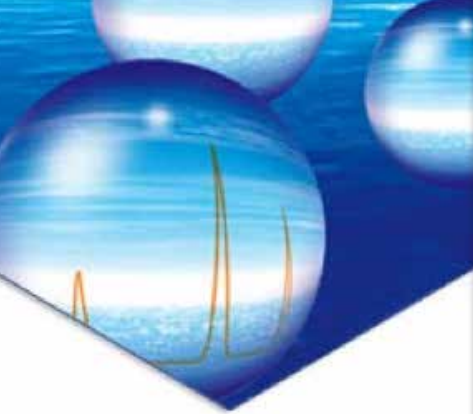




Epic Aromatic Selectivity HPLC Columns

pharmaceutical • environmental • chemical • biochemical
separation & purification





Epic Phenyl $\pi - \pi$ Interaction (Aromatic Selectivity) Stationary Phases & Columns

- *A Recognized Supplier of Quality HPLC Columns*
- *Available in 1.8, 3, 5 and 10 μm for Analytical and Preparative*
- *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*

Phenyl π - π interaction Phases

Reversed phase HPLC analyses are normally performed on alkyl phases, such as C6, C8 or C18 columns. These phases are very effective for nonpolar analytes, however these phases do not always provide the desired selectivity for other moieties. In these cases, phenyl phases are one alternative to alkyl phases. Phenyl phases exhibit π - π interactions with some of these moieties and may produce better or alternate selectivity to alkyl phases. The standard phenyl phase, a phenyl ring bonded to high purity silica via a propyl bond, produces only moderate retention for hydrophobic compounds when compared to a C18 column; however to increase hydrophobic retention longer chains such as hexyl are bonded to phenyl rings.

ES Industries chemists have extensively researched phenyl stationary phases and developed the Biphenyl, Naphthyl, Diphenyl and PFP phases — the next generation phenyl phases. The Biphenyl and Naphthyl phases, are composed of two phenyl groups and are unique among phenyl phases in both structure and performance. Rather than using a straight chain hexyl bond, these phases incorporate an aryl group. This makes them more hydrophobic and provides a larger electron cloud than single phenyl ring phases, which provides for increased π - π interaction, resulting in excellent aromatic selectivity and good hydrophobic retention.

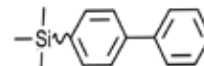
Available π - π interaction products:

Epic Biphenyl	Epic Naphthyl
Epic Phenyl	Epic Phenyl Hexyl
Epic Diphenyl	Epic Penta Fluoro Phenyl
3 and 5 μm π - π interaction kits	

The π - π Family

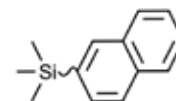
BIPHENYL

- **Employs an aryl linker to the silica surface**
- **Excellent aromatic selectivity**
- **Good hydrophobic retention**



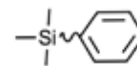
NAPHTHYL

- **Employs an aryl linker to the silica surface**
- **Excellent aromatic selectivity**
- **Good hydrophobic retention**



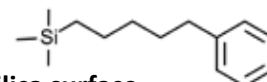
PHENYL

- **Standard phenyl stationary phase**
- **Weak to moderate hydrophobic retention**
- **Capable of aromatic selectivity**



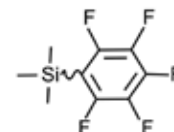
PHENYL HEXYL

- **Employs a hexyl linker to the silica surface**
- **Increased hydrophobic retention**
- **Increased aromatic selectivity**



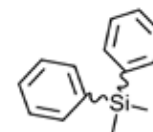
PFP

- **High Density Phase**
- **Excellent interaction with Halogenated Aromatic**
- **Excellent π - π interaction**

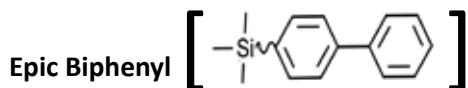


DIPHENYL

- **High density phenyl stationary phase**
- **Higher hydrophobic retention and aromatic selectivity than standard phenyl phases**

