Choosing an SPE Product

These are the typical steps when you have to choose the proper SPE product for your application:

1. Caracterize your sample.
The polarity of your analyte vs. the matrix, the charged functional groups, molecular weight, solubitlity influence how the analyte is retained by the SPE bed.

2. Choice of Retention Strategy
Two basic methods exist for the sample treatment
a. Select the proper packing to retain the target analyte. The contaminants are washed off and the target analyte is elute for further analyses.
b. Select the proper packing to retain the contaminant. The target analyte directly pass through the SPE column.

3. Choose the Proper Packing
According with the previous points you need to select the proper packing to obtain the highest recovery and cleanest extract.
a. Reversed-Phase silica based materials are hydrophobic and retain moderately polar to non-polar interferences. Or retain non-polar contaminants while the polar compounds pass through the bed.
b. Normal-Phase silica based materials are hydrophilic and retain polar compounds from non-polar matrix. Or retain polar contaminants while the non-polar compounds pass through the bed.
c. Ion-Exchange Resins retain charged compounds and/or remove ionic interferences.

4.- Optimization of the Conditions
Choose the bed size and most appropriate solvents.
a. Too big packing bed results in incomplete elution; too small bed results in incomplete retention.
b. Consider the solvent strength versus the packing material. The solvent of the conditioning step should not act as eluting solvent. Buffers should be used to control ionization of charged compounds.
c. The washing solvents should not be strong enough to elute the target analyte. It should only removes the retained interferences.
d. Elution solvents should be strong enough to fully elute an analyte in a small volume (<2mL)

SPE Method Development

Commonly an SPE Method Development contains 4 Steps :

Step 1 : Condition the SPE Column
Two Substeps compose the conditioning step :
a. activation of the sorbent ligands
b. equilibration of the sorbent bed.

Step 2 : Load the sample
In this step the sample is applied to the SPE column. Flow Rate and Matrix are optimized to retain the analyte of interest quantitatively.

Step 3 : Wash the SPE Column
You need to choose the proper solvent to elutes the impurities and retain the target analytes. Often the second conditioning solvent is a good choice of washing.

Step 4 : Elute the Analyte
The elution step should remove all target analytes with the minimum solvent to maximize the sensitivity. A combination of solvents is someti-

General SPE Method Development Procedures

Packing	Step 1 - Conditioning	Step 2 - Loading	Step 3 - Washing	Step 4 - Eluting
Reversed-Phase Mechanism : retain moderately polar to non-polar compounds from a polar sample matrix	MeOH followed by Water	Process sample at 1-5mL/min Flow	Water or Water:MeOH (95:5)	MeOH or Acetonitrile. To break secondary interaction may need to add a strong acid or base.
Normal-Phase Mechanism : retain polar compounds from a non-polar sample matrix	IPA followed by Hexane	Process sample at 1-5mL/min Flow	Hexane or Hexane:IPA (98:2)	IPA, Ethyl Acetate, Acetone, Hexane:IPA (50:50)
Ion-Exchange Mechanism : retain charged compounds (negative/anionic or positive/cationic)	MeOH:Water (50:50) followed by Low Ionic strength (0.1M) Buffer	Process sample at ≤1mL/min Flow. Ion Exchange kinetics are slower than RP or NP	MeOH:Low Ionic Strength (0.1M) Buffer (10:90)	High Ionic Strength (0.5M-1.0M) Buffer or pH modifier to uncharge the analyte. Add organic if need to break hydrophobic interactions.

Recommended Guideline

Bed Size / Sorbent Capacity	Condition Volume (4 Bed Volume)	Wash Volume (6 Bed Volume)	Minimum Elution Volume (3 Bed Volume)
50mg / 2.5mg	0.30mL	0.45mL	0.23mL
100mg / 5mg	0.60mL	0.90mL	1.80mL
200mg / 10mg	1.20mL	1.80mL	0.90mL
500mg / 25mg	3.00mL	4.50mL	2.25mL
1000mg / 50mg	6.00mL	9.00mL	4.50mL
2000mg / 100mg	12.00mL	18.00mL	9.00mL
5000mg / 250mg	30.00mL	45.00mL	22.50mL
10000mg / 500mg	60.00mL	90.00mL	45.00mL

The above table is for estimation purpose only. Must optimize for each application

Technical Tip !

Sorbent Bed
Tipically 150µL for every 150mg Sorbent

Retention Capacity
It describe the total amount that the sorbent will bind, including all the compounds retained, target analytes and contaminants.

