

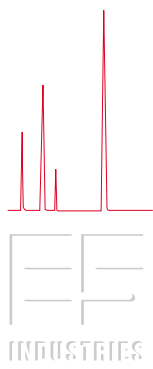
# Quality Focus

H P L C C o l u m n s



I N D U S T R I E S

pharmaceutical • environmental • chemical



H P L C S e p a r a t i o n s S p e c i a l i s t s



# ES Industries

## Leaders in Innovative HPLC Column Technology for Over 25 Years

- ◆ *A Recognized Supplier of Quality HPLC Columns*
- ◆ *Worldwide Service and Support*
- ◆ *Comprehensive Technical and Method Development Assistance*
- ◆ *A Premium HPLC Column Manufacturer Producing Highly Efficient Columns with Superior Reproducibility*
- ◆ *Extensive Capabilities to Produce State-of-the-Art Bonded Phase Chemistries*
- ◆ *The Experience to Provide the HPLC Chromatographer with the Best in Column Technology*

ES Industries offers the HPLC chromatographer an important source for high performance bonded phases and packing materials. The Chromegabond® materials produced at our New Jersey facility represent the state-of-the-art in bonding technology.

ES Industries is a recognized manufacturer of high quality HPLC columns producing highly efficient columns with superior reproducibility. These high quality columns are the product of well-characterized and tightly controlled manufacturing procedures. These manufacturing procedures are constantly under the scrutiny of the most stringent quality control program in the industry.

The combination of superior manufacturing and quality control operations make ES Industries HPLC Columns the finest available to the chromatographer.

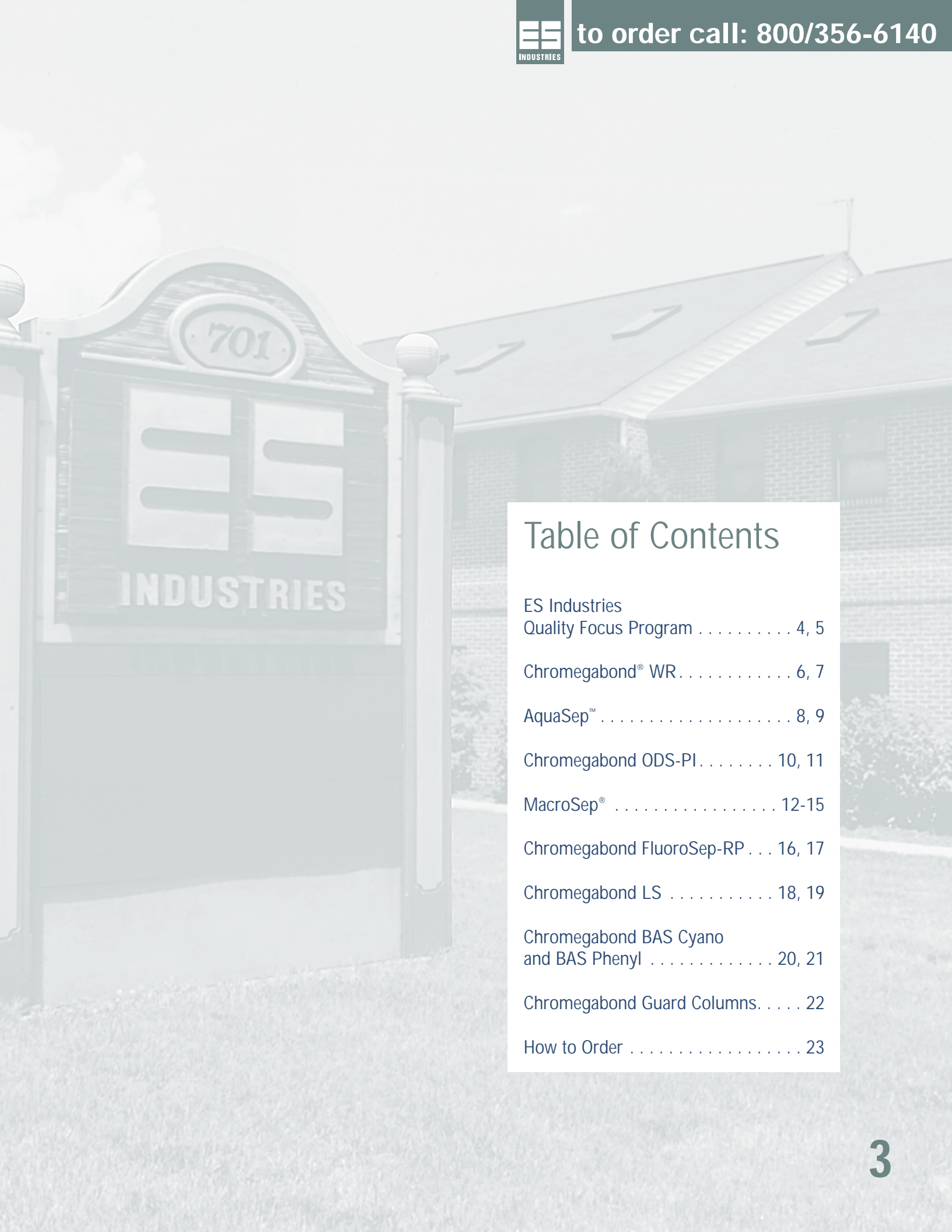
ES Industries columns are engineered to easily handle diverse application areas such as pharmaceutical, environmental, nutritional, natural product discovery, petrochemical and specialty chemicals. In addition, these columns are robust enough to be used at all levels of analysis starting with the methods development process, LC/MS analysis and quality control analysis. HPLC column development at ES Industries represents over 25 years of experience in solving real world separation issues. ES Industries is readily available to fully support our column products including applications assistance, special testing, method development guidance, and column recommendations. We invite you to review our new catalog for your HPLC column needs.

If you would like a copy of our 80 page catalog, which lists all of our products including normal phase bonded, normal phase adsorption, specialty reverse phase, alumina based and commercial packings, please call 1-800-356-6140. This catalog is also a source of additional application information.

We invite you to visit our web site at [www.esind.com](http://www.esind.com).

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# ES Industries Quality Focus Program

ES Industries has been producing HPLC columns for over 25 years. During this period of time, we have gained extensive insight into and an in-depth understanding of the factors affecting the quality and consistency of HPLC columns. This has resulted in the transformation of our company and an adaptation of a *Quality Focus Program* which is incorporated into every facet of our production process.

## The Quality Focus Program

The ES Industries Quality Focus Program (QFP) required a critical review of our manufacturing processes and an institution of strict quality control procedures. The review process included all steps starting with the silica, bonding reagents, bonding procedures, batch testing, column packing, and ending with the final column test. The QFP is composed of five key steps which begins with the application of a systematic method for each packing material.

1. Define the customer-critical parameters
2. Measure how the process performs
3. Analyze the causes of imperfections
4. Improve processes to minimize defects
5. Control processes to ensure continued and improved performance

## Ultra High Purity Spherical Silica

The finest silica based HPLC columns start with the highest quality spherical silica. High quality columns can not be manufactured from low quality silica. High quality spherical silica results from the control and measurement of several key parameters.

### Metal Free Silica

One of the most important parameters to control during the production and use of silica is metal content. Metals are considered to be the primary impurity in silica and reversed-phase packings because metal contamination will result in undesirable effects. Metal impurities are strong adsorption sites for complexing solutes. Chelating analytes can bind directly to metal ions causing poor peak shape. Metal ions can also increase the acidity of adjacent silanol groups, resulting in tailing of basic compounds. The presence of metal ions can influence bonding of the stationary phase, reducing coverage and increasing residual silanols.

Metal contamination generally stems from the silica preparation process and from the synthesis of bonded phases. At ES Industries we utilize only the finest synthetically produced metal free ultra-high purity silica available. The metal free character of this silica material is carefully protected from contamination. This includes possible contamination from reagents, equipment, and material handling which are monitored and minimized. The silica is tested for metals several times before the packing materials are used to produce HPLC columns. These procedures ensure that ES Industries HPLC Columns can provide repeatable performance for even the most challenging analysis. The chromatographer can rest assured that a difficult separation is not the product of an uncontrolled metal interaction.

### Controlled Particle Size, Pore Size, Surface Area, and Surface Hydroxylation

The most efficient and durable columns are produced from monodispersed particles. Unfortunately, even the highest quality spherical silica available is not monodispersed. There is a distribution of particle sizes associated with all silica material. The key to high performance spherical silica is to achieve the tightest particle size distribution possible. HPLC columns produced from a tight distribution of silica particle sizes are reliable for analysis of closely eluting components. Many analysis fail because they were developed on columns containing widely dispersed silica particles. This wide dispersion leads to fluctuations in column efficiencies and can ultimately lead to breakdown in resolution of separated components. At ES Industries we obtain precise measurements of particle distributions for all bulk silica utilized. Only the bulk silica that conforms to the set parameters for tight particle size distribution is released for use in production. These strict tolerances ensure that all columns produced at ES Industries meet the highest efficiency requirements.

Other specific parameters affecting column performance include pore size distribution and surface area consistency. Without a tight pore size distribution a bulk silica material will contain many micropores. These micropores will produce poor peak shapes for many components and are an undesirable silica feature. At ES Industries we only use silicas that meet the highest requirements for pore size distribution.

Surface area consistency is critically important to bonded phase reproducibility. Surface area measurements are carefully reviewed at ES industries and only silicas with consistent surface areas can be used for Chromegabond® columns. As a final step, we treat all of the qualified silica before bonding to ensure that the particle surface is completely hydroxylated. A hydroxylated surface ensures that complete surface coverage is produced during phase bonding reactions. Unreacted silanol groups can lead to peak tailing and adsorption of critical analyte components. The treatment process maximizes bonded phase coverage while minimizing the number of silanol groups. Our proprietary surface hydroxylation procedure yields the best deactivated columns available commercially.

## Bonding Reagents and Bonding Chemistry

Once the high-quality ultra-pure silica has been established, bonding of the stationary phase is the next critical step. ES Industries has extensive knowledge and experience in developing and producing bonded reagents for HPLC stationary phases. We are experts in the production and purification of HPLC grade stationary phase bonding reagents. We have developed technology that primarily consists of monomeric bonding chemistries. Our reagents reliably bond to the silica particle surface. We have discovered that bonding strategies, which depend on polymeric bonding reagents, are unpredictable and yield stationary phases with poor reproducibility. In addition, bonding reagent purification is critically important to stationary phase consistency and reproducibility. Many off-the-shelf bonding reagents are low purity, and many contain significant amounts of isomers. These impurities and isomers can lead to variability in the final bonded stationary phase. At ES Industries we carefully purify and analyze the composition of all bonding reagents to ensure consistent stationary performance.