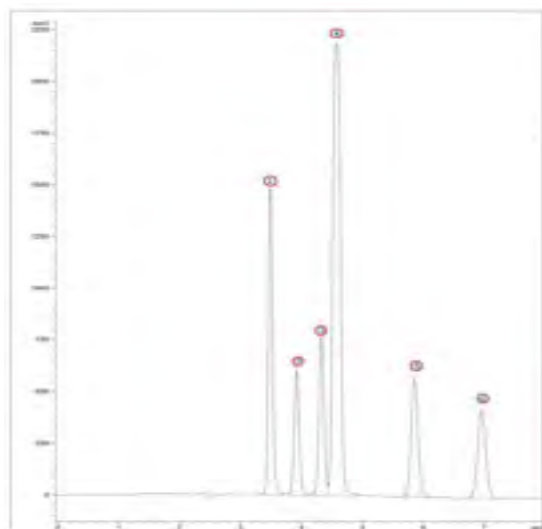


All available in 1.8, 3, 5 and 10 μm for Analytical and Preparative Chromatography



The development of the Epic Biphenyl HPLC stationary phase takes aromatic selectivity to the next level of selective separation performance. Epic Biphenyl is a truly unique stationary phase with properties significantly different than ODS phases. This unique character results from bonded biphenyl groups, covalently attached to high purity silica, imparting a π - π 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, nitro aromatics and conjugated systems. In many cases, Epic Biphenyl provides superior selectivity to Pentafluorophenyl (PFP) stationary

Epic Biphenyl 100 X 2.1 mm 1.8 μ m Catalog # 532A91-EBPH



Mobile Phase: 70% - 30%
Water - Methanol
Flow Rate: 0.2 mL/min
Detection: UV @ 230 nm

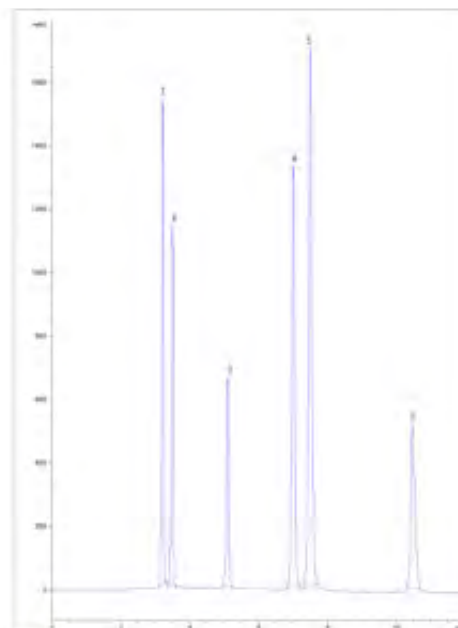
1. Nitrobenzene
2. 1,3 Nitrobenzene
3. 1-Nitronaphthalene
4. 1,8 Dinitronaphthalene
5. 1,5 Dinitronaphthalene
6. 1,3 Dinitronaphthalene

Epic Naphthyl

A naphthalene based material, with high bonding density and intrinsic base deactivation due to a rigid structure that also enables the shape selectivity needed for many diastereomeric separations. It exhibits strong π - π interaction and charge transfer interactions and performs well for diastereomers separations and non-polar compounds.

The unique properties of Epic Naphthyl places its selectivity between graphitized carbon and alkyl type stationary phases.

Epic Naphthyl 150 X 4.6 mm 5 μ m Catalog # 135291-ENAP

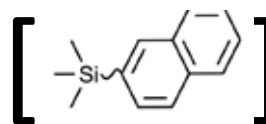
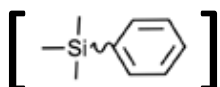


Mobile Phase: 0% - 30%
Water:ACN/IPA (50:50) over 10 minutes
Temperature: 25°C
Flow Rate: 1 mL/min
Detection: UV @ 240 nm

1. Prometron
2. Propazine
3. Prometryn
4. Simazine
5. Ametryn
6. Simetryn

Epic Phenyl

The Epic Phenyl phase is π -basic (electron donating) and is similar in overall retention to alkyl phases. The alternate selectivity exhibited by phenyl phases is explained by the π - π interactions available through the phenyl ring. Compounds that exhibit this alternate selectivity on the Epic Phenyl phase include; Antibiotics such as Tetracycline, moderate bases such as anesthetics, some acidic compounds such as quinoline antibiotics and nucleosides.

