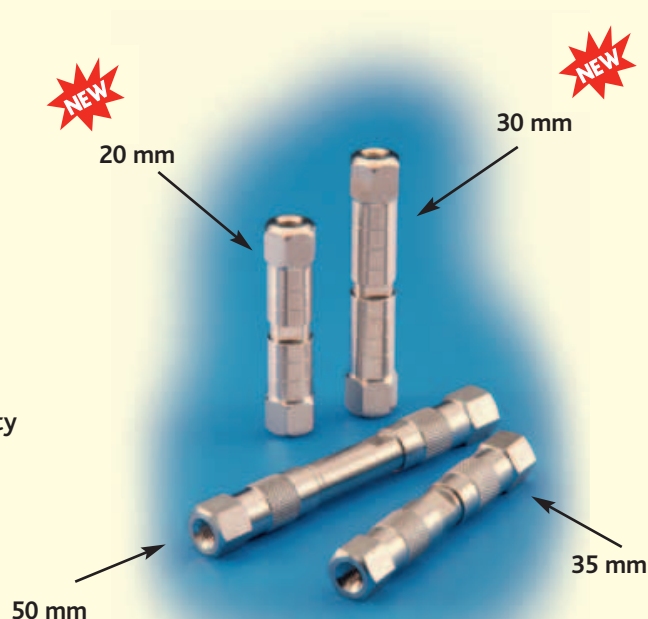


ACE LC/MS and Rapid Analysis HPLC Columns



- 20 mm, 30 mm, 35 mm and 50 mm column lengths
- 1.0, 2.1, 3.0, 4.0 and 4.6 mm column diameters
- Configured for High Sample Throughput
- Specially Manufactured for High Flow Applications
- Ultra-Inert Stationary Phases for Improved Efficiency and Sensitivity
- Highly Stable Columns for Robust, Reliable LC/MS Methods



The Right Reversed Phase HPLC Column to Use for High Throughput LC/MS Applications

Introduction

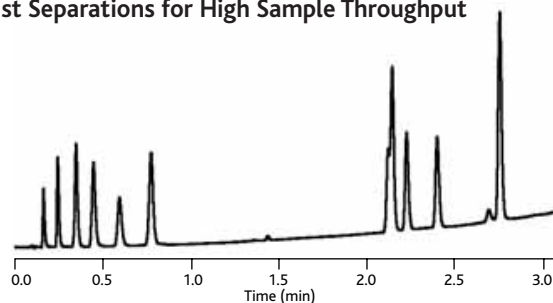
The pressure to get new drugs to market faster requires analytical chemistry tools that can keep up with the frenetic pace of potential lead compound generation during the drug discovery process. By increasing sample throughput, not only does the cost per analysis decrease but, more importantly, critical information can be quickly provided to researchers to screen the large number of compounds generated from synthesis or natural product sources.

Combining mass spectrometry with HPLC has given researchers a powerful analytical tool because of the ability of HPLC to separate complex mixtures and the sensitivity and selectivity of mass spectrometry. The fact that LC/MS is also well suited for high sample throughput makes it the analytical tool of choice for drug discovery.

Configured for High Sample Throughput

To reduce analysis time and increase sample throughput, ACE rapid analysis columns are short in length and packed with high efficiency stationary phases. The shorter column length provides the rapid analysis and the high efficiency 3 micron particles provide the resolution.

FIGURE 1
Fast Separations for High Sample Throughput



Column: ACE C18, 30 x 3.0 mm, 3 μ m
 Mobile Phase: Fast Gradient, 5%B to 100%B, 3 minutes
 A: 20mM Phosphate Buffer, pH 2.7
 B: 65% Methanol, 35% 20mM Phosphate Buffer, pH 2.7
 Flow Rate: 2.0 ml/min

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An ACE rapid analysis column is used with a fast gradient and at high flow rate to achieve a separation of 10 components in a mixture in less than 3 minutes.

