

Improve  
Resolution



**Phenogel™**  
NON-AQUEOUS GPC/SEC COLUMNS

Wide solvent compatibility

Temperature stability up to 140°C/205°C

Narrow bore columns available for  
reduced solvent consumption

# Phenogel™ GPC Materials



- Highly cross-linked for mechanical and chemical stability
- Narrow bore (4.6mm ID) solvent-saver to preparative columns available
- Temperature stable to 140°C / 205°C

Phenogel packing materials are made from styrene-divinylbenzene by emulsion polymerization under conditions to optimize pore size, total pore volume, particle size, and degree of cross-linking. The results yield GPC materials that provide very high resolution, rugged durability, and wide solvent compatibility.

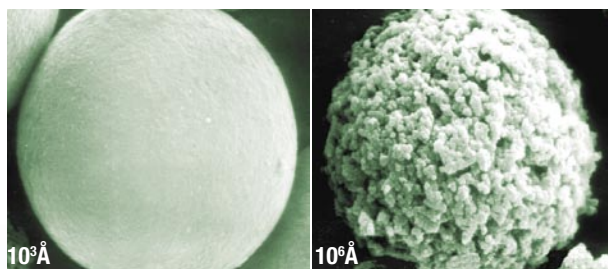
Phenogel is available in seven different pore sizes ranging from 50Å to 10<sup>6</sup>Å, and a unique Linear (2) configuration. Pore size distribution and pore volume are closely controlled parameters in the manufacturing process; attention to these details accounts for the high resolution and tight linear calibration curves associated with Phenogel, as well as the excellent column-to-column reproducibility.

## Technical Specifications

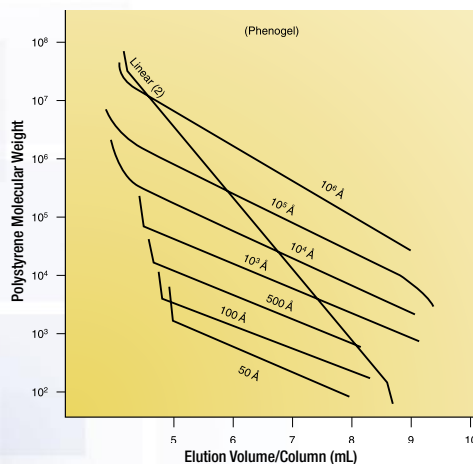
Material:	SDVB	
Particle Size:	5, 10, 20µm	
Porosities:	50Å to 10 <sup>6</sup> Å, and mixed beds	
Typical Pressure:	5µm: 350 psi	10µm: 200 psi
Maximum Pressure:	1000 psi	
Maximum Temperature:	140°C	
Minimum Efficiency*:	5µm: 45,000 p/m**	
	10µm: 35,000 p/m**	
Typical Flow Rates:	4.6mm ID: 0.35 mL/min	
	7.8mm ID: 1.0 mL/min	
	21.2mm ID: 8.0 mL/min	
End Fittings:	Valco Compatible	

\* Tested in THF    \*\* For 300 x 7.8mm ID columns

## SEM Photos of Phenogel Polymer Beads



## Column Molecular Weight Calibration Curves



## Column Selection by Molecular Weight

Sample Type	Molecular Weight	Phenogel Column
Small Organics	100 - 3K	50 Å
	500 - 6K	100 Å
	1K - 15K	500 Å
Resins	1K - 75K	10 <sup>3</sup> Å
	5K - 500K	10 <sup>4</sup> Å
	10K - 10,000K	10 <sup>5</sup> Å
High MW Polymers	60K - 10,000K	10 <sup>6</sup> Å
	100K - 10,000K	Linear(2)



If Phenogel does not provide at least equivalent separation as compared to a competing column of the similar particle size, phase, and dimensions, send in your comparative data within 45 days and keep the column for FREE.



# Solvent and Temperature Compatibility

- Phenogel columns are packed in tetrahydrofuran (THF)
- Columns can also be shipped in solvents such as DMF, Methylene Chloride, NMP, and o-CP, to help minimize equilibration time

Phenogel columns maintain excellent solvent compatibility and high efficiency during sequential solvent switches from:

THF → DMF → Toluene → CHCl<sub>3</sub> → DMF  
 (ambient temp) → DMF (50°C) → THF → NMP  
 → DMSO → THF → DMSO → Methanol

Although styrene-divinylbenzene materials are exceptionally inert, interaction between the column packing and sample materials (especially very polar solutes) occasionally occurs and the mobile phase must be modified to eliminate this effect. Phenogel columns can tolerate up to 0.1% low MW amines, 0.5% glacial acetic acid, or up to 1% water in the mobile phase as modifiers.

Phenogel columns are temperature stable to 140°C to 205°C (Phenogel Ultra Temp) which is important for applications involving solutes with limited solubility at ambient temperatures

or where solubility considerations demand the use of viscous solvents such as DMF or DMSO. At higher temperatures, eluent viscosity is decreased and mass transfer is enhanced, with the effect of increasing sample resolution. This temperature stability is particularly useful when analyzing polymers such as polyethylene and polypropylene which require higher temperatures.