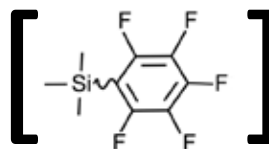


For ordering information please see Pages 6 & 7.





Epic Penta Fluoro Phenyl



Epic Penta-Fluoro-Phenyl phase (PFP) uses multiple retention mechanisms for the separation of challenging compounds. These interactions include hydrophobic, π - π interaction, dipole-dipole, H-bonding and shape selectivity. The use of each retention mechanism is influenced by the solute's physicochemical properties, its structure and the chromatographic conditions employed.

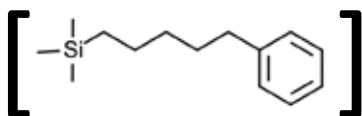
Epic PFP provides excellent separation of polar (halogenated) analytes and positional isomers under standard reversed-phase conditions however they may also be used under highly aqueous conditions.

Epic PFP is becoming increasingly popular when a different selectivity is needed and shows excellent selectivity especially for highly polar analytes, aromatics and unsaturated compounds, phenols, halogenated compounds and taxanes. In addition, positional isomers show increased separation on PFP phases.

Due to the low bleed characteristics of the Epic PFP phase, they are ideally suited for low UV and LC-MS applications. PFP phases. Epic PFP may be used as a USP L43 column.

Epic Penta-Fluoro-Phenyl 100 X 2.1mm 1.8 μ m Catalog # 522A91-EPFP

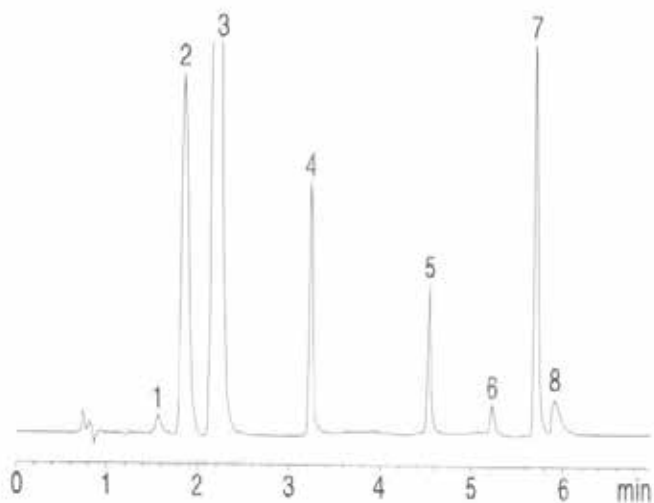
Epic Phenyl Hexyl



Epic Phenyl-Hexyl employs a 6-carbon (hexyl) linked phenyl phase bonded to high purity silica, where the hexyl alkyl chain delivers unique selectivity and increased hydrolytic stability when compared to propyl-linked phenyl phase chemistry.

This retentive phase provides different selectivity to straight chain hydrocarbon phases like C6, C8 or C18, and it is especially useful for aromatic analytes, complex samples and polar pharmaceutical compounds.