Ultra Inert Silica - Improved Efficiency and Peak Shape

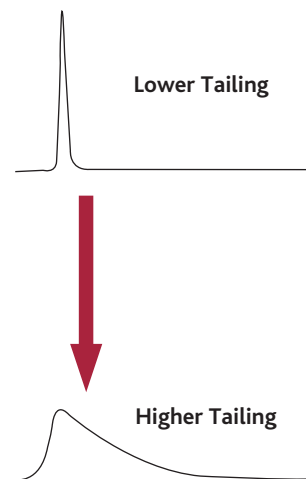
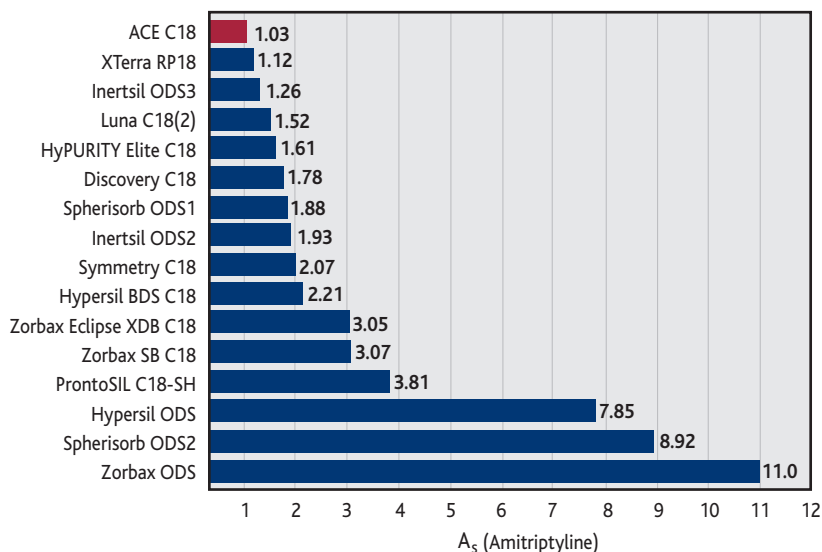
FIGURE 2

Independent Column Comparison of HPLC Columns

- Data obtained from the National Institute of Standards and Technology (NIST), USA

- Leading 5 μm C18 Column Brands
- Basic Molecule Testing
- Peak Asymmetry Investigation

This bar graph, generated from data produced by the National Institute of Standards & Technology, compares columns according to peak asymmetry. The lower the peak asymmetry, the lower the interference from silanols. The ACE C18 showed the least silanol interference of any of the C18 columns tested.



Column: 150 x 4.6 mm, 5 μm Mobile Phase: 80:20 MeOH/5mM potassium phosphate buffer (pH 7.0) Flow: 2.0 ml/min Temperature: 24°C

The above data was obtained from the National Institute of Standards and Technology (NIST), Certificate of Analysis for Standard Reference Material 870 - "Column Performance Test Mixture for Liquid Chromatography" at the NIST Internet site <http://ois.nist.gov/srmcatalog/certificates/870.pdf> in September 2002. The NIST test mixture, which is designed to characterize general aspects of HPLC was revised in December 2002.

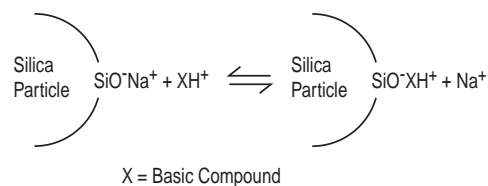
Ultra-Inert Stationary Phases for Improved Efficiency and Sensitivity

Unwanted interaction between solutes and acidic silanols on the surface of silica-based stationary phases is the major cause of poor column efficiency and poor sensitivity when analyzing polar compounds by HPLC. Stationary phases used in ACE HPLC columns are made using ultra-inert silica as the stationary phase support. This silica is then densely covered by the bonded phase so completely that silanol interference is essentially eliminated. The result is a stationary phase that provides superior peak shape, making it particularly well suited for high throughput, high sensitivity LC/MS applications.

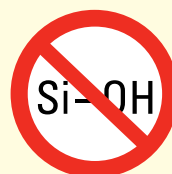
By eliminating silanol interference, mobile phase additives that can contaminate mass spectrometers or reduce sensitivity can be avoided. For example, TFA is often used to improve peak shape and resolution when separating proteins and peptides by reversed phase HPLC. But, TFA in the mobile phase will suppress electrospray ionization of analytes and reduce sensitivity. The extremely inert character of ACE phases permits the use of mobile phases without damaging amounts of additives.