Elution Volume
The Minimum Elution Volume suggested in the table on the left will offer the best sensitivity, however more solvent may be necessary, depending by the application

GracePure™ - Solid Phase Extraction Columns

GracePure™ Choices

GracePure™ SPE product line is suitable in pharmaceutical, agriculture, food & beverage, petrochemical and environmental application. These products deliver the selectivity and high recovery you expect from an SPE process. This guide help you to choose the appropriate sorbent, bed size, and solvent volumes to obtain a cleaner, more concentrated sample at the end of your SPE process, ready for further analyses and investigation.

Highest Quality Control

Every part of GracePure™ SPE manufacturing process is carefully monitored. From silica production to final product, over 30 tests are performed, and the products come with a comprehensive quality assurance certificate that displays the 18 most meaningful results to the SPE user.*

*Applies to silica-based media.

Component Tests

GC/FID shows that GracePure™ tubes are constructed from a highly inert grade of polypropylene to prevent extractable contamination. Polyethylene frits are thoroughly washed in organic solvent which also eliminates extractables.

Manufacturing Control

GracePure™ SPE products are packed and assembled using custom-designed, precision equipment. Every manufacturing batch is guaranteed to have less than 2% bed weight variation and uniform flow rates.

GracePure™ Sorbent Specification - Reversed-Phase and Normal-Phase

Packing	Support	% Carbon	End Capped	Surface Area	Average Particle Size	Pore Size	Feature	Benefits	Typical Application
C18-Max	Silica	17.1%	Yes	518 m^2/g	50µ	60Å	Polymerically bonded	Highest binding capacity, best for complex samples or structurally diverse analytes.	Drugs and their metabolites in serum and plasma, pesticides
C18-Aq	Silica	12.5%	Yes	518 m^2/g	50µ	60Å	Hydrophillic endcapping	100% Water-wettable C18 ideal for aqueous samples. Phase remains active even when completely dry	Desalting proteins, pharmaceuticals, hormones, pesticides, organics in water
C18-Low	Silica	6.5%	Yes	518 m^2/g	50µ	60Å	Least hydrophobic	C18 phase that easily releases very hydrophobic compounds.	Surfactants, oils, antibiotics
C18-Fast	Silica	7.0%	Yes	518 m^2/g	100µ	60Å	Large particle size	Process large volume (>500mL) or viscous samples with fast flow rates	Aniline, pesticides,haloethers, phthalate esters, EPA 3620, 3610
Silica	Silica	N/A	N/A	518 m^2/g	50µ	60Å	Most polar phase	Able to differentiate between structurally similar compounds	Aflatoxins, pesticides,steroids, structural isomers
Amino	Silica	4.3%	No	518 m^2/g	50µ	60Å	Duel retention	Retains polar compounds,or can act as a weak anion exchanger. Easily releases strong acids when SAX binds too strongly.	Carbohydrates, dyes, lipids, mycotoxins, strong acids
Diol	Silica	N/A	No	518 m^2/g	50µ	60Å	Reproducible polar bonded phase	Very polar phase that has the same benefits as silica, but wets easily and offers more reproducibility.	Alkaloids, lipids, oils, structural isomers

GracePure™ Sorbent Specification - Ion-Exchange Phase

Packing	Support	Exchange Capacity	Counter Ion	Average Particle Size	Feature	Benefits	Typical Application
Anion-X	8% cross-linked Styrene-DVB	1.5 meq/g	Acetate Form	50µ	Tetramethyl ammonium functional group on polymer	pH range from 1–14, with excellent exchange capacity	Anionic compounds: organic acids, fatty acids
Cation-X	8% cross-linked Styrene-DVB	2.4 meq/g	Hydrogen Form	50µ	Benzene sulfonic acid functional group on polymer base material	pH range from 1–14, with excellent exchange capacity.	Cationic compounds: amines, amino acids