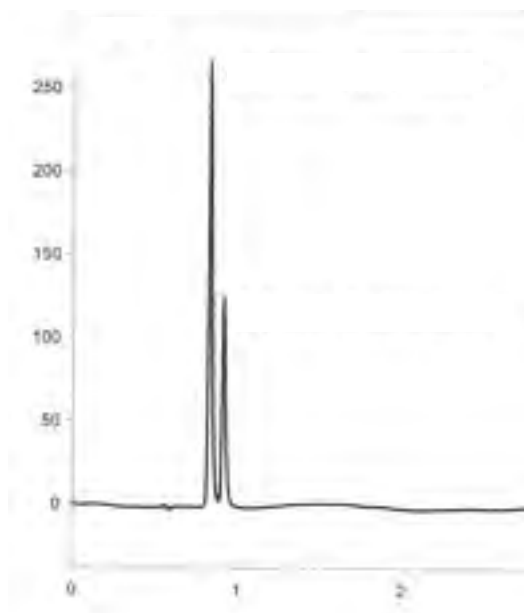
Epic Phenyl-Hexyl 50 X 4.6mm 3 μ m Catalog # 115291-EPHX



Mobile Phase:
A: Acetonitrile
B: Methanol/20mM KH₂PO₄ (80:30) pH 9.0
A/B (0:100) to A/B (80:20) in 5min
Temperature: 25°C
Flow Rate: 1.3 mL/min
Detection: UV 214nm
Injection: 5 μ l

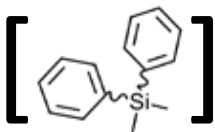
1. P-Aminophenol
2. Benzoic acid
3. Acetaminophen
4. Pseudoephedrine
5. Butyl paraben
6. Chlorpheniramine
7. Diphenhydramine
8. Dextromethorphan

All available in 1.8, 3, 5 and 10 μ m for Analytical and Preparative Chromatography



Mobile Phase: 75% - 25%
Acetonitrile - Water
Temperature: 35°C
Flow Rate: 375 μ L/min
Detection: UV @ 254nm
1. 4-Fluoro-2-nitroaniline
2. 4-Fluoro-3-nitroaniline

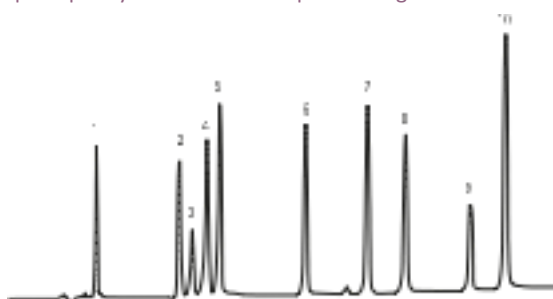
Epic Diphenyl



Epic Diphenyl bonded phase, with reduced hydrophobicity produces HPLC columns with novel selectivity, exhibiting increased speed and resolution, utilizes strong dipole-dipole hydrogen bonding and π - π mechanisms for different selectivity for compounds containing double bonds or aromatic functional groups.

Epic Diphenyl is highly selective for proteins with aromatic side chains and may be used as a USP L11 column.

Epic Diphenyl 150 X 4.6 mm 5 μ m Catalog # 135291-EDPH



Mobile Phase: A: Water+0.1% HCOOH
B: MeCN+0.1% HCOOH
Gradient: 25-80% B in 20 min

Temperature: 25°C
Flow Rate: 1.0 mL/min
Detection: UV, 254 nm

- | | |
|-------------------------|------------------|
| 1. Acetaminophen | 6. Carbamazepine |
| 2. Acetanilide | 7. Tolmetin |
| 3. Salicylic acid | 8. Naproxen |
| 4. Acetylsalicylic acid | 9. Ibuprofen |
| 5. Phenacetin | 10. Diclofenac |

Epic π - π interaction column Kit

A specialty SFC stationary phase that has proven superior to conventional stationary phases in the areas of separation selectivity and loading capacity which was designed for the separation of amines, alcohols and acids by SFC without the use of additives. Works well in Normal Phase mixed mode offering π - π interaction and exhibits good base deactivation.

All available in 1.8, 3, 5 and 10 μ m for Analytical and Preparative Chromatography

Column Packing and Hardware

One of the most important parts of the whole column production sequence is the packing of the column. Over the last 35 years of column production, we have developed and refined techniques for packing columns and now utilize the most advanced column packing technology in the industry. This technology enables us to pack the finest columns available. A significant part of our superior packing technology resides in unsurpassed column hardware where only end fittings and column tubing of the highest quality and performance are acceptable. Stainless steel column tubing with highly polished, mirrored finished internal bores are used. As a result, the chromatographer can be confident that they are receiving the highest quality column hardware in the industry.