FIGURE 3

Peak Tailing Interaction



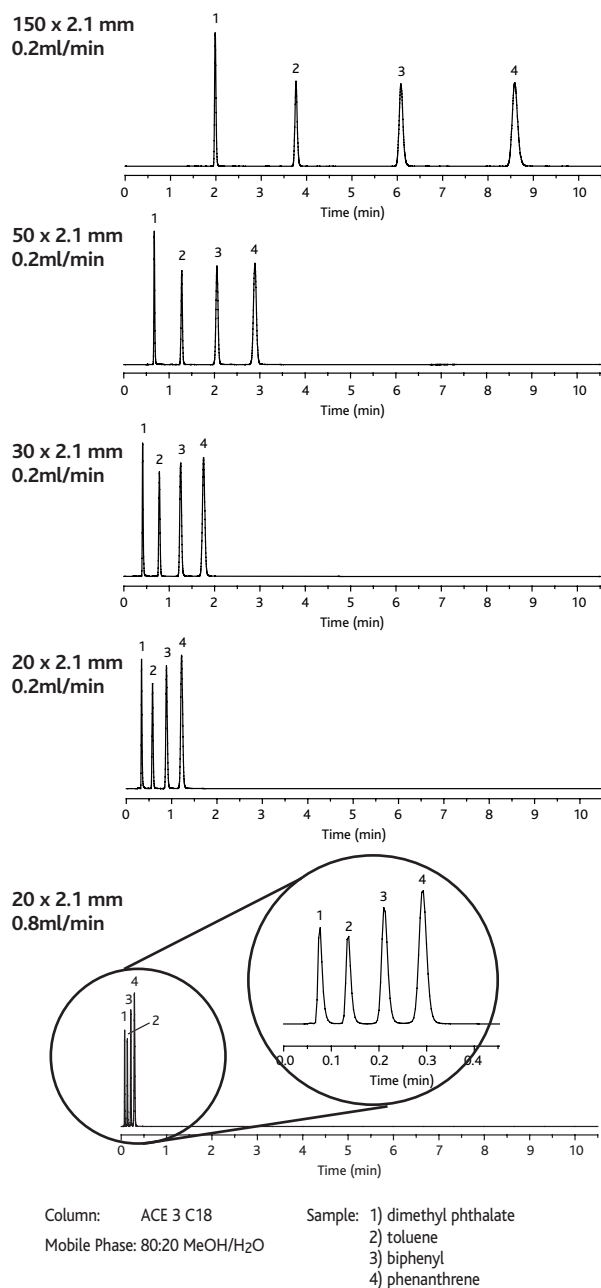
Acidic silanols on the surface of silica stationary phase supports can form ion-exchange sites that interact with polar compounds. This ion-exchange interaction will often contribute to peak retention and cause peak tailing, poor efficiency and poor sensitivity.



ACE® Stationary Phases Virtually Eliminate the Negative Effects of Silanols on HPLC Separations

High Efficiency Short Columns for Rapid Analysis

FIGURE 4
Using ACE HPLC Columns for Fast Separations



ACE HPLC columns are now available in new ultra short 20mm and 30mm lengths enabling rapid, reproducible high throughput screening at elevated flow rates.

ACE ultra inert base deactivated HPLC columns virtually eliminate the negative effects of silanols in HPLC separations. This unequalled performance is now available in 20, 30, 35 and 50 mm length columns, with diameters from 1.0 to 4.6 mm i.d. The ACE columns are suitable for high throughput and LC/MS applications, and are the ideal choice for high volume screening assays used for drug analysis and combinatorial libraries where robust, reproducible columns are essential.

Apart from being the most inert HPLC columns on the market, they are also the most efficient, and are manufactured and validated to the same exacting standards as all ACE columns. Increased efficiency is an important benefit given the short columns typically used in LC/MS and rapid analysis applications.

Increased Sensitivity

ACE HPLC columns, by virtue of their inert characteristics, give inherently higher sensitivity because of the sharp, narrow peaks produced by their stationary phases. When there is a limited amount of sample for analysis, which is often the case in drug discovery, sensitivity can be increased by choosing columns with smaller internal diameters. As the column internal diameter decreases, the volume of the chromatographic peaks also decreases, concentrating the sample and increasing sensitivity. Columns with 2.1 mm and 1.0 mm internal diameters are particularly attractive for situations where the amount of sample is limited but sensitivity is important.