The quality of the bonded phase does not end with stable bonding chemistry or highly purified reagents. The bonding process is completed when the stationary phase is thoroughly washed to remove reaction by-products, catalysts, and unreacted chemicals. This cleansing procedure is a necessity for production of stable and repeatable packing materials. Without this step the packed column bed would be unstable and baseline performance would be unacceptable. At ES Industries we subject all of our packings to a battery of washing procedures including high pressure solvent washing and super critical fluid extraction. These washing procedures yield high quality packings that produce columns of unmatched performance and stability.

## Column Packing and Hardware

One of the most important parts of the whole HPLC column production sequence is the packing of the column. Stationary phases have been carefully prepared and washed, but unless these materials are packed with the highest precision possible, the integrity of the packing material can be lost. Over the last 25 years of HPLC column production, we have developed and refined techniques for packing columns. As a result of our experience, we now utilize the most advanced column packing technology in the industry. This technology enables us to pack the finest columns available across a wide variety of internal diameters from 0.5 mm to 4 inch and in lengths from 10 mm and 500 mm.

A significant part of our superior packing technology resides in unsurpassed column hardware. Only end fittings and column tubing of the highest quality and performance is acceptable for ES Industries. Stainless steel column tubing with highly polished, mirrored finished internal bores are used. In addition to our strict performance criteria for stainless steel columns, we apply the same requirements to PEEK and glass lined columns. As a result, the chromatographer can be confident that they are receiving the highest quality column hardware in the industry.

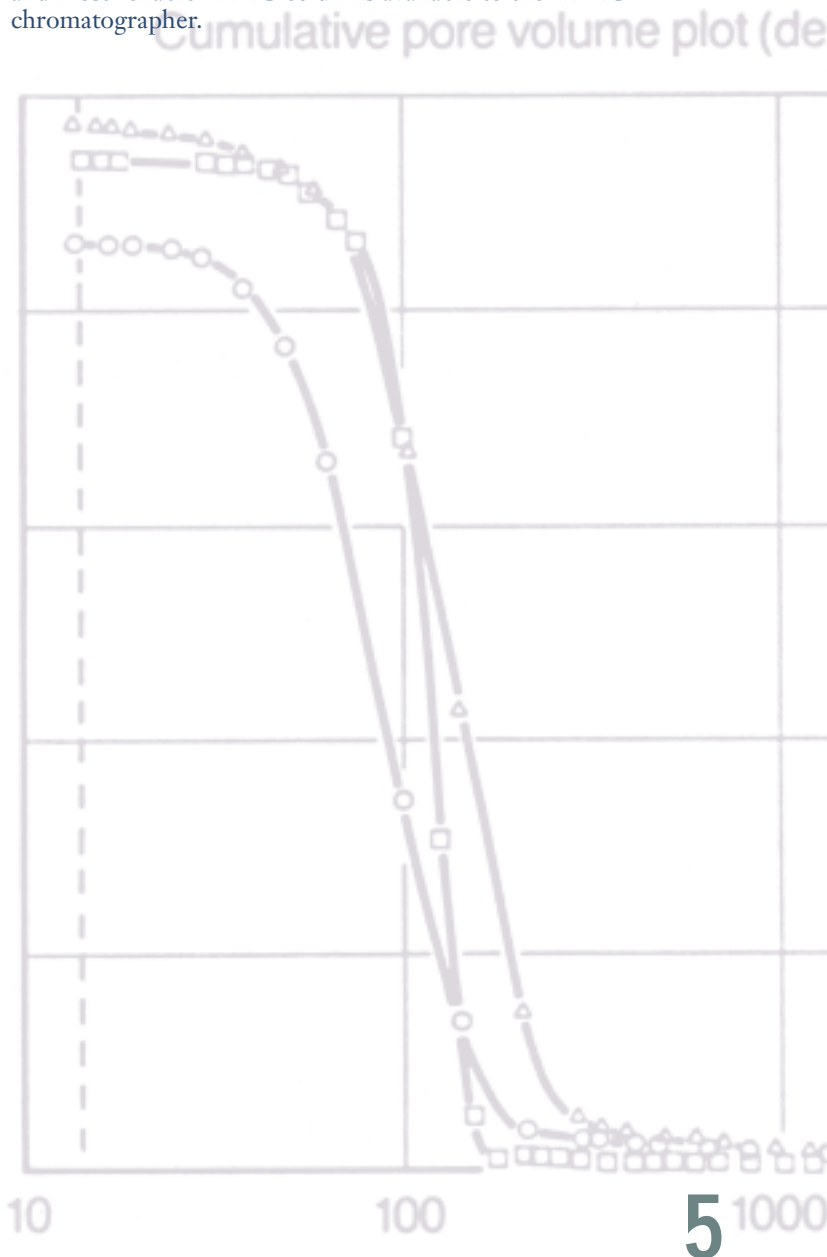
## Testing

At ES Industries every step of our column production sequence is strictly monitored and controlled by an extensive battery of tests. These tests are applied at each step including silica particle formation, bonding reagents and reactions, column hardware, and packing. These tests ensure the quality of the final product with each assay designed to measure a customer-critical parameter.

The final batch test for each product is carefully designed and tailored to test the performance standard set for each phase. In addition to batch testing, each column is tested individually to check the integrity and performance of the packed bed.

## Guaranteed Performance

Every ES Industries column is guaranteed to deliver the highest plate counts and most symmetrical peaks for even the most difficult analysis. We are confident that our Quality Focus Program will deliver the highest quality and most reliable HPLC columns available to the HPLC chromatographer.



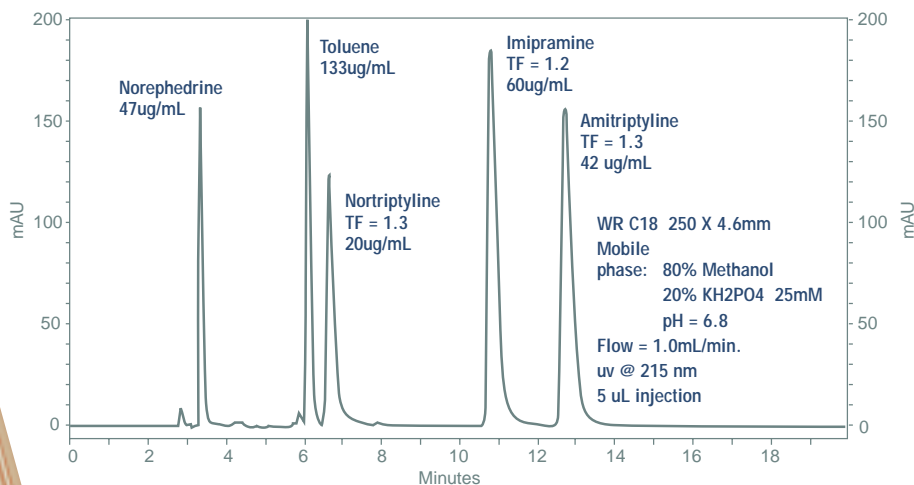
# Chromegabond® WR (Wide Range)

- ◆ *Specially Deactivated to Produce Superior Peak Shapes for Amines and Acids*
- ◆ *The Ultimate in C4, C8, and C18 HPLC Column Technology*
- ◆ *Maximum Performance and Reproducibility Delivered by Superior QC Testing*
- ◆ *Validated Sets Available for Method Validation*

Chromegabond WR (Wide Range) is specially deactivated to produce superior peak shapes for amines and acids. Chromegabond WR superior performance is the result of a multistep process beginning with ultra pure synthetically produced spherical silica. This synthetic silica is manufactured using ultra pure metal free reagents. The resultant particles are carefully analyzed to ensure that their metal-free properties are completely maintained. The ultra-pure silica particles are then fully hydroxylated before they undergo an extensive

bonding of either monomeric C4, C8 or C18 alkyl chains, using our proprietary bonding procedures. The bonded particles are then exhaustively endcapped to react any remaining silanol groups. Our proprietary endcapping reagents and procedures yield columns that are much more resistant to degradation by acidic and basic mobile phase compositions, while improving peak shapes for amines and acids.

Call **1-800-356-6140** for more information and a Technical Reprint of ***“Evaluating the Chromatographic Test Procedures for Base Deactivated HPLC Columns.”***



All dimensions and lengths available for microbore  
1.0 mm, semi-preparative, preparative,  
specialty sizes, and threaded modular column.  
Please Call for More Information.

# Quality Focus

A key to the maximum performance and reproducibility of Chromegabond WR is the strict quality control parameters applied to the finished columns. Every batch of Chromegabond WR encounters a battery of QC tests. These QC protocols are designed to test the critical performance parameters for Chromegabond WR. Test Probes look for undesirable interactions for amines, acids, and metals. In addition, tests focus on reproducibility by careful measurements of relative retention time, tailing factors, resolution factors, and plate counts.

Because rigorous test conditions have been established, the HPLC chromatographer can be confident that Chromegabond WR delivers superior base deactivation batch to batch, and column to column.

For example, every Chromegabond WR batch is tested with a series of tricyclic antidepressants (Nortriptyline, imipramine and amitriptyline) using a pH=6.8 mobile phase. Tricyclic antidepressants are excellent probes to ensure that the columns have been base deactivated to the fullest extent. The tricyclic antidepressants have a combination of unique properties making them ideally suited as test probes. These compounds contain strong amine groups and possess enough hydrophobic character to enable the molecules to interact completely with the stationary phase. This complete interaction assures the total exposure of the tricyclic antidepressants to any remaining silanol groups. In addition, the pH=6.8 mobile phase, used for the test, also assures the complete exposure of the test probes to residual silanol groups.