## Solvent Selection Table

Recommended GPC Solvent	Sample	Suggested Temp.
THF	Polystyrenes	Ambient
	Polybutadienes	
	Polyethylene Oxide	50°C
	Epoxy Resins	
	Phenolic Resins	Ambient
	Polymethacrylates	
	Polyethylene Glycol	
HFIP**	Polyamides (Nylon)	30°C
	PETP (polyethyleneterephthalate)	
Dichloromethane	Naphthalene	
	Diethylhexyl Phthalate	Ambient
Toluene	Polysisobutylene	Ambient
	Polyisoprene	
	Silicone Oils	
DMF	Chlorinated Rubber	

\*\*HFIP (hexafluoroisopropanol) allows polymers such as polyamides and PET that are analyzed at temperature of 135°C and higher to be analyzed at temperatures below 100°C. The narrow particle distribution of Phenogel columns eliminates the problem of overlapping peaks and band broadening that is typically associated with using this solvent with traditional GPC columns.

## Solvent Compatibility Table

Mobile Phase Solvent	Phenogel Pore Size:						Linear & Mixed	Suggested Operation Temp.
	50Å	100Å	500Å	10 <sup>3</sup> Å	10 <sup>4</sup> Å	10 <sup>5</sup> Å		
Acetone	Y	Y	Y	Y	Y	Y	Y	
Benzene	Y	Y	Y	Y	Y	Y	Y	
Carbon Tetrachloride	Y	Y	Y	Y	Y	Y	Y	
Chloroform	Y	Y	Y	Y	Y	Y	Y	
30% HFIP/Chloroform	Y	Y	Y	Y	Y	Y	Y	
Diethyl Ether	Y	Y	Y	Y	Y	Y	Y	
Dimethylacetamide (DMAC)	Y*	Y	Y	Y	Y	Y	Y	60°C
Dimethylformamide (DMF)	Y*	Y	Y	Y	Y	Y	Y	60°C
Dioxane	Y	Y	Y	Y	Y	Y	Y	
DMSO	Y*	Y	Y	Y	Y	Y	Y	60°C
Ethyl Acetate	Y	Y	Y	Y	Y	Y	Y	
Hexafluoroisopropanol (HFIP)	Y	Y	Y	Y	Y	Y	Y	
Hexane	Y	Y	Y	Y	Y	Y	Y	
M-Cresol	Y*	Y	Y	Y	Y	Y	Y	100°C
Methyl Ethyl Ketone	Y	Y	Y	Y	Y	Y	Y	
Methylene Chloride	Y	Y	Y	Y	Y	Y	Y	
O-Chlorophenol	Y*	Y	Y	Y	Y	Y	Y	100°C
O-Dichlorobenzene	Y*	Y	Y	Y	Y	Y	Y	135°C
Quinolin	Y*	Y	Y	Y	Y	Y	Y	60°C
Tetrahydrofuran	Y	Y	Y	Y	Y	Y	Y	
Toluene	Y	Y	Y	Y	Y	Y	Y	
Trichlorobenzene	Y*	Y	Y	Y	Y	Y	Y	135°C
Water	N	N	N	N	N	N	N	
Xylene	Y	Y	Y	Y	Y	Y	Y	

\*Not recommended on 5µm 50Å columns.

N = Not Compatible  
 Y = Compatible

# Solvent Switching

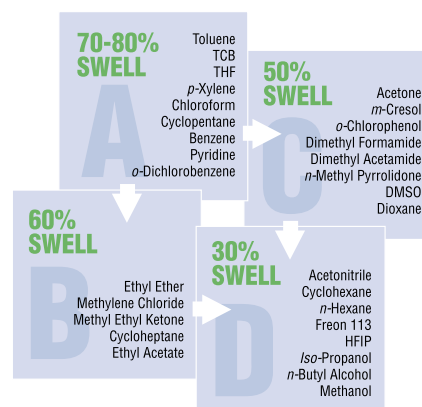
## Solvent Switching Considerations

Although Phenogel columns are rugged and can withstand strong solvent changes, care should be exercised when switching from high-swell solvents (A) to low-swell solvents (B, C, and D), see diagram at right. Improper solvent switches can result in a void. Best results are attained when an intermediate-swell solvent is used, and column lifetime is improved. Contact Phenomenex regarding solvents not listed below.

Column life can be maximized by dedicating certain columns to certain solvents. This will also minimize solvent switches. If care is not taken, a void may occur.

- Reduce flow rate to 0.2mL/min
- Backpressure must NEVER exceed 1000 psi
- Always check solvent miscibility in a beaker or follow the solvent miscibility table below before proceeding with ANY solvent switch.
- Compare the swell characteristics of solvent 1 (old solvent) to solvent 2 (new solvent) and follow the guidelines at right.
  - If solvent 1 and solvent 2 belong to the same swell category (see table at right), check the solvent miscibility and proceed with the switch.
  - If solvent 1 and solvent 2 belong to successive swell categories as indicated by the arrows in the table at right, check the miscibility and proceed with the switch.