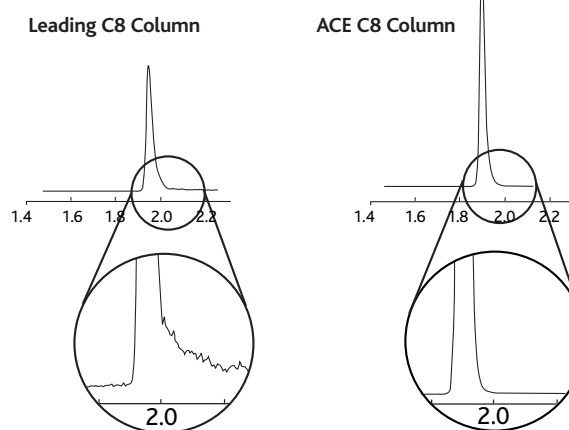
FIGURE 5
The Effect of Column id on Sensitivity

Column id	Relative Sensitivity
4.6 mm	--
3.0 mm	2.3
2.1 mm	4.8
1.0 mm	21

As the column internal diameter decreases, the volume of the chromatographic peaks decreases, concentrating the sample and increasing sensitivity. If the same amount of sample is injected, a column with an id of 2.1 mm will give about 5 fold the sensitivity of a column with an id of 4.6 mm.



FIGURE 6
Effect of Tailing on Sensitivity



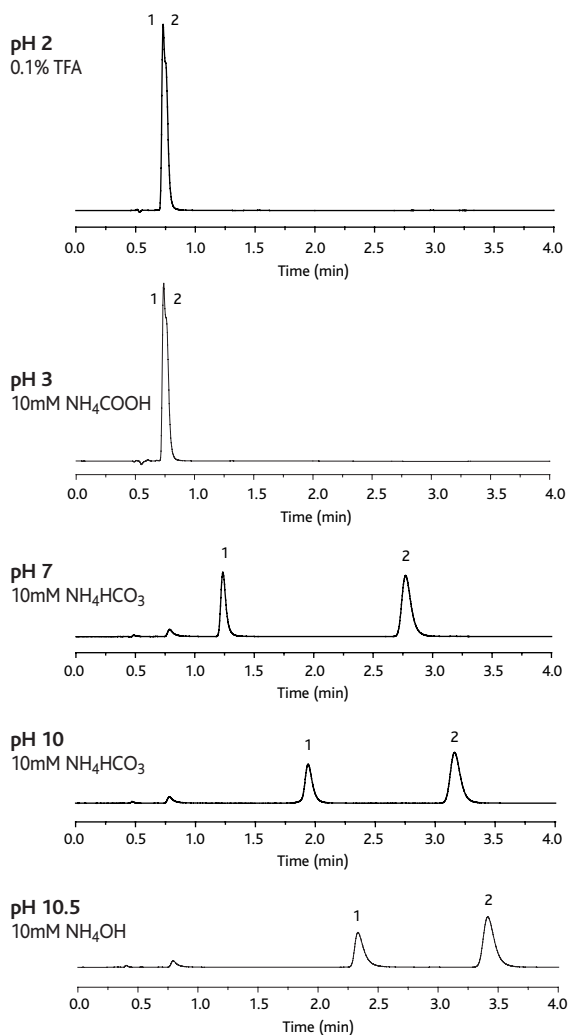
This figure compares the LC/MS signal intensity on two different brands of HPLC columns. Because ACE stationary phases are more inert, with less silanol interference, the chromatographic peak produced by the ACE C8 column has less tailing and, therefore, provides greater sensitivity. The highly inert characteristics of the ACE HPLC columns give them inherently higher sensitivity than other columns.

Increased Column Lifetime

Specially Manufactured for High Flow Applications

To maximize sample throughput, very high mobile phase linear velocity (flow rate) is often used, sometimes 3 to 4 times higher than would be used for typical HPLC applications. This puts extra strain on the column packing bed and causes early failure due to voids or channels that develop. ACE stationary phases are mechanically very strong and able to withstand aggressive packing techniques. This has permitted the development of proprietary packing technology that is designed specifically to produce columns robust enough for high throughput applications.