The complete base deactivation for Chromegabond WR series delivers unmatched performance for a variety of challenging applications. Chromegabond WR affords the analytical chemist unsurpassed flexibility in methods development, quality control, and LC/MS applications.

| Description | Particle Size (µ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Standard-bore (4.0 mm) | Small-bore (3.2 mm) | Small-bore (2.0 mm) |
|-------------|-------------------|-------------|-------------|------------------------|------------------------|---------------------|---------------------|
| WR-C4       | 3                 | 120         | 50          | 115191-WR-C4           | 114191-WR-C4           | 11d191-WR-C4        | 112191-WR-C4        |
| WR-C4       | 3                 | 120         | 100         | 125191-WR-C4           | 124191-WR-C4           | 12d191-WR-C4        | 122191-WR-C4        |
| WR-C4       | 3                 | 120         | 150         | 135191-WR-C4           | 134191-WR-C4           | 13d191-WR-C4        | 132191-WR-C4        |
| WR-C4       | 5                 | 120         | 50          | 115291-WR-C4           | 114291-WR-C4           | 11d291-WR-C4        | 112291-WR-C4        |
| WR-C4       | 5                 | 120         | 100         | 125291-WR-C4           | 124291-WR-C4           | 12d291-WR-C4        | 122291-WR-C4        |
| WR-C4       | 5                 | 120         | 150         | 135291-WR-C4           | 134291-WR-C4           | 13d291-WR-C4        | 132291-WR-C4        |
| WR-C4       | 5                 | 120         | 250         | 155291-WR-C4           | 154291-WR-C4           | 15d291-WR-C4        | 152291-WR-C4        |
| WR-C4       | 5                 | 120         | 300         | 165291-WR-C4           | 164291-WR-C4           | 16d291-WR-C4        | 162291-WR-C4        |
| WR-C8       | 3                 | 120         | 50          | 115191-WR-C8           | 114191-WR-C8           | 11d191-WR-C8        | 112191-WR-C8        |
| WR-C8       | 3                 | 120         | 100         | 125191-WR-C8           | 124191-WR-C8           | 12d191-WR-C8        | 122191-WR-C8        |
| WR-C8       | 3                 | 120         | 150         | 135191-WR-C8           | 134191-WR-C8           | 13d191-WR-C8        | 132191-WR-C8        |
| WR-C8       | 5                 | 120         | 50          | 115291-WR-C8           | 114291-WR-C8           | 11d291-WR-C8        | 112291-WR-C8        |
| WR-C8       | 5                 | 120         | 100         | 125291-WR-C8           | 124291-WR-C8           | 12d291-WR-C8        | 122291-WR-C8        |
| WR-C8       | 5                 | 120         | 150         | 135291-WR-C8           | 134291-WR-C8           | 13d291-WR-C8        | 132291-WR-C8        |
| WR-C8       | 5                 | 120         | 250         | 155291-WR-C8           | 154291-WR-C8           | 15d291-WR-C8        | 152291-WR-C8        |
| WR-C8       | 5                 | 120         | 300         | 165291-WR-C8           | 164291-WR-C8           | 16d291-WR-C8        | 162291-WR-C8        |
| WR-C18      | 3                 | 120         | 50          | 115191-WR-C18          | 114191-WR-C18          | 11d191-WR-C18       | 112191-WR-C18       |
| WR-C18      | 3                 | 120         | 100         | 125191-WR-C18          | 124191-WR-C18          | 12d191-WR-C18       | 122191-WR-C18       |
| WR-C18      | 3                 | 120         | 150         | 135191-WR-C18          | 134191-WR-C18          | 13d191-WR-C18       | 132191-WR-C18       |
| WR-C18      | 5                 | 120         | 50          | 115291-WR-C18          | 114291-WR-C18          | 11d291-WR-C18       | 112291-WR-C18       |
| WR-C18      | 5                 | 120         | 100         | 125291-WR-C18          | 124291-WR-C18          | 12d291-WR-C18       | 122291-WR-C18       |
| WR-C18      | 5                 | 120         | 150         | 135291-WR-C18          | 134291-WR-C18          | 13d291-WR-C18       | 132291-WR-C18       |
| WR-C18      | 5                 | 120         | 250         | 155291-WR-C18          | 154291-WR-C18          | 15d291-WR-C18       | 152291-WR-C18       |
| WR-C18      | 5                 | 120         | 300         | 165291-WR-C18          | 164291-WR-C18          | 16d291-WR-C18       | 162291-WR-C18       |





# AquaSep™

- ◆ *The Best In "Phase Collapse" Resistant HPLC Column Technology Currently Available*
- ◆ *Chromatograph Polar Compounds*
- ◆ *No Ion-Pairing Reagents Required for Highly Polar Compounds*
- ◆ *Rapid Re-Equilibration with Gradients*
- ◆ *Patented Single Step Bonding*
- ◆ *Performance with Highly Aqueous Mobile Phases Guaranteed by Relevant QC Testing*

AquaSep is the clear choice for the discriminating HPLC chromatographer faced with a difficult separation challenge such as polar compounds, compounds requiring a highly aqueous mobile phase or difficult to retain compounds. The AquaSep phase has been specially developed using patented technology for use with highly aqueous mobile phases, including 100% aqueous. Our unique patented approach provides a complete solution to ensure that AquaSep is totally resistant to "phase collapse" under all mobile phase conditions.

ES Industries has conducted extensive research to gain a fundamental insight into the "phase collapse" phenomenon. Our research has uncovered the key fundamental mechanism to explain and ultimately prevent "phase collapse". The key facet to the mechanism is the relationship between mobile phase operating pressure and surface wettability of the bonded phase/silica particle. Other column designs have been tried, with limited success, to prevent "phase collapse" from occurring. One of these approaches requires the use of a hydrophilic endcapping after the initial alkyl chain bonding. This approach falls short in two major areas. First, it requires a two-step bonding sequence, which subjects the final product to increased variability that can seriously jeopardize the reliability of HPLC methods. Secondly, the hydrophilic

endcapping can be easily damaged by the mobile phase which can considerably shorten column life and lead to unacceptable poor performance for routine chromatographic methods. Given these two major limitations we did not pursue the development of any hydrophilic endcapping approach in the development of a "phase collapse" resistant product.

AquaSep, "phase collapse" resistant phase is the result of patented single step bonded silane. The single step bonding procedure minimizes variation and eliminates column damage from the mobile phase.

Our patented silane allows the bonded alkyl chains to remain fully extended in the mobile phase even under highly aqueous conditions. To obtain high aqueous stability and maximum hydrophobic interaction AquaSep relies on our specially developed silane which is bonded to ultra high purity synthetically produced spherical silica. This silane contains an ether linkage placed near the point of attachment to the silica base particle. This ether group is polar enough to allow water to penetrate and hydrate the silica surface preventing the self association of the hydrophobic alkyl chains. This layer of hydration permits the maximum interaction of the alkyl chains with the analytes of interest and prevents any phase collapse.

For more information please call **1-800-356-6140** for a Technical Reprint of ***"Reverse Phase HPLC Columns for Highly Aqueous Mobile Phases: A Solution to the Phase Collapse Challenge."***

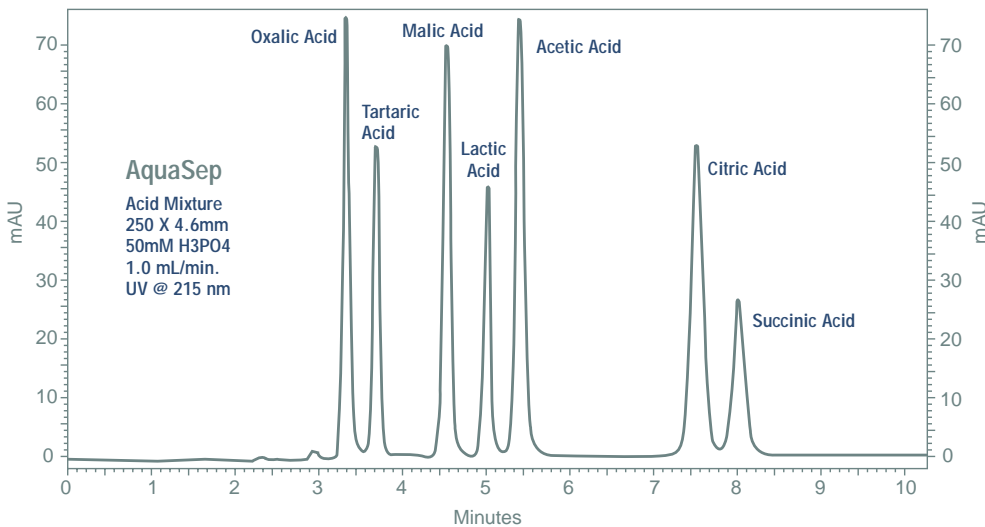


All dimensions and lengths available for microbore  
 1.0 mm, semi-preparative, preparative,  
 specialty sizes, and threaded modular column.  
 Please Call for More Information.

# Quality Focus

AquaSep is the best performing aqueous stable phase available commercially. Its performance is the result of a combination of superior technology and strict quality control. AquaSep's unique performance qualities require a special set of chromatographic test probes. The conventional test probes such as toluene and naphthalene fail to adequately test the stability of the phase under highly aqueous mobile phase conditions. The complete quality testing of AquaSep includes a test specifically designed to check performance using 100% aqueous

mobile phase. For this test we have selected a series of low molecular weight acids that are difficult to retain and separate on conventional ODS stationary phases. These acids are extremely useful probes to test for variations due to bonding deficiencies and contamination. In addition, the acids actual test the integrity of the phase under 100% aqueous mobile conditions. Chromatographers can be confident that every AquaSep column purchased is thoroughly tested and will not undergo "phase collapse" even when exposed to 100% aqueous mobile phase for an extended period of time.



| Description | Particle Size (µ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Standard-bore (4.0 mm) | Small-bore (3.2 mm) | Small-bore (2.0 mm) |
|-------------|-------------------|-------------|-------------|------------------------|------------------------|---------------------|---------------------|
| AquaSep     | 3                 | 100         | 50          | 115121-AQS             | 114121-AQS             | 11d121-AQS          | 112121-AQS          |
| AquaSep     | 3                 | 100         | 100         | 125121-AQS             | 124121-AQS             | 12d121-AQS          | 122121-AQS          |
| AquaSep     | 3                 | 100         | 150         | 135121-AQS             | 134121-AQS             | 13d121-AQS          | 132121-AQS          |
| AquaSep     | 5                 | 100         | 50          | 115221-AQS             | 114221-AQS             | 11d221-AQS          | 112221-AQS          |
| AquaSep     | 5                 | 100         | 100         | 125221-AQS             | 124221-AQS             | 12d221-AQS          | 122221-AQS          |
| AquaSep     | 5                 | 100         | 150         | 135221-AQS             | 134221-AQS             | 13d221-AQS          | 132221-AQS          |
| AquaSep     | 5                 | 100         | 250         | 155221-AQS             | 134221-AQS             | 15d221-AQS          | 152221-AQS          |

The image features a large, semi-transparent orange HPLC column with a hexagonal nut at the top and bottom, and a thin, clear tube extending from the top. In the background, there is a collage of laboratory glassware, including a large Erlenmeyer flask with a stopper, a smaller Erlenmeyer flask, and a beaker, all containing liquids of various colors (yellow, clear, white). The background is a dark blue gradient.

## Chromegabond® ODS-PI

- ◆ *Unique Polar Imbedded Interaction*
- ◆ *Alternative to Conventional ODS Technology*
- ◆ *Newly Developed Polar Imbedded ODS Column*
- ◆ *Shortened Analysis Times*
- ◆ *The Consistency of the Polar Imbedded Interaction Assured by Specifically Designed QC Tests*

Chromegabond ODS-PI (Polar Imbedded) is the newest stationary phase to result from ES Industries extensive research programs.

It is a truly unique product that demonstrates our commitment to innovative HPLC stationary phase development.

Chromegabond ODS-PI delivers unmatched base deactivated performance for the analysis of amine containing compounds.

Chromegabond ODS-PI incorporates ureide polar imbedded technology that results in a reproducible, highly base deactivated pH stable phase. It is produced by a single step bonding approach and avoids all the difficulties faced by amide based polar imbedded columns which suffer poor pH stability and undesirable interaction with acids.