- If solvent 1 and solvent 2 DO NOT belong to the same OR successive swell categories, switch to an intermediate solvent FIRST, as indicated by the arrows in the table.



## Solvent Miscibility Table

Solvent	Polarity Index	Refractive Index @20°C	UV(nm) Cutoff @1AU	Boiling Point(°C)	Viscosity (cPoise)	Solubility in water (%w/w)
Acetic Acid	6.2	1.372	230	118	1.26	100
Acetone	5.1	1.359	330	56	0.32	100
Acetonitrile	5.8	1.344	190	82	0.37	100
Benzene	2.7	1.501	280	80	0.65	0.18
n-Butanol	4.0	1.394	254	125	0.73	0.43
Butyl Acetate	3.9	1.399	215	118	2.98	7.81
Carbon Tetrachloride	1.6	1.466	263	77	0.97	0.08
Chloroform	4.1	1.446	245	61	0.57	0.815
Cyclohexane	0.2	1.426	200	81	1.00	0.01
1,2-Dichloroethane <sup>1</sup>	3.5	1.444	225	84	0.79	0.81
Dichloromethane <sup>2</sup>	3.1	1.424	235	41	0.44	1.6
Dimethylformamide	6.4	1.431	268	155	0.92	100
Dimethyl Sulfoxide <sup>3</sup>	7.2	1.478	268	189	2.00	100
Dioxane	4.8	1.422	215	101	1.54	100
Ethanol	5.2	1.360	210	78	1.20	100
Ethyl Acetate	4.4	1.372	260	77	0.45	8.7
Di-Ethyl Ether	2.8	1.353	220	35	0.32	6.89
Heptane	0.0	1.387	200	98	0.39	0.0003
Hexane	0.0	1.375	200	69	0.33	0.001
Methanol	5.1	1.329	205	65	0.60	100
Methyl-t-Butyl Ether <sup>4</sup>	2.5	1.369	210	55	0.27	4.8
Methyl Ethyl Ketone <sup>5</sup>	4.7	1.379	329	80	0.45	24
Pentane	0.0	1.358	200	36	0.23	0.004
n-Propanol	4.0	1.384	210	97	2.27	100
Iso-Propanol <sup>6</sup>	3.9	1.377	210	82	2.30	100
Di-Iso-Propyl Ether	2.2	1.368	220	68	0.37	
Tetrahydrofuran	4.0	1.407	215	65	0.55	100
Toluene	2.4	1.496	285	111	0.59	0.051
Tichloroethylene	1.0	1.477	273	87	0.57	0.11
Water	9.0	1.333	200	100	1.00	100
Xylene	2.5	1.500	290	139	0.61	0.018

**Legend:**

■ Immiscible

□ Miscible

Immiscible means that in some proportions two phases will be produced

**Synonym Table**

<sup>1</sup> Ethylene Chloride  
<sup>2</sup> Methylene Chloride  
<sup>3</sup> Methyl Sulfoxide  
<sup>4</sup> tert-Butyl Methyl Ether  
<sup>5</sup> 2-Butanone  
<sup>6</sup> 2-Propanol

# Applications on Phenogel Linear Non-Aqueous GPC Columns

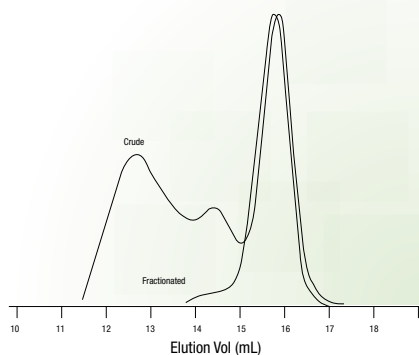
## Phenogel Linear Columns

- Linear calibration to 10 million Daltons
- Excellent mechanical stability
- Excellent for analyzing a wide range of molecular weights

### Cyclic Polymer Characterization

**Column:** Phenogel 10µm Linear(2)  
**Dimensions:** 600 x 7.8mm  
**Part No.:** 00K-3260-KO  
**Mobile Phase:** THF with 1% TEA  
**Flow Rate:** 1.3 mL/min  
**Detection:** UV @ 268nm  
**Injection Volume:** 40 µL 0.2% w/v  
**Temperature:** Ambient  
**Sample:** Poly-(2-Vinylpyridine) [0.05% - 0.25% (w/v)]

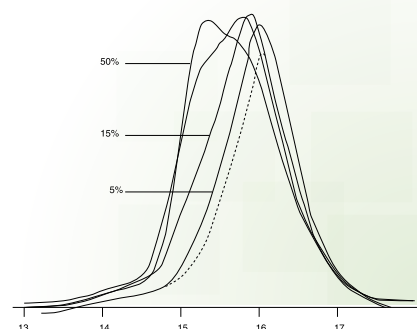
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### Cyclic Polymer Characterization