FIGURE 7
ACE HPLC Columns are Compatible with a Wide Range of "MS Friendly" Buffers

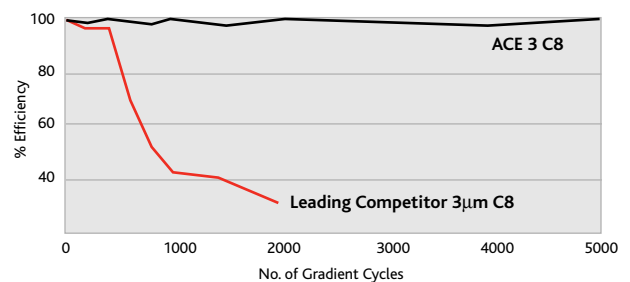


Column: ACE C18, 50 x 2.1 mm, 3µm, Mobile Phase: 80% MeOH, 20% buffer, Flow Rate: 0.20 ml/min, Temp: 22°C, Sample: 1) Nortriptyline, 2) Amitriptyline, Wavelength: 215 nm

ACE HPLC columns can be used over a broad pH range, allowing for simplified method development on a single column. And, ACE columns are compatible with volatile mobile phase buffers recommended for LC/MS applications.

Increased retention of basic molecules

FIGURE 8
Columns Specially Manufactured for Long Life Under High Throughput Conditions



Column: 50 x 3.0 mm
Gradient: Fast gradient cycling, 5% to 95% Acetonitrile in 2.25 minutes
Flow Rate: 1.25 ml/min

In this lifetime test under high flow and fast gradient conditions, the specially manufactured ACE HPLC column showed no loss in performance after over 5,000 gradient cycles. A typical "fast analysis" column failed to provide acceptable performance after less than a 1,000 gradient cycles.

Highly Stable Columns for Robust, Reliable Methods

ACE HPLC columns, by virtue of their high bonding density and ultra-inert characteristics, can be used with mobile phase conditions that are optimal for LC/MS applications. Stability at both low and high pH and compatibility with volatile buffers makes these the right columns for demanding situations such as standard methods and open access LC/MS. The proprietary packing technology used to specially manufacture these columns for high throughput applications produces extremely durable HPLC columns that are the key to robust LC/MS methods.

Summary

ACE Rapid Analysis HPLC Columns are Optimized for High Sample Throughput Applications

- **High Throughput**
ACE columns are now available in ultra short column lengths designed for high resolution of complex mixtures in seconds.
- **High Sensitivity**
Small-bore columns packed with high efficiency ultra inert stationary phases provide excellent peak shape for maximum sensitivity. For peptide/protein samples, ACE columns provide maximum sensitivity, since TFA is not required in the mobile phase.
- **Robust Performance**
Proprietary column packing technology produces columns rugged enough to stand up to the demands of high throughput applications. Highly inert stationary phases eliminate column bleed and permit operation over a wide range of mobile phase conditions, allowing optimal conditions for LC/MS applications.

Choice of 12 High Performance ACE Phases

ACE Phase	Functional Group	Endcapped	Particle Size (µm)	Pore Size (Å)	Surface Area (m ² /g)	% Carbon	LC/MS Compatible
C18	Octadecyl	Yes	3, 5, 10	100	300	15.5	Yes
C8	Octyl	Yes	3, 5, 10	100	300	9.0	Yes
C4	Butyl	Yes	3, 5, 10	100	300	5.5	Yes
CN	Cyano	Yes	3, 5, 10	100	300	5.5	Yes
Ph	Phenyl	Yes	3, 5, 10	100	300	9.5	Yes
AQ	Proprietary	Yes	3, 5, 10	100	300	14.0	Yes
C18-HL	Octadecyl	Yes	3, 5, 10, 15	90	400	20.0	Yes
C18-300	Octadecyl	Yes	3, 5, 10	300	100	9.0	Yes
C8-300	Octyl	Yes	3, 5, 10	300	100	5.0	Yes
C4-300	Butyl	Yes	3, 5, 10	300	100	2.6	Yes
CN-300	Cyano	Yes	3, 5, 10	300	100	2.6	Yes
Ph-300	Phenyl	Yes	3, 5, 10	300	100	5.3	Yes