Chromegabond ODS-PI, however, does maintain the hydrophilic character displayed by many polar imbedded phases. Typical ODS stationary phases rely on hydrophobic interactions as their primary mode of separation which are virtually nonselective and lend almost no assistance in difficult separations. The hydrophilic nature of Chromegabond ODS-PI offers the chromatographer a selective tool for separation of difficult to resolve compounds.

For more information please call **1-800-356-6140** for a Technical Reprint of ***"Evaluation and Application of Amide Carbamate Linked Stationary Phases for Reversed-Phase HPLC."***

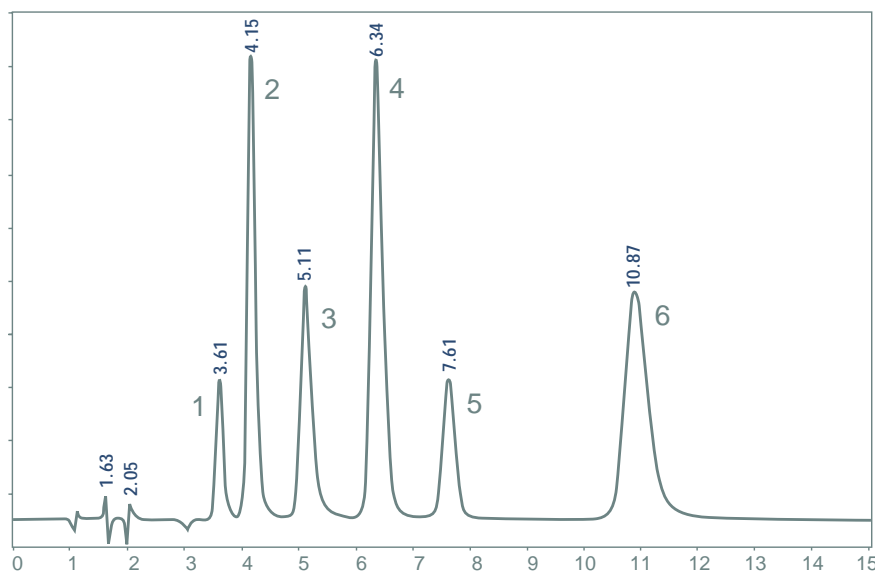
All dimensions and lengths available for microbore  
 1.0 mm, semi-preparative, preparative,  
 specialty sizes, and threaded modular column.  
 Please Call for More Information.

# Quality Focus

Chromegabond® ODS-PI columns are subjected to a battery of tests to ensure that they deliver the best possible performance. These columns are tested with a series of tricyclic antidepressants using a pH=6.8 mobile phase. Tricyclic antidepressants are excellent probes to ensure that the columns have been base deactivated to the fullest extent. Tricyclic antidepressants contain strong amine groups, which are extremely sensitive to exposed silanol.

The unique hydrophilic nature of Chromegabond ODS-PI, however, required the development of additional test probes and new test conditions.

These test probes and conditions would have to be sensitive to the unique hydrophilic interaction of the stationary phase. To accomplish this, we selected a mixture of compounds which are extremely polar and sensitive to any hydrophilic variation in the Chromegabond ODS-PI columns. Chromatographers that rely on the hydrophilic interaction to accomplish their specific separation can be confident that Chromegabond ODS-PI will perform consistently column to column and batch to batch. We have subjected the columns to strict quality control parameters which carefully take into account the unique interaction and selectivity.



### Chromegabond® ODS-PI

#### Caffeine Metabolites

Mobile Phase: 1:7:93 AcOH:MeOH:H<sub>2</sub>O  
 Flow Rate: 1.0 mL/min.  
 Detector: UV at 254 nm  
 Backpressure: 100 bar

- Test Compounds:
1. 3-Methylaniline
  2. Theobromine
  3. 1,3-Dimethyl uric acid
  4. 1,7-Dimethylxanthine
  5. Theophylline
  6. 1,7-Dimethyluric acid

| Description | Particle Size (µ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Standard-bore (4.0 mm) | Small-bore (3.2 mm) | Small-bore (2.0 mm) |
|-------------|-------------------|-------------|-------------|------------------------|------------------------|---------------------|---------------------|
| ODS-PI      | 3                 | 120         | 50          | 115191-ODS-PI          | 114191-ODS-PI          | 11d191-ODS-PI       | 112191-ODS-PI       |
| ODS-PI      | 3                 | 120         | 100         | 125191-ODS-PI          | 124191-ODS-PI          | 12d191-ODS-PI       | 122191-ODS-PI       |
| ODS-PI      | 3                 | 120         | 150         | 135191-ODS-PI          | 134191-ODS-PI          | 13d191-ODS-PI       | 132191-ODS-PI       |
| ODS-PI      | 5                 | 120         | 50          | 115291-ODS-PI          | 114291-ODS-PI          | 11d291-ODS-PI       | 112291-ODS-PI       |
| ODS-PI      | 5                 | 120         | 100         | 125291-ODS-PI          | 124291-ODS-PI          | 12d291-ODS-PI       | 122291-ODS-PI       |
| ODS-PI      | 5                 | 120         | 150         | 135291-ODS-PI          | 134291-ODS-PI          | 13d291-ODS-PI       | 132291-ODS-PI       |
| ODS-PI      | 5                 | 120         | 250         | 155291-ODS-PI          | 154291-ODS-PI          | 15d291-ODS-PI       | 152291-ODS-PI       |
| ODS-PI      | 5                 | 120         | 300         | 165291-ODS-PI          | 164291-ODS-PI          | 16d291-ODS-PI       | 162291-ODS-PI       |





## MacroSep<sup>®</sup>

- ◆ *Wide Pore Surface for the Analysis of Proteins and Peptides*
- ◆ *Ultra-High Purity Metal Free Silica*
- ◆ *State-of-the-Art Base Deactivation to Ensure Superior Recoveries of Proteins and Peptides*
- ◆ *Columns Manufactured Under Strict QC Requirements Using Testing Protocols Designed by Bioanalytical Chromatographers*

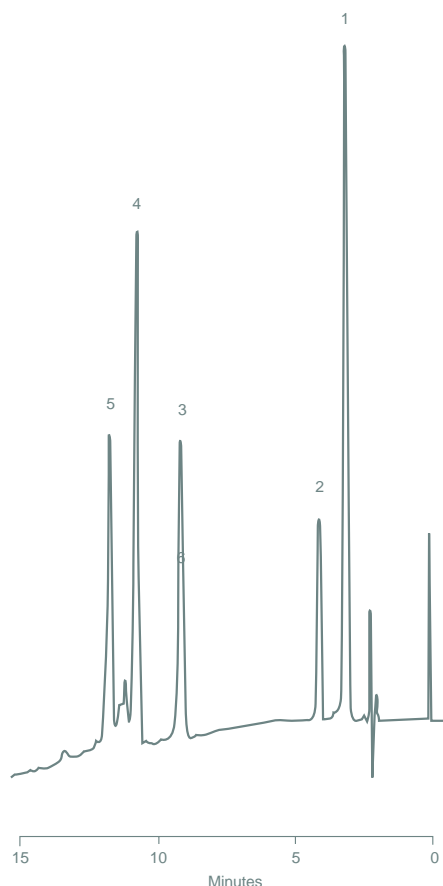
ES Industries has developed a new line of wide pore columns to provide the bioanalytical chromatographer with a highly efficient state-of-the-art base deactivated wide pore HPLC column. The MacroSep line is based upon ultra-high purity metal free silica containing highly controlled pores of 300Å diameter. This column technology is a superior tool for the analysis of proteins, peptides, and other biomolecules.

To enable flexibility for method development and QC applications, we offer five types of phases for the MacroSep series including C4, C8, C18, AQS and Cyano.

All dimensions and lengths available for microbore  
1.0 mm, semi-preparative, preparative,  
specialty sizes, and threaded modular column.  
Please Call for More Information.

# Quality Focus

All of the MacroSep® phases undergo extensive QC testing to ensure consistent column to column performance. Tightly controlled pore size and particle size distribution lead to extremely durable columns with low back pressure and long lifetimes. Our ultra-high purity silica is carefully analyzed to ensure that it remains free from any metal contamination through the entire manufacturing process. All columns are manufactured under strict QC requirements using test procedures and protocols designed by bioanalytical chromatographers.



## MacroSep C4

MacroSep C4 consists of butyl aliphatic groups bonded to the surface of 300Å pore diameter ultra-high purity silica. MacroSep C4 can be used to separate glycoproteins, hemoglobin variants, human growth hormone, and membrane proteins.

### MacroSep®

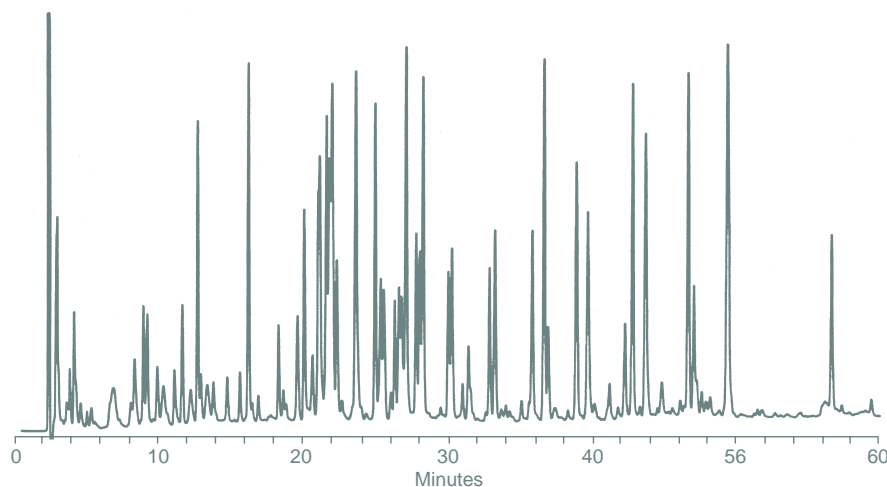
|                       |  |    |
|-----------------------|--|----|
| Peptides              |  |    |
| Column:               | MacroSep C4, 300A,                     |    |
|                       | 5u 15cm X 4.6mm                        |    |
| Flow Rate:            | 1 mL/min                               |    |
| Temperature:          | 23°C                                   |    |
| Mobile phase Program: | A - 0.1% TFA                           |    |
|                       | B - 90/10 CH3CN/H2O, 0.1% TFA          |    |
| Time(min)             | %A                                     | %B |
| 0                     | 75                                     | 25 |
| 20                    | 50                                     | 50 |
| 25                    | 75                                     | 25 |
| Detection:            | UV -210nm x 1.0AUF                     |    |
| Injection Volume:     | 20uL                                   |    |
| Sample:               | 1. Bradykinin                          |    |
|                       | 2. Leucine Enkephalin                  |    |
|                       | 3. Renin Substrate<br>Tetradecapeptide |    |
|                       | 4. Insulin                             |    |
|                       | 5. Insulin chain B                     |    |