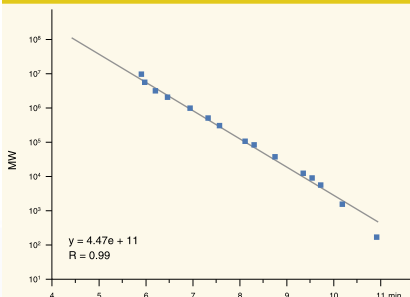
**Column:** Phenogel 10µm Linear(2)  
**Dimensions:** 600 x 7.8mm  
**Part No.:** 00K-3260-KO  
**Mobile Phase:** THF with 1% TEA  
**Flow Rate:** 1.3 mL/min  
**Detection:** UV @ 268nm  
**Injection Volume:** 7µL 1.25% w/v  
**Temperature:** Ambient  
**Sample:** Poly-(2-Vinylpyridine) [0.05% - 0.25% (w/v)]

App ID 5440



SEC traces of solutions of cyclic P2VP which contain the indicated percentages of added linear precursor (dotted line is 'pure' cyclic P2VP)

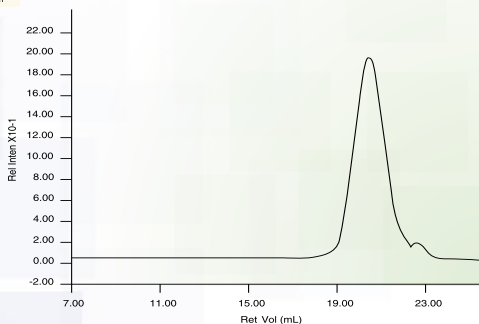
### Calibration Curve: Linear (2) Phenogel 5µm 300 x 7.8mm



### Nylon 6 in HFIP

**Column:** Phenogel 10µm Linear (2) x 2  
**Dimensions:** 300 x 7.8mm  
**Part No.:** 00H-3260-KO  
**Mobile Phase:** HFIP (0.01 M NATFAT)  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.025% w/v  
**Temperature:** 30°C  
**Sample:** 14,500 MW

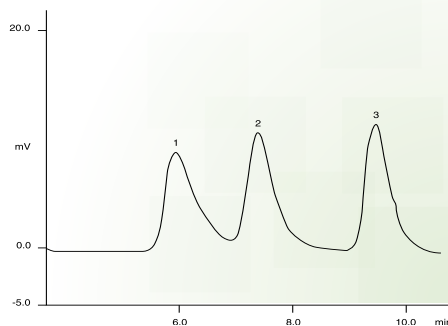
App ID 5445



### Mixed Polystyrene Standard on Linear (2) Column

**Column:** Phenogel 5µm Linear (2)  
**Dimensions:** 300 x 7.8mm  
**Part No.:** 00H-3259-KO  
**Mobile Phase:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** RI  
**Injection Volume:** 50 µL  
**Temperature:** 35°C  
**Sample:** Polystyrene standards injected  
 1. 2,860,000 MW  
 2. 277,000 MW  
 3. 9,350 MW

App ID 5444





# Applications on Phenogel Non-Aqueous GPC/SEC Columns

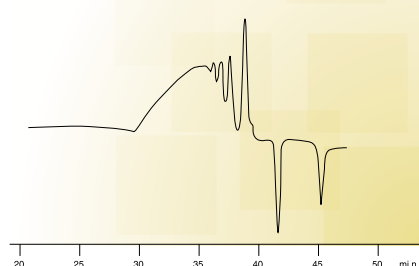
## Phenogel Non-Aqueous GPC/SEC 50Å - 10<sup>6</sup>Å Columns

- High resolution at low cost
- Customize your analysis by coupling different pore-size columns
- Wide range of solvent compatibility

### Phenolic Resins

**Column:** Phenogel 5µm 500Å x 2, 10<sup>3</sup>Å, 10<sup>4</sup>Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** RI  
**Injection Volume:** 5 µL  
**Temperature:** 25°C  
**Sample:** Phenolic Aldehyde Resin, MW 500 to 470k

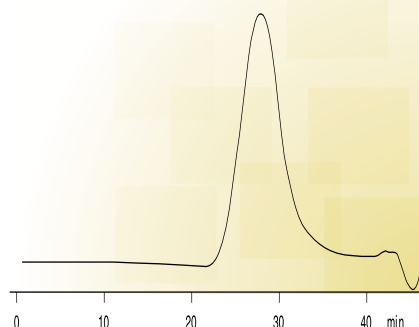
App ID 5429



### Polyvinyl Butyral

**Column:** Phenogel 5µm 500, 10<sup>3</sup>, 10<sup>4</sup>, 10<sup>5</sup>Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Temperature:** 25°C  
**Sample:** 300,000 MW

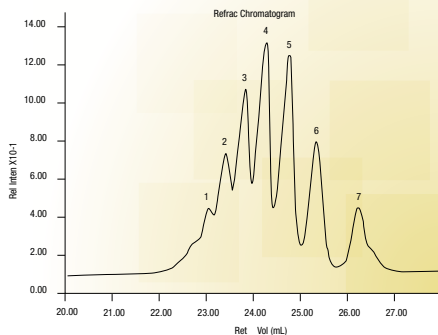
App ID 5438



### Polyethylene Glycol 330

**Column:** Phenogel 5µm 50Å x 2, 100Å, 500Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Temperature:** Ambient  
**Sample:** 1. dp7 546 MW 5. dp3 194 MW  
 2. dp6 458 MW 6. dp2 106 MW  
 3. dp5 370 MW 7. dp1 62 MW  
 4. dp4 282 MW