Testing

Every step of our column production sequence is strictly monitored and controlled by an extensive battery of tests which are applied to all steps including silica particle formation, bonding reagents and reactions, column hardware, and packing which ensure the quality of the final product - with each test designed to measure a customer-critical parameter.

The final batch test for each product has been carefully designed and tailored to test the performance standard set for each phase and 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 the GreenSep line of products will deliver the highest quality and most reliable SFC columns available to you.

For ordering information please see Pages 6 & 7



Epic π-π interaction column screening kits

Two π-π interaction column screening kits, one each in 3 and 5 micron with all six aromatic selectivity phases included, are available in convenient column dimensions for optimal aromatic selectivity phase selection on a screening panel.

The 3μm π-π Phenyl Column Screening Kit Contains one (1) 100 X 2.1mm column of each of the following phases:

Epic Biphenyl
Epic Naphthyl
Epic Phenyl
Epic Phenyl Hexyl
Epic PFP LB
Epic Diphenyl

The 5μm π-π Phenyl Column Screening Kit Contains one (1) 150 X 4.6mm column of each of the following phases:

Epic Biphenyl
Epic Naphthyl
Epic Phenyl
Epic Phenyl Hexyl
Epic PFP LB
Epic Diphenyl

For ordering information please see below

Epic Aromatic Selectivity Columns - Ordering Information					
Description	Part Number	US \$ List Price			
Kit					
3μm Epic π-π column screening kit	KEPH31021	Call for Quote			
5μm Epic π-π column screening kit	KEPH51546	Call for Quote			
Description	Small Bore (3.0 mm)		Small Bore (2.1 mm)		Small Bore (1.0 mm)
1.8 micron					
Epic Biphenyl 30mm	583A91-EBPH		582A91-EBPH		581A91-EBPH
Epic Biphenyl 50mm	513A91-EBPH		512A91-EBPH		511A91-EBPH
Epic Biphenyl 100mm	523A91-EBPH		522A91-EBPH		521A91-EBPH
Epic Biphenyl 150mm	533A91-EBPH		532A91-EBPH		531A91-EBPH
Epic Naphthyl 30mm	583A91-ENAP		582A91-ENAP		581A91-ENAP
Epic Naphthyl 50mm	513A91-ENAP		512A91-ENAP		511A91-ENAP
Epic Naphthyl 100mm	523A91-ENAP		522A91-ENAP		521A91-ENAP
Epic Naphthyl 150mm	533A91-ENAP		532A91-ENAP		531A91-ENAP
Epic Phenyl 30mm	583A91-EPH		582A91-EPH		581A91-EPH
Epic Phenyl 50mm	513A91-EPH		512A91-EPH		511A91-EPH
Epic Phenyl 100mm	523A91-EPH		522A91-EPH		521A91-EPH
Epic Phenyl 150mm	533A91-EPH		532A91-EPH		531A91-EPH
Epic Phenyl Hexyl 30mm	583A91-EPHX		582A91-EPHX		581A91-EPHX
Epic Phenyl Hexyl 50mm	513A91-EPHX		512A91-EPHX		511A91-EPHX
Epic Phenyl Hexyl 100mm	523A91-EPHX		522A91-EPHX		521A91-EPHX
Epic Phenyl Hexyl 150mm	533A91-EPHX		532A91-EPHX		531A91-EPHX
Epic PFP LB 30mm	583A91-EPFP-LB		582A91-EPFP-LB		581A91-EPFP-LB
Epic PFP LB 50mm	513A91-EPFP-LB		512A91-EPFP-LB		511A91-EPFP-LB
Epic PFP LB 100mm	523A91-EPFP-LB		522A91-EPFP-LB		521A91-EPFP-LB
Epic PFP LB 150mm	533A91-EPFP-LB		532A91-EPFP-LB		531A91-EPFP-LB
Epic Diphenyl 30mm	583A91-EDPH		582A91-EDPH		581A91-EDPH
Epic Diphenyl 50mm	513A91-EDPH		512A91-EDPH		511A91-EDPH
Epic Diphenyl 100mm	523A91-EDPH		522A91-EDPH		521A91-EDPH
Epic Diphenyl 150mm	533A91-EDPH		532A91-EDPH		531A91-EDPH