Cross Reference Tradename List

GracePure™	Phenomenex Strata™	Waters Spe-Pak®	Supelco Discovery™ Supelclean™	Agilent Bond-Elute®	JT Baker Bakerbond™	Biotage Isolute®
C18-Max	C18-E	tC18	DSC-18	C18	Octadecyl	C18 (EC)
C18-Aq	C18-U	C18	DSC-18Lt	C18OH	Octadecyl lightload	MF C18
C18-Low	---	---	LC-18	---	---	---
C18-Fast	---	---	---	---	---	---
Silica	Si-1	Silica	DSC-Si or LC-Si	LC-Si	Silica Gel	SI
Amino	NH2	NH2	LC-NH2	NH2	Amino	NH2
Diol	---	Diol	DSC-Diol or LC-Diol	2OH	---	Diol
Anion-X	SAX	---	DSC-SAX or LC-SAX	SAX	Quaternary Amine	Sax
Cation-X	SCX	---	DSC-SCX or LC-SCX	SCX	Aromatic Sulfonic Acid	Scx

GracePure™ SPE Columns

- Reversed-Phase Columns
- Normal-Phase Columns
- Ion-Exchange Columns

GracePure™ - Reversed-Phase Columns

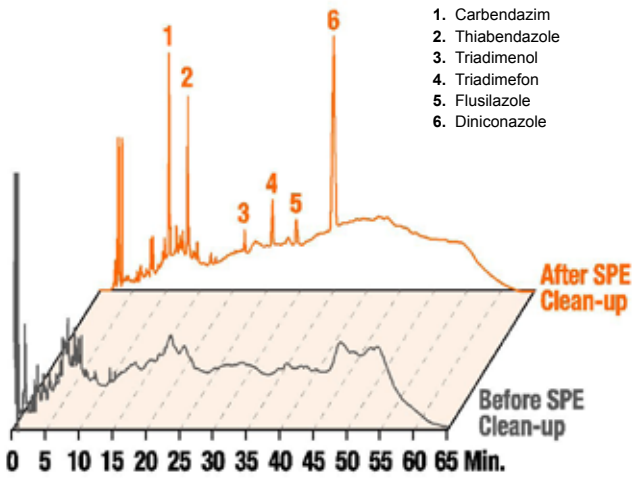
Packing	Bed Weight / Tube Volume	Qty	Old Alltech #	Part.No
C18-MAX	50mg / 1mL	100	*5141484*	LD0225
	100mg / 1mL	100	*5138765*	LD0207
	200mg / 3mL	50	*5141686*	LD0001
	500mg / 3mL	50	*5138766*	LD0208
	500mg / 6mL	30	*5138767*	LD0209
	1000mg / 6mL	30	*5138768*	LD0210
	2000mg / 20mL	20	*5141525*	LD0234
	5000mg / 20mL	20	*5141524*	LD0233
C18-Aq	50mg / 1mL	100	*5141486*	LD0226
	100mg / 1mL	100	*5138774*	LD0214
	500mg / 3mL	50	*5138775*	LD0215
	1000mg / 6mL	30	*5138776*	LD0242
	2000mg / 12mL	30	*5141482*	LD0224
	5000mg / 20mL	20	*5141523*	LD0232
C18-Low	100mg / 1mL	100	*5138760*	LD0202
	200mg / 3mL	50	*5138761*	LD0203
	500mg / 3mL	50	*5138762*	LD0204
	500mg / 6mL	30	*5138763*	LD0205
	1000mg / 6mL	30	*5138764*	LD0206
C18-Fast	500mg / 3mL	50	*5138758*	LD0200
	1000mg / 6mL	30	*5138759*	LD0201
	5000mg / 20mL	20	*5141527*	LD0235

Fungicides from Red Wine

Procedure using GracePure™ C18-Max, 500mg:

Sample Treatment – Add 0.167mg/mL each of carbendazim, thiabendazolem, triadimenol, triadimefon, flusilazole, diniconazole into 1mL water. Combine with 1mL Beaujolais red wine.
Conditioning – Rinse device with 3mL methanol followed by 3mL water.
Sample Application – Apply 2mL red wine mixture.
Wash – No wash.
Elution – Elute with 3mL methanol.