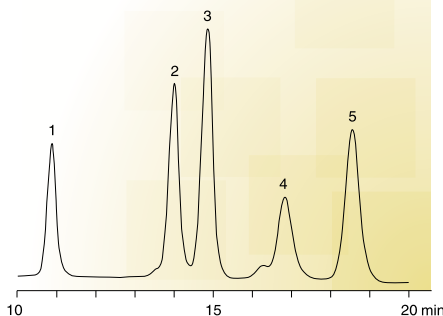
App ID 5433



### Organic Compounds

**Column:** Phenogel 10µm 100Å  
**Dimensions:** 250 x 21.2mm  
**Part No.:** 00G-0642-P0  
**Mobile Phase:** Dichloromethane  
**Flow Rate:** 4.0 mL/min  
**Detection:** UV @254nm  
**Temperature:** Ambient  
**Sample:** 1. Diethylhexyl Phthalate  
 2. Biphenyl  
 3. Naphthalene  
 4. Coronene  
 5. Sulfur

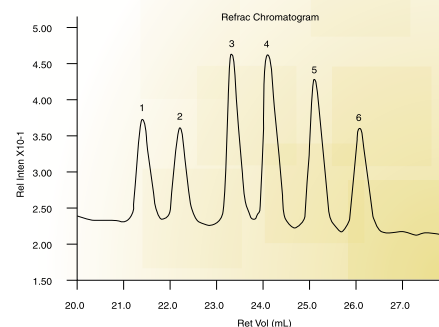
App ID 5430



### Closely Related Hydrocarbons

**Column:** Phenogel 5µm 50Å, 100Å, 500Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Temperature:** Ambient  
**Sample:** 1. C40 562 MW 4. C20 282 MW  
 2. C32 450 MW 5. C16 226 MW  
 3. C24 338 MW 6. C13 184 MW

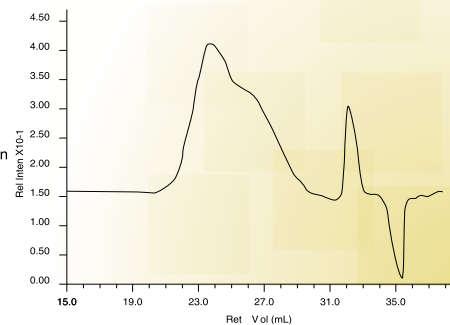
App ID 5432



### Polyethylene Oxide (PEO)

**Column:** Phenogel 10µm 10<sup>3</sup>, 10<sup>4</sup>, 10<sup>5</sup>Å  
**Dimensions:** 300 x 7.8mm  
**Mobile Phase:** DMF (0.1M LiBr)  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.125% w/v  
**Temperature:** 50°C  
**Sample:** 1,400,000 MW

App ID 5434



# Applications on Phenogel Non-Aqueous GPC/SEC Columns

## Phenogel Non-Aqueous GPC/SEC 50Å - 10<sup>6</sup>Å Columns (continued)

### Polystyrenes (Wide MW Range)

**Column:** Phenogel 10µm 10<sup>5</sup>, 10<sup>4</sup>, 10<sup>3</sup>Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Temperature:** Ambient  
**Sample:**  
 1. 1,560,000 MW 5. 6,100 MW  
 2. 260,000 MW 6. 854 MW  
 3. 94,000 MW 7. 146 MW  
 4. 30,000 MW

App ID 5435

### Poly - (α-Methyl Styrene) (Wide MW Range)

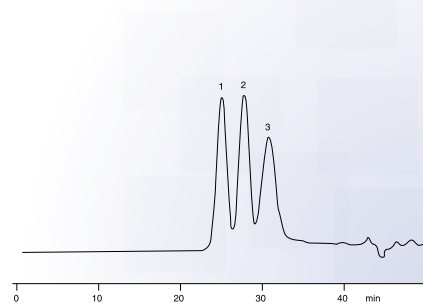
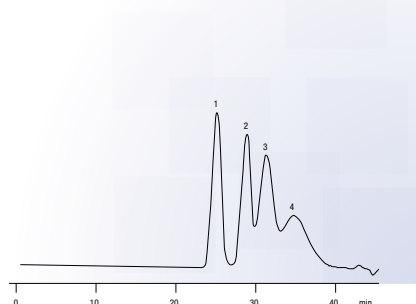
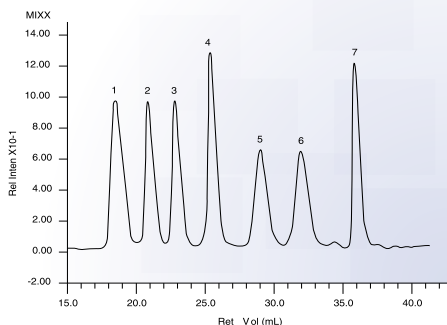
**Column:** Phenogel 5µm 10<sup>5</sup>, 10<sup>4</sup>, 10<sup>3</sup>, 500Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Sample:**  
 1. 680,000 MW  
 2. 90,000 MW  
 3. 30,000 MW  
 4. 6,000 MW