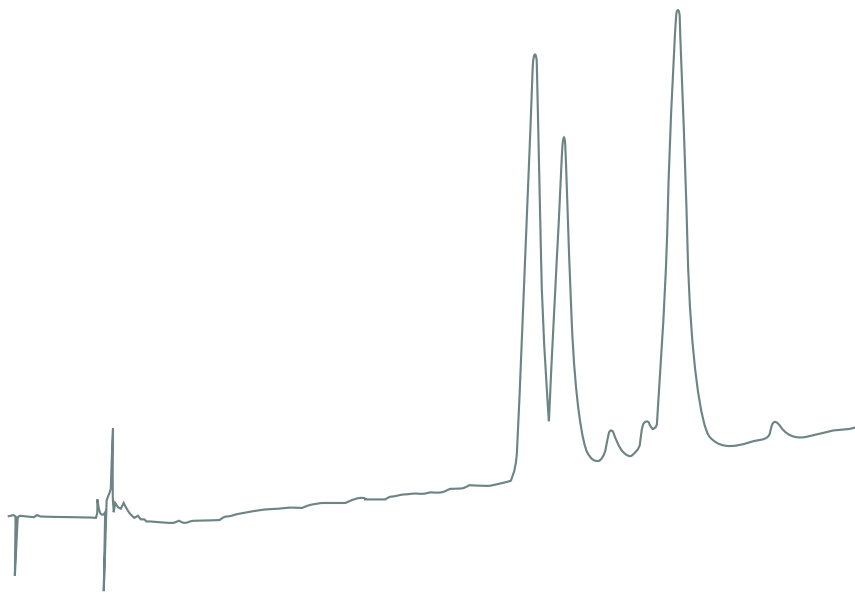
## MacroSep C8

MacroSep C8 consists of n-octyl aliphatic groups bonded to the surface of 300Å pore diameter ultra-high purity silica. MacroSep C8 can be used to separate peptides and enzymatic digest fragments.

### Tryptic Digest Fragments

|               |  |              |
|---------------|--|--------------|
| Column:       | MacroSep C8                                | 15cm X 4.6mm |
| Mobile phase: | Linear Gradient, 2-62%B in 70 min.         |              |
|               | A = 0.1% TFA in Water                      |              |
|               | B = 0.1% TFA in 805 Acetonitrile/205 Water |              |
| Sample:       | 50 pmol of BSA digest in 4M urea           |              |
| Temperature:  | 50°C                                       |              |
| Flow Rate:    | 1 mL/min.                                  |              |



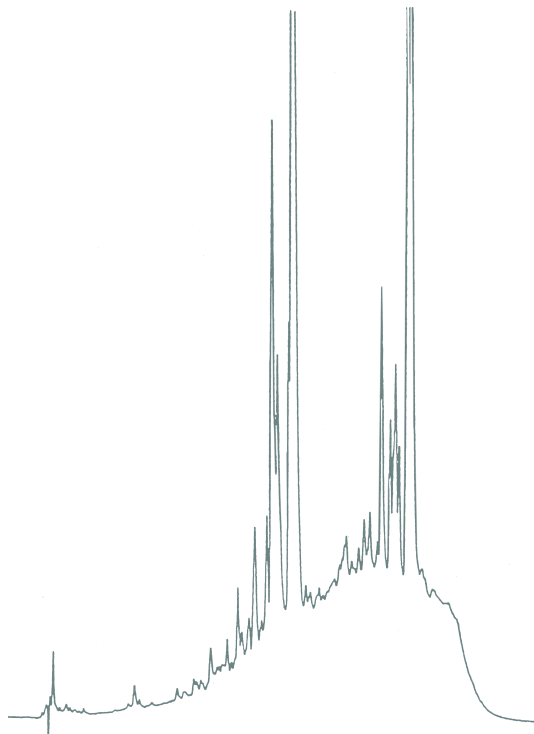


## MacroSep® C18

MacroSep C18 consists of n-octadecyl aliphatic groups bonded to the surface of 300Å pore diameter ultra-high purity silica. MacroSep C18 can be used to separate small polypeptides, tryptic digests, synthetic peptides, and natural peptides.

### Insulins

|            |                                 |
|------------|---------------------------------|
| Column:    | 250 x 4.6mm                     |
| Eluent A:  | Water/0.1% TFA                  |
| Flowrate:  | 1ml/min                         |
| Packing:   | MacroSep C18                    |
| Eluent B:  | MeCN/0.1% TFA                   |
| Sample:    | Bovine, Ovine, Porcine Insulins |
| Gradient:  | 30 to 33% B in 25 min           |
| Detection: | UV at 230 nm, 0.1 AuFS          |



## MacroSep (AQS)

MacroSep AQS consists of ether linked aliphatic groups bonded to the surface of 300Å pore diameter ultra-high purity silica. MacroSep AQS is phase collapse resistant with highly aqueous mobile phases. MacroSep AQS can be used to separate glyco-proteins, peptides, tryptic digests, and hemoglobin variants.

### Separation of Bacitracin

|            |                             |
|------------|-----------------------------|
| Column:    | 250 x 4.6mm                 |
| Eluent:    | Water/0.1% TFA              |
| Flowrate:  | 1ml/min                     |
| Packing:   | MacroSep AQS                |
| Eluent B:  | MeCN/0.1% TFA               |
| Sample:    | 4ul 25% Bacitracin solution |
| Gradient:  | 20%B to 50%B in 20 min      |
| Detection: | UV at 230 nm. 0.5 AUFS      |

## MacroSep High Protein Recovery (HPR)

MacroSep HPR consists of specially produced perfluorinated aliphatic groups bonded to the surface of 300Å pore diameter ultra-high purity silica. MacroSep HPR is specially engineered for analysis of hydrophobic proteins. MacroSep HPR can be used to separate large hydrophobic proteins, lipid peptides, polypeptide with aliphatic side chains and membrane-spanning peptides.



All dimensions and lengths available for microbore  
 1.0 mm, semi-preparative, preparative,  
 specialty sizes, and threaded modular column.  
 Please Call for More Information.

| Description    | Particle Size (μ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Small-bore (2.0 mm) | All Peek Standard-bore (4.6 mm) | All Peek Small-bore (2.0 mm) |
|----------------|-------------------|-------------|-------------|------------------------|---------------------|---------------------------------|------------------------------|
| MacroSep C4    | 3                 | 300         | 50          | 115131-MSP-C4          | 112131-MSP-C4       | BC15131-MSP-C4                  | BC12131-MSP-C4               |
| MacroSep C4    | 3                 | 300         | 100         | 125131-MSP-C4          | 122131-MSP-C4       | BC25131-MSP-C4                  | BC22131-MSP-C4               |
| MacroSep C4    | 3                 | 300         | 150         | 135131-MSP-C4          | 132131-MSP-C4       | BC35131-MSP-C4                  | BC32131-MSP-C4               |
| MacroSep C4    | 5                 | 300         | 50          | 115231-MSP-C4          | 112231-MSP-C4       | BC15231-MSP-C4                  | BC12231-MSP-C4               |
| MacroSep C4    | 5                 | 300         | 100         | 125231-MSP-C4          | 122231-MSP-C4       | BC25231-MSP-C4                  | BC22231-MSP-C4               |
| MacroSep C4    | 5                 | 300         | 150         | 135231-MSP-C4          | 132231-MSP-C4       | BC35231-MSP-C4                  | BC32231-MSP-C4               |
| MacroSep C4    | 5                 | 300         | 250         | 155231-MSP-C4          | 152231-MSP-C4       | BC55231-MSP-C4                  | BC52231-MSP-C4               |
| MacroSep C4    | 5                 | 300         | 300         | 165231-MSP-C4          | 162231-MSP-C4       | BC65231-MSP-C4                  | BC62231-MSP-C4               |
| MacroSep C8    | 3                 | 300         | 50          | 115131-MSP-C8          | 112131-MSP-C8       | BC15131-MSP-C8                  | BC12131-MSP-C8               |
| MacroSep C8    | 3                 | 300         | 100         | 125131-MSP-C8          | 122131-MSP-C8       | BC25131-MSP-C8                  | BC22131-MSP-C8               |
| MacroSep C8    | 3                 | 300         | 150         | 135131-MSP-C8          | 132131-MSP-C8       | BC35131-MSP-C8                  | BC32131-MSP-C8               |
| MacroSep C8    | 5                 | 300         | 50          | 115231-MSP-C8          | 112231-MSP-C8       | BC15231-MSP-C8                  | BC12231-MSP-C8               |
| MacroSep C8    | 5                 | 300         | 100         | 125231-MSP-C8          | 122231-MSP-C8       | BC25231-MSP-C8                  | BC22231-MSP-C8               |
| MacroSep C8    | 5                 | 300         | 150         | 135231-MSP-C8          | 132231-MSP-C8       | BC35231-MSP-C8                  | BC32231-MSP-C8               |
| MacroSep C8    | 5                 | 300         | 250         | 155231-MSP-C8          | 152231-MSP-C8       | BC55231-MSP-C8                  | BC52231-MSP-C8               |
| MacroSep C8    | 5                 | 300         | 300         | 165231-MSP-C8          | 162231-MSP-C8       | BC65231-MSP-C8                  | BC62231-MSP-C8               |
| MacroSep C18   | 3                 | 300         | 50          | 115131-MSP-C18         | 112131-MSP-C18      | BC15131-MSP-C18                 | BC12131-MSP-C18              |
| MacroSep C18   | 3                 | 300         | 100         | 125131-MSP-C18         | 122131-MSP-C18      | BC25131-MSP-C18                 | BC22131-MSP-C18              |
| MacroSep C18   | 3                 | 300         | 150         | 135131-MSP-C18         | 132131-MSP-C18      | BC35131-MSP-C18                 | BC32131-MSP-C18              |
| MacroSep C18   | 5                 | 300         | 50          | 115231-MSP-C18         | 112231-MSP-C18      | BC15231-MSP-C18                 | BC12231-MSP-C18              |
| MacroSep C18   | 5                 | 300         | 100         | 125231-MSP-C18         | 122231-MSP-C18      | BC25231-MSP-C18                 | BC22231-MSP-C18              |
| MacroSep C18   | 5                 | 300         | 150         | 135231-MSP-C18         | 132231-MSP-C18      | BC35231-MSP-C18                 | BC32231-MSP-C18              |
| MacroSep C18   | 5                 | 300         | 250         | 155231-MSP-C18         | 152231-MSP-C18      | BC55231-MSP-C18                 | BC52231-MSP-C18              |
| MacroSep C18   | 5                 | 300         | 300         | 165231-MSP-C18         | 162231-MSP-C18      | BC65231-MSP-C18                 | BC62231-MSP-C18              |
| MacroSep AQS   | 3                 | 300         | 50          | 115131-MSP-AQS         | 112131-MSP-AQS      | BC15131-MSP-AQS                 | BC12131-MSP-AQS              |
| MacroSep AQS   | 3                 | 300         | 100         | 125131-MSP-AQS         | 122131-MSP-AQS      | BC25131-MSP-AQS                 | BC22131-MSP-AQS              |
| MacroSep AQS   | 3                 | 300         | 150         | 135131-MSP-AQS         | 132131-MSP-AQS      | BC35131-MSP-AQS                 | BC32131-MSP-AQS              |
| MacroSep AQS   | 3                 | 300         | 250         | 155131-MSP-AQS         | 152131-MSP-AQS      | BC55131-MSP-AQS                 | BC52131-MSP-AQS              |
| MacroSep AQS   | 5                 | 300         | 50          | 115231-MSP-AQS         | 112231-MSP-AQS      | BC15231-MSP-AQS                 | BC12231-MSP-AQS              |
| MacroSep AQS   | 5                 | 300         | 100         | 125231-MSP-AQS         | 122231-MSP-AQS      | BC25231-MSP-AQS                 | BC22231-MSP-AQS              |
| MacroSep AQS   | 5                 | 300         | 150         | 135231-MSP-AQS         | 132231-MSP-AQS      | BC35231-MSP-AQS                 | BC32231-MSP-AQS              |
| MacroSep AQS   | 5                 | 300         | 250         | 155231-MSP-AQS         | 152231-MSP-AQS      | BC55231-MSP-AQS                 | BC52231-MSP-AQS              |
| MacroSep Cyano | 3                 | 300         | 50          | 115131-MSP-CN          | 112131-MSP-CN       | BC15131-MSP-CN                  | BC12131-MSP-CN               |
| MacroSep Cyano | 3                 | 300         | 100         | 125131-MSP-CN          | 122131-MSP-CN       | BC25131-MSP-CN                  | BC22131-MSP-CN               |
| MacroSep Cyano | 3                 | 300         | 150         | 135131-MSP-CN          | 132131-MSP-CN       | BC35131-MSP-CN                  | BC32131-MSP-CN               |
| MacroSep Cyano | 5                 | 300         | 50          | 115231-MSP-CN          | 112231-MSP-CN       | BC15231-MSP-CN                  | BC12231-MSP-CN               |
| MacroSep Cyano | 5                 | 300         | 100         | 125231-MSP-CN          | 122231-MSP-CN       | BC25231-MSP-CN                  | BC22231-MSP-CN               |
| MacroSep Cyano | 5                 | 300         | 150         | 135231-MSP-CN          | 132231-MSP-CN       | BC35231-MSP-CN                  | BC32231-MSP-CN               |
| MacroSep Cyano | 5                 | 300         | 250         | 155231-MSP-CN          | 152231-MSP-CN       | BC55231-MSP-CN                  | BC52231-MSP-CN               |
| MacroSep HPR   | 3                 | 300         | 50          | 115131-MSP-HPR         | 112131-MSP-HPR      | BC15131-MSP-HPR                 | BC12131-MSP-HPR              |
| MacroSep HPR   | 3                 | 300         | 100         | 125131-MSP-HPR         | 122131-MSP-HPR      | BC25131-MSP-HPR                 | BC22131-MSP-HPR              |
| MacroSep HPR   | 3                 | 300         | 150         | 135131-MSP-HPR         | 132131-MSP-HPR      | BC35131-MSP-HPR                 | BC32131-MSP-HPR              |
| MacroSep HPR   | 5                 | 300         | 50          | 115231-MSP-HPR         | 112231-MSP-HPR      | BC15231-MSP-HPR                 | BC12231-MSP-HPR              |
| MacroSep HPR   | 5                 | 300         | 100         | 125231-MSP-HPR         | 122231-MSP-HPR      | BC25231-MSP-HPR                 | BC22231-MSP-HPR              |
| MacroSep HPR   | 5                 | 300         | 150         | 135231-MSP-HPR         | 132231-MSP-HPR      | BC35231-MSP-HPR                 | BC32231-MSP-HPR              |
| MacroSep HPR   | 5                 | 300         | 250         | 155231-MSP-HPR         | 152231-MSP-HPR      | BC55231-MSP-HPR                 | BC52231-MSP-HPR              |