1. Carbendazim
2. Thiabendazole
3. Triadimenol
4. Triadimefon
5. Flusilazole
6. Diniconazole



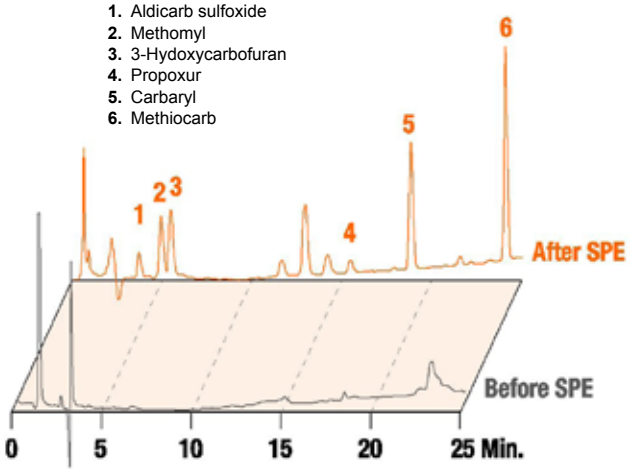
Column: Alltima™ HP C18 Amide, 5µm, 250 x 4.6mm HPLC Column (**Part No.** BF0163)
Mobile Phase: A: Water B: Acetonitrile
Gradient: (Time, %B): (0,15%), (15,45%), (50,45%), (65,15%)
Flow Rate: 1mL/min
Detector: UV at 254nm

Carbamate Pesticides from Water

Procedure using GracePure™ C18-Fast, 500mg:

Sample Treatment – Spike 500mL tap water with 125µL carbamate solution for final concentration of 25ppb.
Conditioning – Rinse with 3mL acetonitrile:water (80:20) followed by 3mL water. Dry with vacuum.
Sample Application – Apply 500µL sample.
Wash – 2 x 3mL water.
Elution – Elute with 4 x 1mL acetonitrile:water (80:20)

1. Aldicarb sulfoxide
2. Methomyl
3. 3-Hydoxycarbofuran
4. Propoxur
5. Carbaryl
6. Methiocarb



Column: Platinum™ EPS C18, 5µm, 250 x 4.6mm HPLC Column **(Part No.** BC0001**)**
Mobile Phase: A: DI water B: Acetonitrile
Gradient: (Time, %B): (0,25,), (5,25), (20,50), (25,50), (30,25)
Flow Rate: 1mL/min
Detector: UV at 210nm
Temperature: Ambient

GracePure™ - Normal-Phase Columns

Packing	Bed Weight / Tube Volume	Qty	Old Alltech #	Part.No
Silica	100mg / 1mL	100	*5138777*	LD0216
	200mg / 3mL	50	*5138778*	LD0217
	500mg / 3mL	50	*5138779*	LD0218
	500mg / 6mL	30	*5138781*	LD0220
	1000mg / 6mL	30	*5138782*	LD0221
	2000mg / 12mL	30	*5138783*	LD0222
	5000mg / 20mL	20	*5138780*	LD0219
	10000mg / 60mL	16	*5138784*	LD0223
Amino	500mg / 3mL	50	*5138752*	LD0196
	1000mg / 6mL	30	*5138753*	LD0197
Diol	500mg / 3mL	50	*5138773*	LD0213

GracePure™ - Ion-Exchange Columns

Packing	Bed Weight / Tube Volume	Qty	Old Alltech #	Part.No
Anion-X	100mg / 1mL	100	*5138754*	LD0198
	500mg / 3mL	50	*5138755*	LD0199
	1000mg / 6mL	50	*5141487*	LD0227
Cation-X	500mg / 6mL	100	*5138769*	LD0211
	500mg / 3mL	50	*5138770*	LD0212
	1000mg / 6mL	50	*5141488*	LD0228

GracePure™ Florisil SPE Columns

Florisil® is a commonly used sorbent for the clean-up or concentration of samples in environmental analysis.
We can offer you Florisil® SPE columns with:

- Highest quality control for maximum reproducibility
- A Quality Certificate in every box
- Less than 2% bed weight variation
- Highly inert tubes and frits to prevent extractable contamination
- *At Exceptional Price*

GracePure™ Sorbent Specification - Florisil®

Support	Endcap-ping	Surface Area	Particle Size	Pore Size	Feature	Benefits	Typical Application
Magnenium Silicate	No	298 m^2/g	120µ	60Å	Alternate Polar Phase	Large Particle Size processes large sample sizes quickly	Environmental

GracePure™ - Florisil® SPE Columns

Packing	Bed Weight	Qty	Old Alltech #	Part.No
Florisil®	500mg / 3mL	50	*5141522*	LD0231
	1000mg / 6mL	30	*5141520*	LD0229
	2000mg / 12mL	30	*5141521*	LD0230