App ID 5439

### Polymethyl Methacrylates (Wide MW Range)

**Column:** Phenogel 5µm 10<sup>5</sup>Å, 10<sup>4</sup>Å, 10<sup>3</sup>Å, 500Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Sample:**  
 1. 700,000 MW  
 2. 107,000 MW  
 3. 27,000 MW

App ID 5431

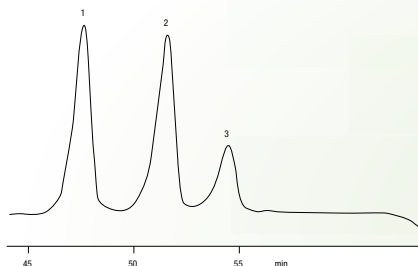


### Isoprenes from In Vitro Translation on Products

**Column:** Phenogel 5µm 50Å, 100Å in series  
**Dimensions:** 300 x 7.8mm  
**Mobile Phase:** THF  
**Flow Rate:** 0.25 mL/min  
**Detection:** Differential Refractometer  
**Sample:**  
 1. Squalene C30  
 (2, 6, 10, 15, 19, 23-Hexamethyltetracosane)  
 2. Phytane C20  
 (2, 6, 10, 14-Tetramethylhexadane)  
 3. Farnesne C15  
 (2, 6, 10-Trimethyldecane)

App ID 5436

The columns were used in tandem to characterize isoprene chain lengths removed from labeled in vitro translation products or cell proteins. The isoprenoids were removed by treatment with Raney nickel and extracted into pentane. The pentane extractable material was hydrogenated over platinum catalyst and injected onto the column. Fractions were collected at 0.5 minute intervals and radioactivity was monitored by liquid scintillation. These saturated hydrocarbon chains were characterized by comparing radioactive peaks to standard retention times.

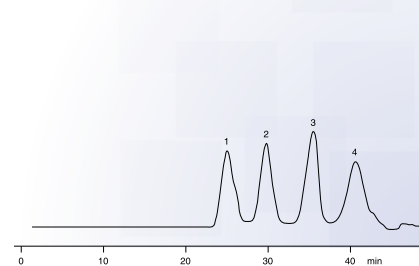


Chromatogram courtesy of W. Maltese and R. Erdman, Weis Center for Research, Geisinger Clinic.

### Polybutadines (Wide MW Range)

**Column:** Phenogel 5µm 10<sup>5</sup>, 10<sup>4</sup>, 10<sup>3</sup>, 500Å  
**Dimensions:** 300 x 7.8mm  
**Solvent:** THF  
**Flow Rate:** 1.0 mL/min  
**Detection:** Differential Refractometer  
**Injection Volume:** 100 µL 0.25% w/v  
**Sample:**  
 1. 420,000 MW  
 2. 24,000 MW  
 3. 2,500 MW  
 4. 500 MW

App ID 5437



# Reduced Solvent and High Temperature Stability

## Phenogel UltraTemp Columns

- High-temperature column stability up to 205°C
- Improved analysis of ultra-high molecular weight polymers
- Virtually free from shear degradation
- Excellent chemical stability
- Custom-packing in other solvents

Phenogel UltraTemp is a series of three high efficiency, extremely rugged, nonaqueous GPC columns for ultra-high temperature analysis

of polymers. The resins are based on highly cross linked poly (styrene-divinylbenzene), resulting in excellent mechanical, chemical and thermal stability. The result is a robust column virtually free from shear degradation, with exceptional solvent compatibility, and prolonged operational life at ultra-high temperatures. Analysis at temperatures from 100 up to 205°C are possible, making these columns an excellent choice for the analysis of refractory polymers of ultra-high molecular

weight, such as high-density polyethylene and polypropylene. Columns are highly resistant to most aggressive organics and can tolerate frequent mobile phase changeovers, with nominal gel shrinking and swelling.

Custom columns packed with other solvents such as o-dichlorobenzene, tetrachloroethane and dimethylformamide are available upon request.

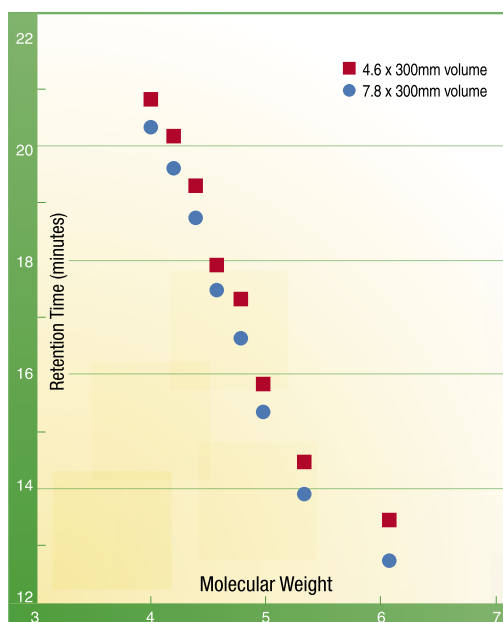
## Phenogel-Narrow Bore: An Improved Dimension in GPC Analysis

- Decrease solvent consumption
- Retain same elution profile
- Reduce solvent disposal costs

Phenogel-NB (NarrowBore) columns are optimized to reduce solvent consumption. The Phenogel-NB columns have a 4.6mm column ID and run at 0.35mL/minute, reducing solvent consumption and disposal costs up to 65%!