## Chromegabond<sup>®</sup> FluoroSep-RP Phenyl (FSP)

- ◆ *Unique Reverse Phase Interaction*
- ◆ *Selectivity Alternative to C18*
- ◆ *Fluorinated to Enhance Interaction with Aromatics, Halogens, Conjugated Systems, and Epimers*
- ◆ *Produced Under Strict Quality Control Parameters to Assure the Finest Quality and Consistency*
- ◆ *Validated Sets Available for Method Validation*

Chromegabond FSP is a truly unique stationary phase with properties significantly different than ODS phases. This unique character results from bonded pentafluorophenyl groups imparting a pi-pi electron interaction which produces an enhanced retention for many compounds particularly those that contain polarizable electrons. Many classes of compounds contain polarizable electrons including halogenated compounds, aromatics, and conjugated systems.

Many naturally occurring chemicals also contain polarizable electrons and can be separated using Chromegabond FSP. Chromegabond FSP has been extremely useful in the separation of epimers. Epimers also exist in many natural mixtures such as pharmaceutically active natural taxol.

Chromegabond FSP is an excellent alternative to ODS Columns for the bulk characterization of pharmaceuticals. It can be a difficult task to uncover an impurity profile for a bulk pharmaceutical substance. Many of the impurities co-elute with the active compound on ODS columns and even major changes in mobile phase composition can fail to effect a separation. Chromegabond FSP because of its unique separation mechanism can often separate these impurities. In addition, impurities can be more definitively resolved thus improving quantification and reproducibility.

For more information please call **1-800-356-6140** for a Technical Reprint of ***"Perfluorinated Stationary Phases: A Powerful Tool For Method Development"*** and/or ***"Characterization of Bulk Pharmaceuticals Using Fluorinated Stationary Phases."***

All dimensions and lengths available for microbore  
1.0 mm, semi-preparative, preparative,  
specialty sizes, and threaded modular column.  
Please Call for More Information.

# Quality Focus

Traditionally columns that rely on selective mechanisms for separations have had a poor track record of consistent performance. Variations in component retention times, peak resolution factors, and elution profiles are unacceptable. These variations have rendered selective columns suspect and relegated them to a secondary role behind ODS columns. At ES Industries we are confident that

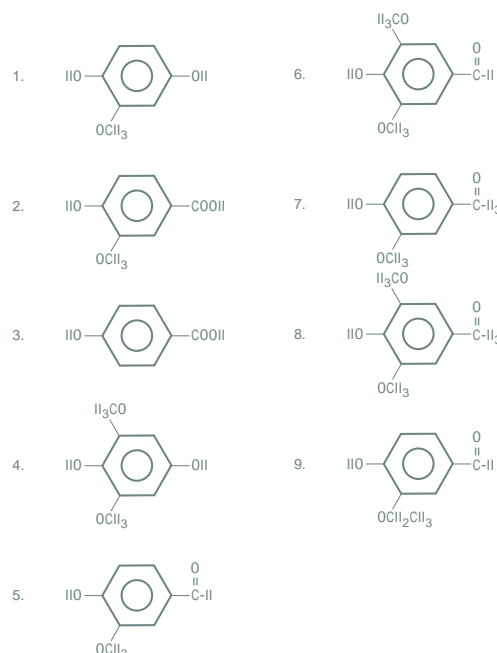
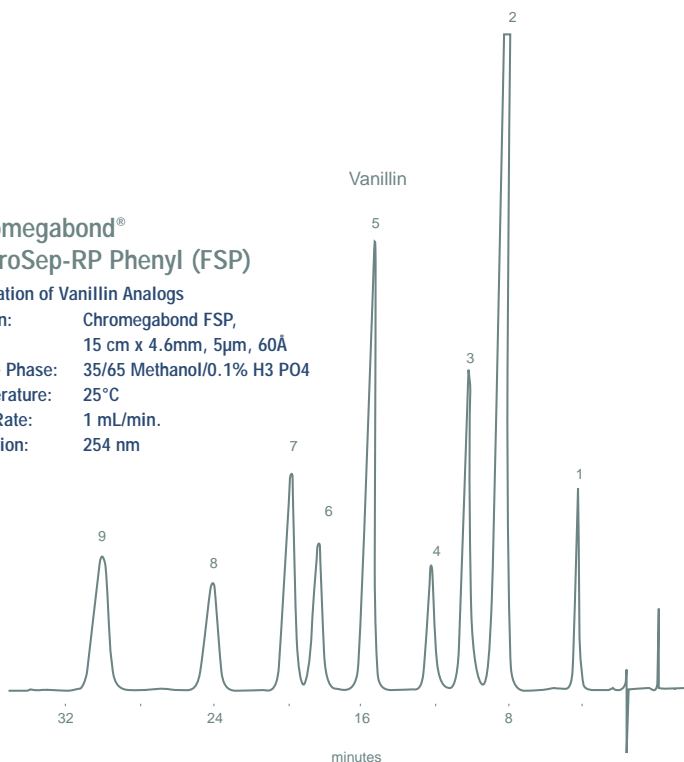
we have established reliable chemical bonding procedures utilizing the finest ultra-high pure silica available and a tightly controlled manufacturing process to deliver Chromegabond FSP columns that surpass the ruggedness, reliability, and reproducibility of any ODS type column available commercially. Production of Chromegabond FSP columns are carefully monitored with a quality control program specifically tailored

to its unique retention properties. The typical QC tests applied to ODS type columns are inadequate when applied to the super selective FSP columns. These tests simply rely on hydrophobic interactions making them insensitive to other retention mechanisms. At ES Industries we have developed specific criteria that utilize special test probes which are sensitive to pi-pi interactions and guarantee consistent separations.