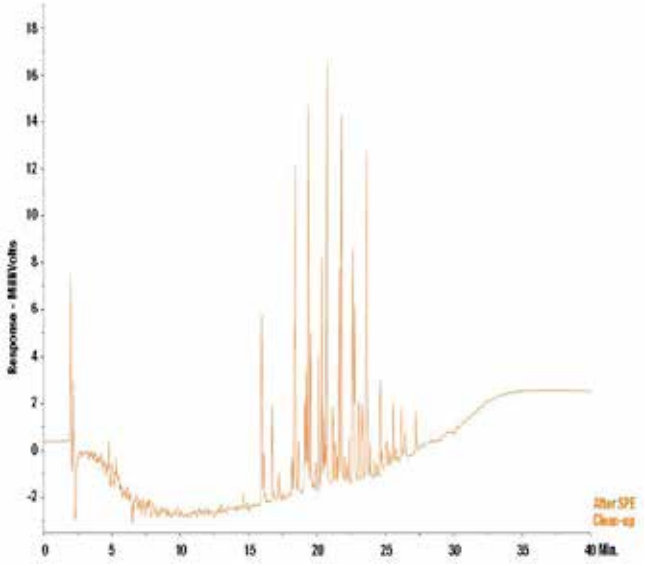
PCBs in Transformer Oil

SPE Column : GracePure™ Florisil® 1000mg/6mL (Part No LD0229):

Sample Treatment – Dissolve 0.25g of transformer oil spiked with Aroclor 1254 (at a concentration of 50mg/kg) in 20mL of n-Hexane.

Conditioning – 2 x 5mL n-Hexane, making sure the column does not dry.

Sample Application – Attach 25mL reservoir (Part No. LA0006) with a syringe adapter and run sample through conditioned Florisil® column, aspirating all the solution from the tube. Evaporate the volume down to 4mL and analyzed by GC/ECD.



Column: AT™5ms column. 30m x 0.25mmID, 0.25µ film (**Part No.** PG0062)
Oven: 150°C (2 min) - 300°C (8 min) at 5°C/min
Linear Velocity: 25 cm/second
Flow: 0.74 mL/min
Split Ratio: 64:1, SGE FocusLiner with glass wool
Injector: 275°C

GracePure™ Florisil® SPE Columns

Typical applications:

Clean-up of pesticide residues (EPA 3620 norm):
- Chlorinated Hydrocarbons
- Organochlorine Pesticides (NF EN 12393)
- Organophosphorus pesticides
- PCBs
- Phthalate Esters
- Nitrosamines
- Nitroaromatics
- Haloethers

Determination of hydrocarbons in water (ISO 9377-2 norm)

Determination of Aflatoxins and Tricothecenes in food

Isolation of Antibiotics, Steroids and Alkaloids

Separation of Lipids

Purification of pharmaceuticals

Decolorization of oils, fats and waxes

Vacuum Manifolds

- 12 position, 16 position and 24 position Vacuum Manifolds available for maximum productivity
- Glass chamber for visula monitoring
- Use standard Male Luer devices

These manifolds permit consistent extraction and filtration results. Multiple sample processing with these manifolds simplifies procedures and saves time.The manifolds consist of a clear glass chamber and lid to which a vacuum is applied to draw a sample through an SPE column, cartridge, or disk.
Adjustable racks placed in the glass vacuum chamber will accommodate a variety of sample collection vessels, including test tubes, autosampler vials, volumetric flasks, and Erlenmeyer flasks. Eluants are deposited directly into the collection vessel of choice via polypropylene, optional stainless steel, or Teflon needles.Drying attachments for the 12 and 24 port manifolds will direct a flow of air or nitrogen into the collection vessels to dry eluants prior to further analysis. Drying attachments can also be connected, via adapters, to SPE columns or cartridges in order to dry the column or cartridge prior to final elusion.Optional disposable solvent resistant polypropylene liners are available for the twelve port manifolds.These waste liners greatly simplify sample preparation, solvent disposal, and clean-up

12 Position Manifold and Accessories

Description	Qty	Old Alltech #	Part.No
12 Position Manifold	**1**	***210351***	**LA0033**
Replacement parts			
Cover, Gasket & 12 Stopcocks	1	*212001*	LA0034
Glass Chamber	1	*213212*	LA0035
Vacuum Gauge, Valve & Glass Chamber	1	*212304*	LA0035
Collection Rak, Legs, Clips & Post*	1	*212518*	LA0036
Gaskets	2	*212112*	LA0037
Plate - 13mm	1		LA0038
Plate - Volumetric Flask	1		LA0039
Plate - 16mm Test Tube	1		LA0040
Plate - Autosampler Vials	1		LA0041
Plate - Dimple	1		LA0042
Plate - Base	1		LA0043
Waste Container	1	*210033*	LA0045

* Contains 3 support posts, bottom plate, 13&16mm plates, autosampler vial plate, volumetric plate, 12 retention clips.