Columns are also available in 10 micron material
Visit our web site at www.esind.com or call 1-800-356-6140
for pricing and ordering information

Epic Aromatic Selectivity Columns - Ordering Information						
Description	Analytical (4.6 mm)	Analytical (4.0 mm)	SmallBore (3.0 mm)	Small Bore(3.2 mm)	Small Bore(2.1 mm)	
3 micron						
Epic Biphenyl 50mm	115191-EBPH	114191-EBPH	113191-EBPH	11d191-EBPH	112191-EBPH	
Epic Biphenyl 100mm	125191-EBPH	124191-EBPH	123191-EBPH	12d191-EBPH	122191-EBPH	
Epic Biphenyl 150mm	135191-EBPH	134191-EBPH	133191-EBPH	13d191-EBPH	132191-EBPH	
Epic Naphthyl 50mm	115191-ENAP	114191-ENAP	113191-ENAP	11d191-ENAP	112191-ENAP	
Epic Naphthyl 100mm	125191-ENAP	124191-ENAP	123191-ENAP	12d191-ENAP	122191-ENAP	
Epic Naphthyl 150mm	135191-ENAP	134191-ENAP	133191-ENAP	13d191-ENAP	132191-ENAP	
Epic Phenyl 50mm	115191-EPH	114191-EPH	113191-EPH	11d191-EPH	112191-EPH	
Epic Phenyl 100mm	125191-EPH	124191-EPH	123191-EPH	12d191-EPH	122191-EPH	
Epic Phenyl 150mm	135191-EPH	134191-EPH	133191-EPH	13d191-EPH	132191-EPH	
Epic Phenyl Hexyl 50mm	115191-EPHX	114191-EPHX	113191-EPHX	11d191-EPHX	112191-EPHX	
Epic Phenyl Hexyl 100mm	125191-EPHX	124191-EPHX	123191-EPHX	12d191-EPHX	122191-EPHX	
Epic Phenyl Hexyl 150mm	135191-EPHX	134191-EPHX	133191-EPHX	13d191-EPHX	132191-EPHX	
Epic PFP LB 50mm	115191-EPFP-LB	114191-EPFP-LB	113191-EPFP-LB	11d191-EPFP-LB	112191-EPFP-LB	
Epic PFP LB 100mm	125191-EPFP-LB	124191-EPFP-LB	123191-EPFP-LB	12d191-EPFP-LB	122191-EPFP-LB	
Epic PFP LB 150mm	135191-EPFP-LB	134191-EPFP-LB	133191-EPFP-LB	13d191-EPFP-LB	132191-EPFP-LB	
Epic Diphenyl 50mm	115191-EDPH	114191-EDPH	113191-EDPH	11d191-EDPH	112191-EDPH	
Epic Diphenyl 100mm	125191-EDPH	124191-EDPH	123191-EDPH	12d191-EDPH	122191-EDPH	
Epic Diphenyl 150mm	135191-EDPH	134191-EDPH	133191-EDPH	13d191-EDPH	132191-EDPH	
5 micron						
Epic Biphenyl 50mm	115291-EBPH	114291-EBPH	113291-EBPH	11d291-EBPH	112291-EBPH	
Epic Biphenyl 100mm	125291-EBPH	124291-EBPH	123291-EBPH	12d291-EBPH	122291-EBPH	
Epic Biphenyl 150mm	135291-EBPH	134291-EBPH	133291-EBPH	13d291-EBPH	132291-EBPH	
Epic Biphenyl 250mm	155291-EBPH	154291-EBPH	153291-EBPH	15d291-EBPH	152291-EBPH	
Epic Biphenyl 300mm	165291-EBPH	164291-EBPH	163291-EBPH	16d291-EBPH	162291-EBPH	
Epic Naphthyl 50mm	115291-ENAP	114291-ENAP	113291-ENAP	11d291-ENAP	112291-ENAP	
Epic Naphthyl 100mm	125291-ENAP	124291-ENAP	123291-ENAP	12d291-ENAP	122291-ENAP	