ACE LC/MS and Rapid Analysis Columns - Part Numbers

ACE 3µm Columns

ACE 3µm C18				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-111-0201	ACE-111-0301	ACE-111-3501	ACE-111-0501
2.1mm	ACE-111-0202	ACE-111-0302	ACE-111-3502	ACE-111-0502
3.0mm	ACE-111-0203	ACE-111-0303	ACE-111-3503	ACE-111-0503
4.0mm	-	-	ACE-111-3504	ACE-111-0504
4.6mm	ACE-111-0246	ACE-111-0346	ACE-111-3546	ACE-111-0546
ACE 3µm C8				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-112-0201	ACE-112-0301	ACE-112-3501	ACE-112-0501
2.1mm	ACE-112-0202	ACE-112-0302	ACE-112-3502	ACE-112-0502
3.0mm	ACE-112-0203	ACE-112-0303	ACE-112-3503	ACE-112-0503
4.0mm	-	-	ACE-112-3504	ACE-112-0504
4.6mm	ACE-112-0246	ACE-112-0346	ACE-112-3546	ACE-112-0546
ACE 3µm C4				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-113-0201	ACE-113-0301	ACE-113-3501	ACE-113-0501
2.1mm	ACE-113-0202	ACE-113-0302	ACE-113-3502	ACE-113-0502
3.0mm	ACE-113-0203	ACE-113-0303	ACE-113-3503	ACE-113-0503
4.0mm	-	-	ACE-113-3504	ACE-113-0504
4.6mm	ACE-113-0246	ACE-113-0346	ACE-113-3546	ACE-113-0546
ACE 3µm CN				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-114-0201	ACE-114-0301	ACE-114-3501	ACE-114-0501
2.1mm	ACE-114-0202	ACE-114-0302	ACE-114-3502	ACE-114-0502
3.0mm	ACE-114-0203	ACE-114-0303	ACE-114-3503	ACE-114-0503
4.0mm	-	-	ACE-114-3504	ACE-114-0504
4.6mm	ACE-114-0246	ACE-114-0346	ACE-114-3546	ACE-114-0546
ACE 3µm Phenyl				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-115-0201	ACE-115-0301	ACE-115-3501	ACE-115-0501
2.1mm	ACE-115-0202	ACE-115-0302	ACE-115-3502	ACE-115-0502
3.0mm	ACE-115-0203	ACE-115-0303	ACE-115-3503	ACE-115-0503
4.0mm	-	-	ACE-115-3504	ACE-115-0504
4.6mm	ACE-115-0246	ACE-115-0346	ACE-115-3546	ACE-115-0546
ACE 3µm AQ				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-116-0201	ACE-116-0301	ACE-116-3501	ACE-116-0501
2.1mm	ACE-116-0202	ACE-116-0302	ACE-116-3502	ACE-116-0502
3.0mm	ACE-116-0203	ACE-116-0303	ACE-116-3503	ACE-116-0503
4.0mm	-	-	ACE-116-3504	ACE-116-0504
4.6mm	ACE-116-0246	ACE-116-0346	ACE-116-3546	ACE-116-0546