## Chromegabond® FluoroSep-RP Phenyl (FSP)

Separation of Vanillin Analogs

column: Chromegabond FSP,  
15 cm x 4.6mm, 5µm, 60Å  
Onbile Phase: 35/65 Methanol/0.1% H3 PO4  
Temperature: 25°C  
Flow Rate: 1 mL/min.  
Detection: 254 nm



| Description        | Particle Size (µ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Standard-bore (4.0 mm) | Small-bore (3.2 mm) | Small-bore (2.0 mm) |
|--------------------|-------------------|-------------|-------------|------------------------|------------------------|---------------------|---------------------|
| Perfluorophenyl    | 3                 | 60          | 50          | 115111-FSP             | 114111-FSP             | 11d111-FSP          | 112111-FSP          |
| Perfluorophenyl    | 3                 | 60          | 100         | 125111-FSP             | 124111-FSP             | 12d111-FSP          | 122111-FSP          |
| Perfluorophenyl    | 3                 | 60          | 150         | 135111-FSP             | 134111-FSP             | 13d111-FSP          | 132111-FSP          |
| Perfluorophenyl    | 5                 | 60          | 50          | 115211-FSP             | 114211-FSP             | 11d211-FSP          | 112211-FSP          |
| Perfluorophenyl    | 5                 | 60          | 100         | 125211-FSP             | 124211-FSP             | 12d211-FSP          | 122211-FSP          |
| Perfluorophenyl    | 5                 | 60          | 150         | 135211-FSP             | 134211-FSP             | 13d211-FSP          | 132211-FSP          |
| Perfluorophenyl    | 5                 | 60          | 250         | 155211-FSP             | 154211-FSP             | 15d211-FSP          | 152211-FSP          |
| Perfluorophenyl HS | 3                 | 60          | 50          | 115111-FSP/HS          | 114111-FSP/HS          | 11d111-FSP/HS       | 112111-FSP/HS       |
| Perfluorophenyl HS | 3                 | 60          | 100         | 125111-FSP/HS          | 124111-FSP/HS          | 12d111-FSP/HS       | 122111-FSP/HS       |
| Perfluorophenyl HS | 3                 | 60          | 150         | 135111-FSP/HS          | 134111-FSP/HS          | 13d111-FSP/HS       | 132111-FSP/HS       |
| Perfluorophenyl HS | 5                 | 60          | 50          | 115211-FSP/HS          | 114211-FSP/HS          | 11d211-FSP/HS       | 112211-FSP/HS       |
| Perfluorophenyl HS | 5                 | 60          | 100         | 125211-FSP/HS          | 124211-FSP/HS          | 12d211-FSP/HS       | 122211-FSP/HS       |
| Perfluorophenyl HS | 5                 | 60          | 150         | 135211-FSP/HS          | 134211-FSP/HS          | 13d211-FSP/HS       | 132211-FSP/HS       |
| Perfluorophenyl HS | 5                 | 60          | 250         | 155211-FSP/HS          | 154211-FSP/HS          | 15d211-FSP/HS       | 152211-FSP/HS       |





## Chromegabond® LS

- ◆ *Designed for the Analysis of Lipophilic Compounds*
- ◆ *Useful for the Analysis of Fatty Soluble Vitamins, Aliphatic Surfactants, Aliphatic Fatty Acids, and Other Strongly Hydrophobic Compounds*
- ◆ *Reduces Analysis Time for Many Separations*
- ◆ *High Resolution Performance for Difficult Separations*
- ◆ *Improved Hydrolytic Stability*

Chromegabond LS (Lipophilic Separations) has been developed for analysis of lipophilic analytes such as fat-soluble vitamins, fatty acids, aliphatic pharmaceutical, and surfactants. The development of this new stationary phase evolved from our experience with fluorine based stationary phases. We discovered that many lipophilic compounds such as fat-soluble vitamins can be analyzed using reversed phase conditions on fluoro-phases. Using our knowledge of fluoro-aliphatic phase with a proprietary fluoro-endcapping. This new phase can produce chromatograms that are difficult to obtain on

conventional ODS stationary phases or with short-chain hydrocarbon phases.

Chromegabond LS is a versatile phase, not only for lipophilic compounds, but for many analysis where run times need to shorten. In numerous applications Chromegabond LS may shorten analysis time considerably without any loss in resolution. In addition, Chromegabond LS is an excellent alternative to short chain alkyl chains because of its superior hydrolytic stability.

For more information please call **1-800-356-6140** for a Technical Reprint of ***"A New Stationary Phase for the Reversed Phase HPLC Analysis of Highly Lipophilic Analytes."***

All dimensions and lengths available for microbore  
1.0 mm, semi-preparative, preparative,  
specialty sizes, and threaded modular column.  
Please Call for More Information.

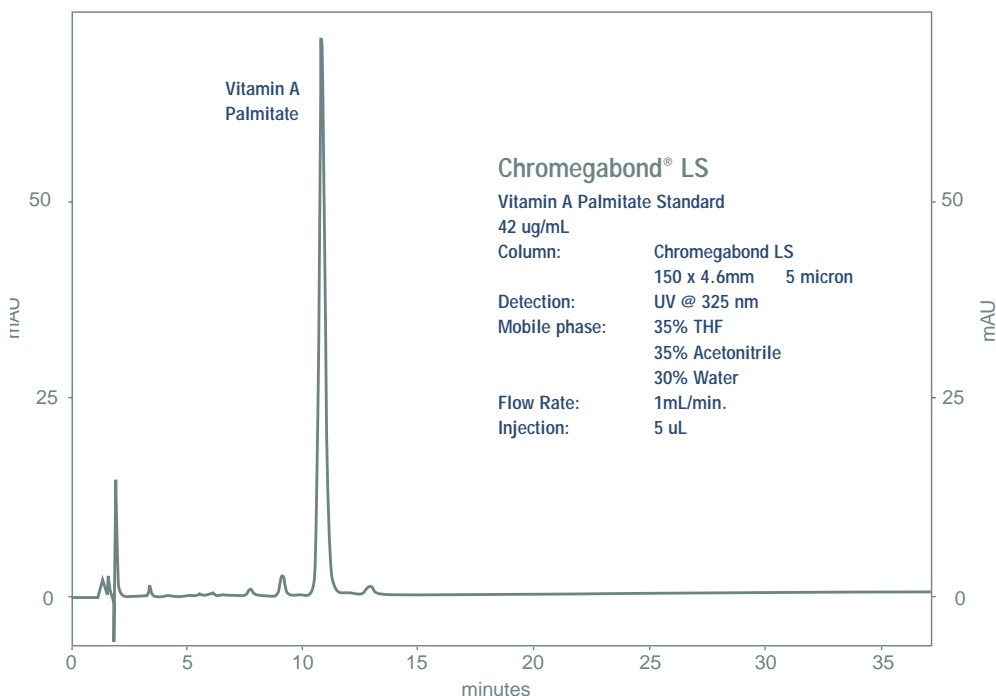
# Quality Focus

Given its unique retention behavior, Chromegabond® LS presents a real challenge for the design of relevant and meaningful quality control testing. Conventional test probes and mobile phase conditions would generate QC chromatograms with short retention times for test components. These short retention times would not allow for the full interaction of the test probe with the stationary phase and the underlying silica surface.

In addition, conventional tests would fail to adequately demonstrate the quality of the bonded phase.

To ensure the quality of Chromegabond LS columns we developed QC tests containing compounds that could interact extensively with the bonded phase. After an intensive investigation we determined that fat soluble vitamins such as vitamin A palmitate would provide the most reliable QC test performance. These fat soluble

vitamins interact completely with the Chromegabond LS phase and ensure that we are producing the highest quality phase possible. Chromegabond LS meets and exceeds the strict quality standards set for all ES Industries HPLC columns.



| Description | Particle Size (µ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Standard-bore (4.0 mm) | Small-bore (3.2 mm) | Small-bore (2.0 mm) |
|-------------|-------------------|-------------|-------------|------------------------|------------------------|---------------------|---------------------|
| LS          | 3                 | 180         | 50          | 115101-LS              | 114101-LS              | 11d101-LS           | 112101-LS           |
| LS          | 3                 | 180         | 100         | 125101-LS              | 124101-LS              | 12d101-LS           | 122101-LS           |
| LS          | 3                 | 180         | 150         | 135101-LS              | 134101-LS              | 13d101-LS           | 132101-LS           |
| LS          | 5                 | 180         | 50          | 115201-LS              | 114201-LS              | 11d201-LS           | 112201-LS           |
| LS          | 5                 | 180         | 100         | 125201-LS              | 124201-LS              | 12d201-LS           | 122201-LS           |
| LS          | 5                 | 180         | 150         | 135201-LS              | 134201-LS              | 13d201-LS           | 132201-LS           |
| LS          | 5                 | 180         | 250         | 155201-LS              | 154201-LS              | 15d201-LS           | 152201-LS           |
| LS/HS       | 3                 | 100         | 50          | 115121-LS/HS           | 114121-LS/HS           | 11d121-LS/HS        | 112121-LS/HS        |
| LS/HS       | 3                 | 100         | 100         | 125121-LS/HS           | 124121-LS/HS           | 12d121-LS/HS        | 122121-LS/HS        |
| LS/HS       | 3                 | 100         | 150         | 135121-LS/HS           | 134121-LS/HS           | 13d121-LS/HS        | 132121-LS/HS        |
| LS/HS       | 5                 | 100         | 50          | 115221-LS/HS           | 114221-LS/HS           | 11d221-LS/HS        | 112221-LS/HS        |
| LS/HS       | 5                 | 100         | 100         | 125221-LS/HS           | 124221-LS/HS           | 12d221-LS/HS        | 122221-LS/HS        |
| LS/HS       | 5                 | 100         | 150         | 135221-LS/HS           | 134221-LS/HS           | 13d221-LS/HS        | 132221-LS/HS        |
| LS/HS       | 5                 | 100         | 250         | 155221-LS/HS           | 154221-LS/HS           | 15d221-LS/HS        | 152221-LS/HS        |



## Chromegabond® BAS Cyano and BAS Phenyl

- ◆ *Enhanced pH Stability*
- ◆ *Excellent Retention of Polar Compounds*
- ◆ *Alternative Selectivity to C18*
- ◆ *Rapid Equilibration for Gradient Analysis*

Chromegabond BAS Cyano and Phenyl columns offer an alternative selectivity to conventional C8 and C18 columns. Both phase types are very useful for gradient applications due to their rapid equilibration characteristics. Both phenyl and cyano maintain retention for polar solutes while they decrease the retention of less polar solutes.

Chromegabond BAS Cyano is a versatile phase produced from a proprietary bonding process incorporating cyanopropyl monolayer. The proprietary process makes the Chromegabond BAS Cyano more resistant to degradation from acidic mobile phases. Cyano columns are typically used in application involving polar pharmaceuticals such as anticonvulsants and antimicrobials.

Chromegabond BAS Phenyl is an alternative to ODS phases and is particularly useful for the analysis of aromatic containing compounds. The unique selectivity for the Chromegabond BAS Phenyl phase is derived from an interaction of the pi-electrons found in the phenyl groups. These pi-electrons can enhance the selectivity of aromatic compounds through an induced polarization of electrons. A unique proprietary bonding process yields a phenyl phase with improved pH stability and increased reliability. Phenyl columns are typically used in applications involving pharmaceuticals such as analgesics and other aromatic compounds.

For more information please call **1-800-356-6140** for a Technical Reprint of "*A Highly Acid Resistant Cyano HPLC Phase.*"

All dimensions and lengths available for microbore  
 1.0 mm, semi-preparative, preparative,  
 specialty sizes, and threaded modular column.  
 Please Call for More Information.

# Quality Focus

Both Cyano and Phenyl columns require QC testing beyond the scope of routine ODS column testing. The mechanism of interaction and retention for both phases differ significantly from ODS type stationary phases.

At ES Industries we batch test all Chromegabond® BAS Cyano columns with a special mixture. The mixture contains polar compounds which are capable of showing minor variations in quality from batch to batch. Traditional testing is insensitive to variations with cyano phase.

All ES Industries Chromegabond BAS Phenyl Columns are batch tested with a mixture of aromatic hydrocarbons. These electron rich compounds are extremely sensitive to variations in phenyl stationary phases. Phenyl phases interact with electron rich compounds such as the aromatic hydrocarbons.

