styrene-d8)

Polymers with Functional End Groups

Polymer	Molar Mass range [Da]	
	min.	max.
Poly(butadiene-1.4) OH-endgroup		10 000
Poly(ethylene glycol) dimethylether	90	2 000
Poly(styrene) brominated	40 000	230 000
Poly(styrene) fluorescein labeled	3 500	45 000
Poly(styrene) sulfonated Li-labeled	5 000	18 000
Poly(styrene) with deuterium end group	2 000	70 000
Poly(styrene) without initiator end group	2 000	60 000

Star Polymers

Polymer	Molar Mass range [Da]	
	min.	max.
Poly(isoprene-1.4) 3-star	67 000	120 000
Poly(styrene) 3-star	45 000	300 000

Block Copolymers

Excerpt of the available Copolymers

Poly(styrene-b-methyl methacrylate)
Poly(styrene-b-n-butyl methacrylate)
Poly(styrene-b-2-vinylpyridine)
Poly(styrene-b-butadiene-1.4)
Poly(styrene-b-isoprene-1.4)
Poly(styrene-b-dimethyl siloxane)
Poly(styrene-b-alpha-methylstyrene)
Poly(styrene-b-acrylic acid)
Poly(styrene-b-ethylene oxide)
Poly(methyl methacrylate-b-n-butyl methacrylate)
Poly(methyl methacrylate-b-t-butyl methacrylate)
Poly(butadiene-1.4-b-methacrylic acid)
Poly(isoprene-1.4-b-butadiene-1.2)
Poly(dodecyl methacrylate-b-n-butyl methacrylate)
Poly(2-vinylpyridine-b-methyl methacrylate)

1.5| Particle Standards*



The PSS Particle Standards are traceable to the Standard Meter through the National Institute of Standards and Technology (NIST). They are available as uniform spheres of polymer in a range of discrete sizes from 20 nm to 1 000 µm. Each standard comes with a "Certificate of Calibration and Traceability to NIST" which includes a description of the calibration method and its uncertainty, and a table of chemical and physical properties.

Particle	Pack Size	Size	
		min.	max.
Nanospheres	15 ml dropper-tipped bottles	20 nm	900 nm
Microspheres	15 ml or 1 g	1 µm	1 000 µm
EZY-CAL	100 ml	2 µm	70 µm

Nanosphere Particle Size Standards are used for the calibration of electron and atomic force microscopes, in laser light scattering studies and colloidal systems research. EZY-CAL Particle Size Standards are a series of ready-to-use standards for validating optical particle counters with an absolute minimum of diluting or handling. The products are suspensions of polymer microspheres in water with a concentration of 2 000 particles/ml. A magnetic stirrer bar is included in each bottle for clean, convenient, and direct sampling.

* Only in selected countries.

Supplies and Services for Comprehensive Characterization of Natural and Synthetic Macromolecules

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- GPC/SEC Standards and Kits
- Certified Reference Materials
- MALDI Kits
- Viscosity & Light Scattering Validation Kits
- ReadyCal Kits
- Deuterated Polymers
- Tailor made Polymers and Copolymers

Software

WinGPC UniChrom MACROMOLECULAR CHROMATOGRAPHY DATA SYSTEM

- Light Scattering Module for LALLS, RALLS, TALLS, MALLS
- Viscosity Module
- Copolymer Module
- End-group Analysis Module
- 2-dimensional Chromatography Module
- Heparin Module
- LAN/Server Solutions
- Compliance Pack
- Mass Spectrometry Module
- 3D-spectra Module

PoroCheck SOFTWARE FOR PORESIZE ANALYSIS AND INVERSE GPC/SEC

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- Branching/Structure Information
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