ACE 3µm C18-HL				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-311-0201	ACE-311-0301	ACE-311-3501	ACE-311-0501
2.1mm	ACE-311-0202	ACE-311-0302	ACE-311-3502	ACE-311-0502
3.0mm	ACE-311-0203	ACE-311-0303	ACE-311-3503	ACE-311-0503
4.0mm	-	-	ACE-311-3504	ACE-311-0504
4.6mm	ACE-311-0246	ACE-311-0346	ACE-311-3546	ACE-311-0546
ACE 3µm C18-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-211-0201	ACE-211-0301	ACE-211-3501	ACE-211-0501
2.1mm	ACE-211-0202	ACE-211-0302	ACE-211-3502	ACE-211-0502
3.0mm	ACE-211-0203	ACE-211-0303	ACE-211-3503	ACE-211-0503
4.0mm	-	-	ACE-211-3504	ACE-211-0504
4.6mm	ACE-211-0246	ACE-211-0346	ACE-211-3546	ACE-211-0546
ACE 3µm C8-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-212-0201	ACE-212-0301	ACE-212-3501	ACE-212-0501
2.1mm	ACE-212-0202	ACE-212-0302	ACE-212-3502	ACE-212-0502
3.0mm	ACE-212-0203	ACE-212-0303	ACE-212-3503	ACE-212-0503
4.0mm	-	-	ACE-212-3504	ACE-212-0504
4.6mm	ACE-212-0246	ACE-212-0346	ACE-212-3546	ACE-212-0546
ACE 3µm C4-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-213-0201	ACE-213-0301	ACE-213-3501	ACE-213-0501
2.1mm	ACE-213-0202	ACE-213-0302	ACE-213-3502	ACE-213-0502
3.0mm	ACE-213-0203	ACE-213-0303	ACE-213-3503	ACE-213-0503
4.0mm	-	-	ACE-213-3504	ACE-213-0504
4.6mm	ACE-213-0246	ACE-213-0346	ACE-213-3546	ACE-213-0546
ACE 3µm CN-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-214-0201	ACE-214-0301	ACE-214-3501	ACE-214-0501
2.1mm	ACE-214-0202	ACE-214-0302	ACE-214-3502	ACE-214-0502
3.0mm	ACE-214-0203	ACE-214-0303	ACE-214-3503	ACE-214-0503
4.0mm	-	-	ACE-214-3504	ACE-214-0504
4.6mm	ACE-214-0246	ACE-214-0346	ACE-214-3546	ACE-214-0546
ACE 3µm Phenyl-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-215-0201	ACE-215-0301	ACE-215-3501	ACE-215-0501
2.1mm	ACE-215-0202	ACE-215-0302	ACE-215-3502	ACE-215-0502
3.0mm	ACE-215-0203	ACE-215-0303	ACE-215-3503	ACE-215-0503
4.0mm	-	-	ACE-215-3504	ACE-215-0504
4.6mm	ACE-215-0246	ACE-215-0346	ACE-215-3546	ACE-215-0546

ACE LC/MS and Rapid Analysis Columns - Part Numbers (continued)

ACE 5µm Columns

ACE 5µm C18				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-121-0201	ACE-121-0301	ACE-121-3501	ACE-121-0501
2.1mm	ACE-121-0202	ACE-121-0302	ACE-121-3502	ACE-121-0502
3.0mm	ACE-121-0203	ACE-121-0303	ACE-121-3503	ACE-121-0503
4.0mm	-	-	ACE-121-3504	ACE-121-0504
4.6mm	ACE-121-0246	ACE-121-0346	ACE-121-3546	ACE-121-0546
ACE 5µm C8				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-122-0201	ACE-122-0301	ACE-122-3501	ACE-122-0501
2.1mm	ACE-122-0202	ACE-122-0302	ACE-122-3502	ACE-122-0502
3.0mm	ACE-122-0203	ACE-122-0303	ACE-122-3503	ACE-122-0503
4.0mm	-	-	ACE-122-3504	ACE-122-0504
4.6mm	ACE-122-0246	ACE-122-0346	ACE-122-3546	ACE-122-0546
ACE 5µm C4				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-123-0201	ACE-123-0301	ACE-123-3501	ACE-123-0501
2.1mm	ACE-123-0202	ACE-123-0302	ACE-123-3502	ACE-123-0502
3.0mm	ACE-123-0203	ACE-123-0303	ACE-123-3503	ACE-123-0503
4.0mm	-	-	ACE-123-3504	ACE-123-0504
4.6mm	ACE-123-0246	ACE-123-0346	ACE-123-3546	ACE-123-0546
ACE 5µm CN				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-124-0201	ACE-124-0301	ACE-124-3501	ACE-124-0501
2.1mm	ACE-124-0202	ACE-124-0302	ACE-124-3502	ACE-124-0502
3.0mm	ACE-124-0203	ACE-124-0303	ACE-124-3503	ACE-124-0503
4.0mm	-	-	ACE-124-3504	ACE-124-0504
4.6mm	ACE-124-0246	ACE-124-0346	ACE-124-3546	ACE-124-0546
ACE 5µm Phenyl				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-125-0201	ACE-125-0301	ACE-125-3501	ACE-125-0501
2.1mm	ACE-125-0202	ACE-125-0302	ACE-125-3502	ACE-125-0502
3.0mm	ACE-125-0203	ACE-125-0303	ACE-125-3503	ACE-125-0503
4.0mm	-	-	ACE-125-3504	ACE-125-0504
4.6mm	ACE-125-0246	ACE-125-0346	ACE-125-3546	ACE-125-0546
ACE 5µm AQ				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-126-0201	ACE-126-0301	ACE-126-3501	ACE-126-0501
2.1mm	ACE-126-0202	ACE-126-0302	ACE-126-3502	ACE-126-0502
3.0mm	ACE-126-0203	ACE-126-0303	ACE-126-3503	ACE-126-0503
4.0mm	-	-	ACE-126-3504	ACE-126-0504
4.6mm	ACE-126-0246	ACE-126-0346	ACE-126-3546	ACE-126-0546