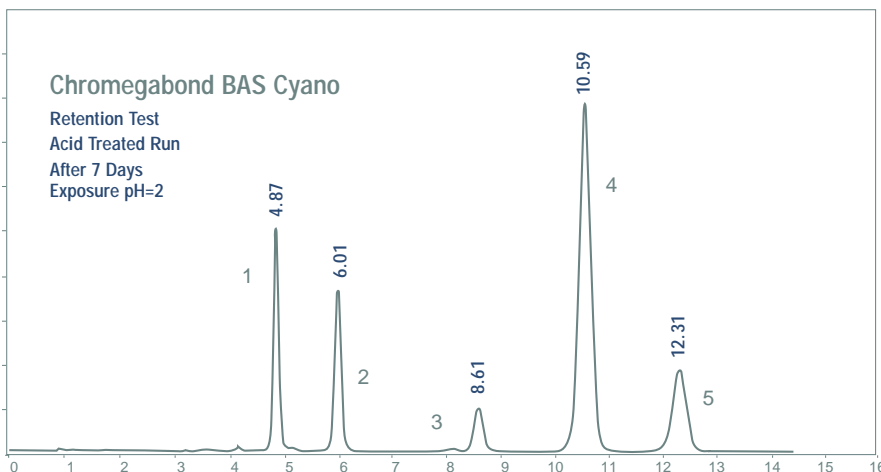
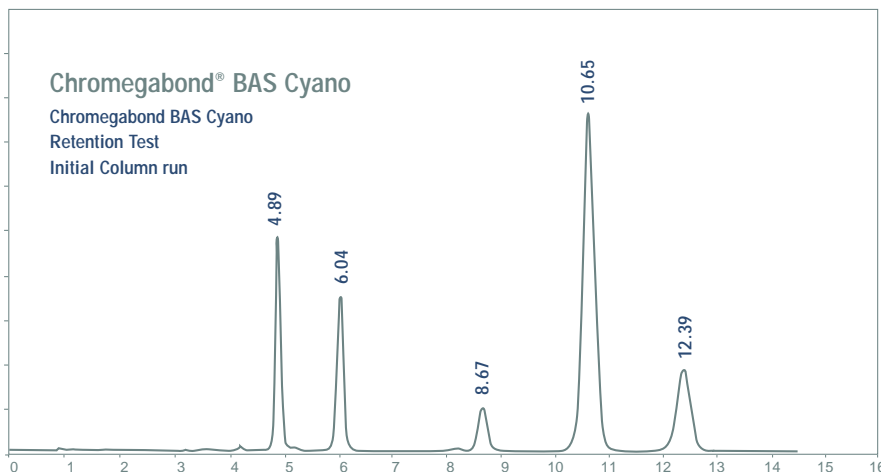
## Chromegabond BAS-Cyano

Reverse Phase QC Test

Mobile Phase: 60/40 Water/Acetonitrile 1.0 mL/min.

Detector: UV at 260 nm

- Sample:
1. Acetophenone
  2. Methyl benzoate
  3. Toluene
  4. Benzophenone
  5. Naphthalene



| Description | Particle Size (µ) | Pore Size-A | Length (mm) | Standard-bore (4.6 mm) | Standard-bore (4.0 mm) | Small-bore (3.2 mm) | Small-bore (2.0 mm) |
|-------------|-------------------|-------------|-------------|------------------------|------------------------|---------------------|---------------------|
| BAS-CN      | 3                 | 120         | 50          | 115191-BAS-CN          | 114191-BAS-CN          | 11d191-BAS-CN       | 112191-BAS-CN       |
| BAS-CN      | 3                 | 120         | 100         | 125191-BAS-CN          | 124191-BAS-CN          | 12d191-BAS-CN       | 122191-BAS-CN       |
| BAS-CN      | 3                 | 120         | 150         | 135191-BAS-CN          | 134191-BAS-CN          | 13d191-BAS-CN       | 132191-BAS-CN       |
| BAS-CN      | 5                 | 120         | 50          | 115291-BAS-CN          | 114291-BAS-CN          | 11d291-BAS-CN       | 112291-BAS-CN       |
| BAS-CN      | 5                 | 120         | 100         | 125291-BAS-CN          | 124291-BAS-CN          | 12d291-BAS-CN       | 122291-BAS-CN       |
| BAS-CN      | 5                 | 120         | 150         | 135291-BAS-CN          | 134291-BAS-CN          | 13d291-BAS-CN       | 132291-BAS-CN       |
| BAS-CN      | 5                 | 120         | 250         | 155291-BAS-CN          | 154291-BAS-CN          | 15d291-BAS-CN       | 152291-BAS-CN       |
| BAS-P       | 3                 | 120         | 50          | 115191-BAS-P           | 114191-BAS-P           | 11d191-BAS-P        | 112191-BAS-P        |
| BAS-P       | 3                 | 120         | 100         | 125191-BAS-P           | 124191-BAS-P           | 12d191-BAS-P        | 122191-BAS-P        |
| BAS-P       | 3                 | 120         | 150         | 135191-BAS-P           | 134191-BAS-P           | 13d191-BAS-P        | 132191-BAS-P        |
| BAS-P       | 5                 | 120         | 50          | 115291-BAS-P           | 114291-BAS-P           | 11d291-BAS-P        | 112291-BAS-P        |
| BAS-P       | 5                 | 120         | 100         | 125291-BAS-P           | 124291-BAS-P           | 12d291-BAS-P        | 122291-BAS-P        |
| BAS-P       | 5                 | 120         | 150         | 135291-BAS-P           | 134291-BAS-P           | 13d291-BAS-P        | 132291-BAS-P        |
| BAS-P       | 5                 | 120         | 250         | 155291-BAS-P           | 154291-BAS-P           | 15d291-BAS-P        | 152291-BAS-P        |



# Chromegabond® Guard Columns

- ◆ *Excellent Protection for Analytical Columns*
- ◆ *Extends Column Life*
- ◆ *Packed to Match the Analytical Column*
- ◆ *Designed to Ensure that System Performance and Column Efficiencies are Maintained*

ES Industries guard column cartridges offer excellent protection for your analytical column. Adding a guard column to your HPLC system extends the life of your analytical column (up to 400%). Placed between the injector and the analytical column, the guard column traps components that would otherwise irreversibly contaminate the stationary phase of the analytical column. Guard columns also protect against the effects of aggressive mobile phases.

ES Industries guard column cartridge packing should exactly match the analytical column. They add capacity to your system and ensure no adverse chemical influence on sensitive separations. These guard column cartridges are packed by a high performance slurry method and will not reduce system performance. They are easy to use and can be changed in seconds. The guard cartridges require a cartridge holder. Column couplers are available to connect guard columns to analytical columns. These couplers are inexpensive, low dead volume, and fingertight.



| Description                             | Part Number    |
|---|----------------|
| Guard Cartridge Holder                  | 300100         |
| Universal Column Coupler                | 300106         |
| WR C4 Guard Cartridges—Pack of 5        | 300101-WR-C4   |
| WR C8 Guard Cartridges—Pack of 5        | 300101-WR-C8   |
| WR C18 Guard Cartridges—Pack of 5       | 300101-WR-C18  |
| AQS Guard Cartridges—Pack of 5          | 300101-AQS     |
| ODS-PI Guard Cartridges—Pack of 5       | 300101-ODS-PI  |
| FSP Guard Cartridges—Pack of 5          | 300101-FSP     |
| FSP/HS Guard Cartridges—Pack of 5       | 300101-FSP/HS  |
| LS Guard Cartridges—Pack of 5           | 300101-LS      |
| LS/HS Guard Cartridges—Pack of 5        | 300101-LS/HS   |
| MacroSep-C4 Guard Cartridges—Pack of 5  | 300101-MSP-C4  |
| MacroSep-C8 Guard Cartridges—Pack of 5  | 300101-MSP-C8  |
| MacroSep-C18 Guard Cartridges—Pack of 5 | 300101-MSP-C18 |
| MacroSep-AQS Guard Cartridges—Pack of 5 | 300101-MSP-AQS |
| MacroSep-CN Guard Cartridges—Pack of 5  | 300101-MSP-CN  |
| MacroSep-HPR Guard Cartridges—Pack of 5 | 300101-MSP-HPR |

All dimensions and lengths available for microbore  
1.0 mm, semi-preparative, preparative,  
specialty sizes, and threaded modular column.  
Please Call for More Information.

# ES INDUSTRIES

## Ordering Information

ES Industries offers a wide range of columns and packings to provide the chromatographer different sizes and selectivities necessary to solve difficult separation problems. Catalog numbers and prices for the most popular size columns are listed with every specific product. ES Industries can pack a variety of column dimensions. Please contact our technical staff at **1-800-356-6140** for assistance in assigning part numbers for non-listed products.

For a complete list of all of our products, please request our full catalog by calling **1-800-356-6140** or access the catalog on the web at **www.esind.com**.

### How to Order

For convenient ordering, use our toll-free number:

**1-800-356-6140**

Or fax your order to:

**856-753-8484**

Or e-mail your order to:

**purchase@esind.com**

Or mail your order to:

**ES Industries  
701 South Route 73  
West Berlin, New Jersey 08091 USA**

When you order, be sure to include:

Purchase order number

Your billing address

Your shipping address

Our catalog number and the product description

Your name and telephone number

ES Industries accepts VISA and MasterCard & American Express

### Terms

We welcome all orders of any size. We do not require a confirming purchase order. If a confirming order is sent, it must be clearly marked as confirming to avoid duplication. Terms of payment are Net 30 days.

Orders are shipped via UPS or Federal Express common carrier unless otherwise instructed. Shipping Point: F.O.B.

Prices are subject to change without notice.

### Returns

Returns of any products must be authorized in advance. Please contact ES Industries at **1-800-356-6140** for a return authorization number and forwarding instructions. All claims must be made within 60 days of shipping. Report shipping damage to the carrier. Keep containers and packaging materials until inspection has been made.

### Warranty

ES Industries products are warranted to be free from defects in material and workmanship. We will replace, without cost, any materials that carry such defects. All claims must be made within 60 days of shipping. ES Industries products are not warranted against misuse. If you have questions regarding a specific ES Industries product, please call our toll free technical support line for assistance, **1-800-356-6140**. All other warranties, expressed or implied, including, but not limited to, the implied warranty of merchantability, fitness for a particular use or any other matter are disclaimed.

ES Industries products are intended for laboratory or manufacturing use only, and are not intended for diagnostic, clinical, food purposes or home use.

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### Discounts

ES Industries offer discounts to corporate accounts that are high volume purchasers of ES Industries columns and media. Discounts are also available for simultaneous purchase of a large number of identical items with a single purchase order. Government institutions are eligible for a special discount irrespective of volume. Call ES Industries for details and conditions.



**ES INDUSTRIES**

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