12 Position Manifold

Waste Container

24 Position Manifold

16 Position Manifold and Accessories

Description	Qty	Old Alltech #	Part.No
16 Position Manifold	**1**		**LA0046**
Replacement parts			
Cover, Gasket & 16 Stopcocks	1		LA0047
Glass Chamber	1		LA0048
Vacuum Gauge, Valve & Glass Chamber	1		LA0050
Collection Rak, Legs, Clips & Post*	1		LA0051
Gaskets	2		LA0052
Plate - 13mm	1		LA0053
Plate - 16mm Test Tube	1		LA0054
Plate - Dimple	1		LA0055
Plate - Base	1		LA0056

* Contains 3 support posts, bottom plate, 13&16mm plates, autosampler vial plate, volumetric plate, 12 retention clips.

24 Position Manifold and Accessories

Description	Qty	Old Alltech #	Part.No
24 Position Manifold	**1**	***210224***	**LA0058**
Replacement parts			
Cover, Gasket & 24 Stopcocks	1	*211224*	LA0059
Glass Chamber	1	*210124*	LA0060
Vacuum Gauge, Valve & Glass Chamber	1	*210324*	LA0061
Collection Rak, Legs, Clips & Post*	1	*210424*	LA0062
Gaskets	2	*210724*	LA0063
Plate - 13mm	1		LA0064
Plate - 16mm Test Tube	1		LA0065
Plate - Dimple	1		LA0066
Plate - Base	1		LA0067

* Contains 3 support posts, bottom plate, dimple plate, 13&16mm plates, 12 retention clips.

Manifold Accessories and Needles

- Replacement Parts for All Models
- Stainless Steel, Polypropylene and Teflon Needles
- Stopcocks

Manifold Accessories			
Description	**Qty**	**Old Alltech #**	**Part.No**
Drying Attachments			
12 Position Drying Attachemnt	1	*212100*	LA0020
16 Position Drying Attachemnt	1	*212117*	LA0021
24 Position Drying Attachemnt	1	*212124*	LA0022
Stopcocks			
12-16-24 Position Stopcocks	100	*212112*	LA0024
Needles			
Polypropylene Needles	24	*210924*	LA0025
Stainless Steel Needles	24	*210824*	LA0026
Teflon Needles	100	*412410*	LA0027
Valved Teflon Needle	25	*411525*	LA0028
Accessories			
Vacuum Gauge & Valve	1	*212203*	LA0029
Female Luer Fitting	2	*212002*	LA0030
Male Luer Fitting	2	*212120*	LA0031
Vacuum Manifold Plug	50	*211234*	LA0032

Teflon, Polypropylene and SS Needles

Stopcocks

12 Port Drying Attachment

Empty SPE Columns and Frits

Inlet Caps and Plugs

SPE Empty Column and Frits

- Select Empty Reservoirs and Frits to Pack Your Own Custom SPE Columns

SPE Empty Column and Frits			
Description	**Qty**	**Old Alltech #**	**Part.No**
Empty Poplypropylene Columns			
1.5mL	100	*210001*	LA0003
4.0mL	100	*210104*	LA0004
8.0mL	100	*210208*	LA0005
15.0mL	100	*210315*	LA0001
25.0mL	100	*210425*	LA0006
75.0mL	100	*210575*	LA0007
Polyethylene Frits			
For 1.5mL Column	100	*211401*	LA0008
For 4.0mL Column	100	*211404*	LA0009
For 8.0mL Column	100	*211408*	LA0010
For 15.0mL Column	100	*211412*	LA0002
For 25.0mL Column	100	*211416*	LA0011
For 75.0mL Column	100	*211775*	LA0012
Caps & Plugs			
Inlet Caps for 1.5mL	100	*222000*	LA0013
Inlet Caps for 4.0mL	100	*220301*	LA0014
Inlet Caps for 8.0mL	100	*220600*	LA0015
Inlet Caps for 15.0mL	100	*221200*	LA0017
Inlet Caps for 25.0mL	100	*221006*	LA0018
Inlet Caps for 75.0mL	100	*227503*	LA0019
Outlet Caps for all Size	100	*220710*	LA0016