### Loading

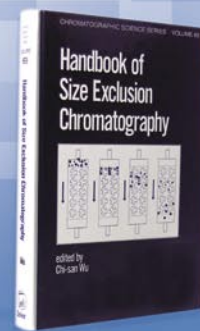
With narrow bore GPC/SEC columns, the volume in which the sample elutes is significantly decreased, thus increasing the effective concentration of the sample. This increase in sensitivity is exploited in HPLC, but in GPC it leads to overloading effects and proportionally lower sample loadings must be used.



## Handbook of Size Exclusion Chromatography

Chromatographic Science Series Vol. 69. Chi-San Wu. 1995. 453pp.

This single-source reference details the practical use of size exclusion chromatography (SEC) in characterizing the molecular weight distribution of important polymeric materials addressing problems encountered in SEC of specific substances, including copolymers, polyamides, polyvinyl alcohol and acetate, lignin derivative, proteins and starch. SEC column technology is thoroughly reviewed, and the use of semi-rigid polymer gels and modified silica-based packing materials is clearly delineated. Written by more than 25 internationally renowned authorities in their respective fields, the *Handbook of Size Exclusion Chromatography* is an invaluable resource for polymer chromatographers.



Part No.: AA0-3346

Price:



# Ordering Information



Other column dimensions available. Phenogel columns are routinely shipped in THF. However, columns are also available in commonly used solvents such as Toluene and Chloroform as well as DMF, NMP, and other solvents. Refer to the chart at the right for the additional charge for these shipping solvents. Please specify shipping solvent when ordering.

## 5µm Columns (mm)

Pore Size	MW Range	300 x 7.8	600 x 7.8	300 x 21.2	Guards 50 x 7.8
50Å	100-3K	00H-0441-K0	00K-0441-K0	—	03B-2088-K0
100Å	500-6K	00H-0442-K0	00K-0442-K0	—	03B-2088-K0
500Å	1K-15K	00H-0443-K0	00K-0443-K0	—	03B-2088-K0
10-3Å	1K-75K	00H-0444-K0	00K-0444-K0	—	03B-2088-K0
10-4Å	5K-500K	00H-0445-K0	00K-0445-K0	00H-0445-P0	03B-2088-K0
10-5Å	10K-1,000K	00H-0446-K0	00K-0446-K0	00H-0446-P0	03B-2088-K0
10-6Å	60K-10,000K	00H-0447-K0	00K-0447-K0	00H-0447-P0	03B-2088-K0

### Mixed Beds

Linear (2)	100-10,000K	00H-3259-K0	00K-3259-K0	—	03B-2088-K0
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## 5µm Narrow Bore (NB) Columns (mm)

Pore Size	MW Range	300 x 4.6	Guards 30 x 4.6
50Å	100-3K	00H-0441-E0	03A-2088-E0
100Å	500-6K	00H-0442-E0	03A-2088-E0
500Å	1K-15K	00H-0443-E0	03A-2088-E0
10-3Å	1K-75K	00H-0444-E0	03A-2088-E0
10-4Å	5K-500K	00H-0445-E0	03A-2088-E0
10-5Å	10K-1,000K	00H-0446-E0	03A-2088-E0

## 10µm Columns (mm)

Pore Size	MW Range	300 x 7.8	600 x 7.8	300 x 21.2	600 x 21.2	Guards 50 x 7.8
50Å	100-3K	00H-0641-K0	00K-0641-K0	00H-0641-P0	00K-0641-P0	03B-2090-K0
100Å	500-6K	00H-0642-K0	00K-0642-K0	00H-0642-P0	00K-0642-P0	03B-2090-K0
500Å	1K-15K	00H-0643-K0	00K-0643-K0	00H-0643-P0	00K-0643-P0	03B-2090-K0
10-3Å	1K-75K	00H-0644-K0	00K-0644-K0	00H-0644-P0	00K-0644-P0	03B-2090-K0
10-4Å	5K-500K	00H-0645-K0	00K-0645-K0	00H-0645-P0	00K-0645-P0	03B-2090-K0
10-5Å	10K-1,000K	00H-0646-K0	00K-0646-K0	00H-0646-P0	00K-0646-P0	03B-2090-K0
10-6Å	60K-10,000K	00H-0647-K0	00K-0647-K0	00H-0647-P0	00K-0647-P0	03B-2090-K0

### Mixed Beds

Linear (2)	100-10,000K	00H-3260-K0	00K-3260-K0	00H-3260-P0	—	03B-2090-K0
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## Ultra Temp (UT) Columns (100-205°C) (mm)

Pore Size	Exclusion Limits*	300 x 7.8	Guards 50 x 7.8
10-3Å	20,000	00H-4100-K0	03B-4100-K0
10-6Å	20,000,000	00H-4101-K0	03B-4101-K0
10-7Å	200,000,000	00H-4102-K0	03B-4102-K0

\* Exclusion limit based on the molecular weight of polystyrene.