Epic Naphthyl 150mm	135291-ENAP	134291-ENAP	133291-ENAP	13d291-ENAP	132291-ENAP	
Epic Naphthyl 250mm	155291-ENAP	154291-ENAP	153291-ENAP	15d291-ENAP	152291-ENAP	
Epic Naphthyl 300mm	165291-ENAP	164291-ENAP	163291-ENAP	16d291-ENAP	162291-ENAP	
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Epic Phenyl 150mm	135291-EPH	134291-EPH	133291-EPH	13d291-EPH	132291-EPH	
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Epic Phenyl 300mm	165291-EPH	164291-EPH	163291-EPH	16d291-EPH	162291-EPH	
Epic Phenyl Hexyl 50mm	115291-EPHX	114291-EPHX	113291-EPHX	11d291-EPHX	112291-EPHX	
Epic Phenyl Hexyl 100mm	125291-EPHX	124291-EPHX	123291-EPHX	12d291-EPHX	122291-EPHX	
Epic Phenyl Hexyl 150mm	135291-EPHX	134291-EPHX	133291-EPHX	13d291-EPHX	132291-EPHX	
Epic Phenyl Hexyl 250mm	155291-EPHX	154291-EPHX	153291-EPHX	15d291-EPHX	152291-EPHX	
Epic Phenyl Hexyl 300mm	165291-EPHX	164291-EPHX	163291-EPHX	16d291-EPHX	162291-EPHX	
Epic PFP LB 50mm	115291-EPFP-LB	114291-EPFP-LB	113291-EPFP-LB	11d291-EPFP-LB	112291-EPFP-LB	
Epic PFP LB 100mm	125291-EPFP-LB	124291-EPFP-LB	123291-EPFP-LB	12d291-EPFP-LB	122291-EPFP-LB	
Epic PFP LB 150mm	135291-EPFP-LB	134291-EPFP-LB	133291-EPFP-LB	13d291-EPFP-LB	132291-EPFP-LB	
Epic PFP LB 250mm	155291-EPFP-LB	154291-EPFP-LB	153291-EPFP-LB	15d291-EPFP-LB	152291-EPFP-LB	
Epic PFP LB 300mm	165291-EPFP-LB	164291-EPFP-LB	163291-EPFP-LB	16d291-EPFP-LB	162291-EPFP-LB	
Epic Diphenyl 50mm	115291-EDPH	114291-EDPH	113291-EDPH	11d291-EDPH	112291-EDPH	
Epic Diphenyl 100mm	125291-EDPH	124291-EDPH	123291-EDPH	12d291-EDPH	122291-EDPH	
Epic Diphenyl 150mm	135291-EDPH	134291-EDPH	133291-EDPH	13d291-EDPH	132291-EDPH	
Epic Diphenyl 250mm	155291-EDPH	154291-EDPH	153291-EDPH	15d291-EDPH	152291-EDPH	
Epic Diphenyl 300mm	165291-EDPH	164291-EDPH	163291-EDPH	16d291-EDPH	162291-EDPH	

Other innovative products available from ES Industries:

- *Chiral Columns and Media*
- *Sub-2 μm HPLC Columns*
- *State of the art Reverse Phase HPLC Columns*
- *Unique Reverse Phase HPLC Columns*
- *Fluorinated Columns*
- *HILIC Columns*
- *LC-MS Columns*
- *Commercial Equivalent Columns*
- *Bio-Analytical Columns*
- *HPLC Columns for Petroleum Products*
- *GreenSep SFC Columns*



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856-753-8400 • 800-356-6140 • Fax 856-753-8484
www.esind.com or Email: info@esind.com