ACE 5µm C18-HL				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-321-0201	ACE-321-0301	ACE-321-3501	ACE-321-0501
2.1mm	ACE-321-0202	ACE-321-0302	ACE-321-3502	ACE-321-0502
3.0mm	ACE-321-0203	ACE-321-0303	ACE-321-3503	ACE-321-0503
4.0mm	-	-	ACE-321-3504	ACE-321-0504
4.6mm	ACE-321-0246	ACE-321-0346	ACE-321-3546	ACE-321-0546
ACE 5µm C18-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-221-0201	ACE-221-0301	ACE-221-3501	ACE-221-0501
2.1mm	ACE-221-0202	ACE-221-0302	ACE-221-3502	ACE-221-0502
3.0mm	ACE-221-0203	ACE-221-0303	ACE-221-3503	ACE-221-0503
4.0mm	-	-	ACE-221-3504	ACE-221-0504
4.6mm	ACE-221-0246	ACE-221-0346	ACE-221-3546	ACE-221-0546
ACE 5µm C8-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-222-0201	ACE-222-0301	ACE-222-3501	ACE-222-0501
2.1mm	ACE-222-0202	ACE-222-0302	ACE-222-3502	ACE-222-0502
3.0mm	ACE-222-0203	ACE-222-0303	ACE-222-3503	ACE-222-0503
4.0mm	-	-	ACE-222-3504	ACE-222-0504
4.6mm	ACE-222-0246	ACE-222-0346	ACE-222-3546	ACE-222-0546
ACE 5µm C4-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-223-0201	ACE-223-0301	ACE-223-3501	ACE-223-0501
2.1mm	ACE-223-0202	ACE-223-0302	ACE-223-3502	ACE-223-0502
3.0mm	ACE-223-0203	ACE-223-0303	ACE-223-3503	ACE-223-0503
4.0mm	-	-	ACE-223-3504	ACE-223-0504
4.6mm	ACE-223-0246	ACE-223-0346	ACE-223-3546	ACE-223-0546
ACE 5µm CN-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-224-0201	ACE-224-0301	ACE-224-3501	ACE-224-0501
2.1mm	ACE-224-0202	ACE-224-0302	ACE-224-3502	ACE-224-0502
3.0mm	ACE-224-0203	ACE-224-0303	ACE-224-3503	ACE-224-0503
4.0mm	-	-	ACE-224-3504	ACE-224-0504
4.6mm	ACE-224-0246	ACE-224-0346	ACE-224-3546	ACE-224-0546
ACE 5µm Phenyl-300				
Column Diameter	20 mm	30 mm	35 mm	50 mm
1.0mm	ACE-225-0201	ACE-225-0301	ACE-225-3501	ACE-225-0501
2.1mm	ACE-225-0202	ACE-225-0302	ACE-225-3502	ACE-225-0502
3.0mm	ACE-225-0203	ACE-225-0303	ACE-225-3503	ACE-225-0503
4.0mm	-	-	ACE-225-3504	ACE-225-0504
4.6mm	ACE-225-0246	ACE-225-0346	ACE-225-3546	ACE-225-0546

For further information on the full ACE HPLC column range (including LC/MS method development kits) please contact your local distributor.

Available from:

ACE performance
guarantee ✓

If ACE does not outperform your existing column (of equivalent phase, particle size and dimensions), send in your comparative data within 60 days and keep the ACE column FREE OF CHARGE.

www.ace-hplc.com

info@ace-hplc.com