## Other Shipping Solvents:

Methanol, Methylene Chloride, Cyclohexane, Ethyl Acetate, NMP, DMAC, DMF

Size (mm)	Price
30 x 4.6	
50 x 4.6	
300 x 4.6	
300 x 7.8	
600 x 7.8	
300 x 21.2	
600 x 21.2	

NOTE: Phenogel columns are routinely shipped in THF. Columns can be shipped in Toluene and Chloroform upon request at no additional charge.

## Phenogel Columns are a Direct Equivalent to:

Company	Column
Jordi Associates	Jordi GPC-DVB
Polymer Labs	PLgel™
Waters	Styragel® µStyragel® UltraStyragel® Styragel HT®



If Phenogel does not provide at least equivalent separation as compared to a competing column of the similar particle size, phase, and dimensions, send in your comparative data within 45 days and keep the column for FREE.

# Polymer Calibration Standards Kits



- Aqueous and organic standards
- Low, medium, high, and ultra-high molecular weights available
- Narrow, medium and broad molecular weight distribution Organic SEC (GPC) Calibration Kits

## Organic SEC (GPC) Calibration Kits

All calibration kits contain standards that are uniformly separated logarithmically to give equally distributed data points on a calibration curve over the Mp range stated.

### Polystyrenes

Part No.	MW	Kit Description	Mp Range	Unit	Price
ALO-2761	Low MW Narrow MWD Kit	8 Standards	100-10,000	250mg/standard	
ALO-2762	Medium MW Narrow MWD Kit	6 Standards	10,000-100,000	250mg/standard	
ALO-2763	High MW Narrow MWD Kit	6 Standards	120,000-1,850,000	250mg/standard	
ALO-2765	Broad MW Narrow MWD Kit	7 Standards	500-250,000	1.0g/standard	

## Aqueous SEC (GFC) Calibration Kits

### Dextrans (Polysaccharides)

Part No.	MW	Kit Description	Mp Range	Unit	Price
ALO-2771	Branched, Kit	7 Standards	200-50,000	250mg/standard	
ALO-2772	Branched, Broad MWD Kit	8 Standards	7,200-1,580,000	1.0g/standard	

### Polyethylene Glycols

Part No.	MW	Kit Description	Mp Range	Unit	Price
ALO-2774	Narrow MWD Kit	10 Standards	100-22,500	1.0g/standard	

### Polystyrene Sulfonates

Part No.	MW	Kit Description	Mp Range	Unit	Price
ALO-4423	Broad MWD Kit	10 Standards	1,300-2,500,000	250mg/standard	

### Polyethylene Oxides

Part No.	MW	Kit Description	Mp Range	Unit	Price
ALO-2775	Narrow MWD Kit	6 Standards	20,000-1,500,000	250mg/standard	

**For Improved GPC Reproducibility,**



**you need constant temperature.  
Use a ThermoSphere™ TS-130 Column Heater**

**Benefits**

- Improves GPC chromatographic reproducibility
- Increases sample through-put (faster run-time)
- Improves peak efficiency and component resolution
- Improves baseline and overall detector performance

**Essential For**

- Polymer analysis and characterization
- Controlling polymer formulations
- Quality systems assurance (GLP, GMP, ISO)

**Features**

- Compact and lightweight
- Transparent compartment cover
- Micro-fan provides rapid thermal equilibration

**Specifications:**

**Column Sizes Accommodated** Fits up to one 30cm length column, or 25cm column with guard column. Multiple inlet and outlet slots allow the shortest length of tubing to be used with any length column.

**Temperature Range** From 25 to 90°C in 0.1°C increments.

**Temperature Stability** ±0.1°C  
Calibration two-point, electronic, factory set.

**Power** 12 volt DC universal power supply takes voltage inputs from 95 VAC to 265 VAC, 50/60 Hz. CE approved.

**Over-Temperature Alarm** Audible with automatic heater shutoff if column temperature exceeds 10°C of target temperature.

**Auto-Off Timer** Count down timer with audible alarm turns off heater, settable to 30 days in days, hours, minutes and seconds

**Injection Counter** Trigger on external contact closure

**ThermoSphere TS-130 Column Heater**

Part No.	Description	Price
EHO-7057	ThermoSphere TS-130 HPLC Column Heater 25-90°C, 95 to 265 VAC, 50/60 Hz	
EHO-7058	Stand for ThermoSphere TS-130 HPLC Column Heater	

1. The ThermoSphere TS-130 is warranted for one year parts and labor. Each unit is individually calibrated and comes with a Certificate of Performance. No adjustment or re-calibration is ever necessary. CE approved, UL and CSA approval pending.

2. Please specify Line Cord if other than USA/Canada (Australia, Germany, Italy and U.K. are available)



If you are not completely satisfied with the performance of your new TS-130 column heater, simply return the unit within 60 days of purchase for A FULL REFUND.

# Phenogel™

## NON-AQUEOUS GPC/SEC COLUMNS



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