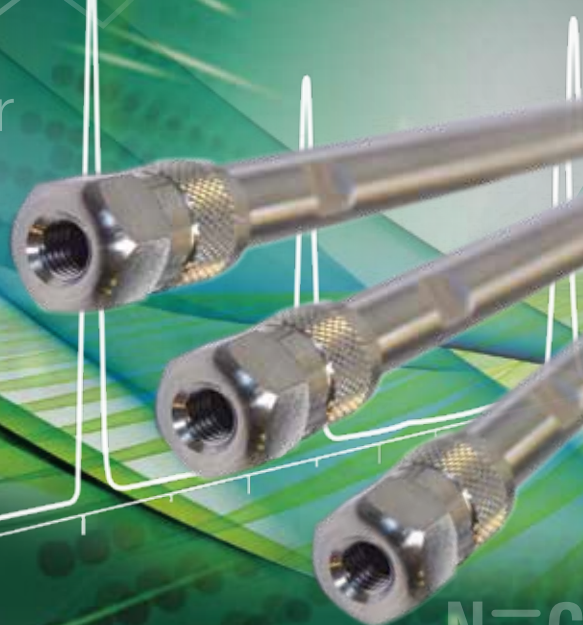


# ACE<sup>®</sup> CN-ES

Combining CN polar selectivity with enhanced hydrophobicity



N≡C  
Extended Spacer

N≡C  
Extra Stability

N≡C

N≡C  
Enhanced Selectivity

- New stationary phase technology for UHPLC and HPLC separations
- Alternative polar selectivity for method development
- High efficiency 2 $\mu$ m, 3 $\mu$ m, 5 $\mu$ m and 10 $\mu$ m particles
- Ultra-inert for maximum performance and reproducibility

N≡C

# ACE<sup>®</sup> CN-ES

Mechanism of Separation	Strength of Interaction
Dipole-dipole interactions	Strong
Hydrophobic binding interactions	Strong

## Target Analytes

Polar and non-polar analytes

Analytes with double and triple bonds

Analytes differing in hydrophobicity

Polar molecules having insufficient retention on traditional CN bonded phases

## Recommended Separations

Mixtures of very polar, polar and non-polar analytes

Suitable for NP and RP separations

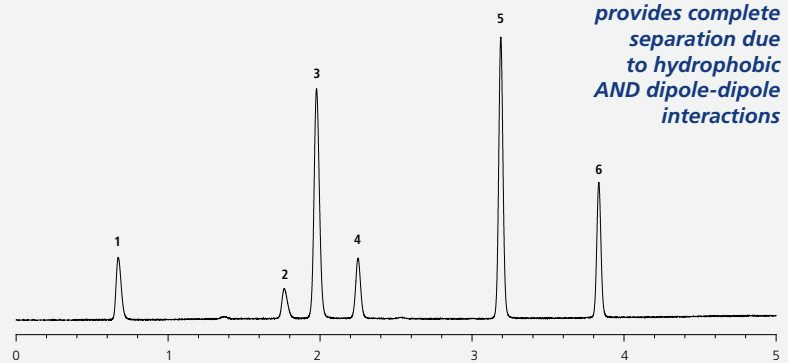
Separations where traditional CN bonded phases show insufficient stability/lifetime

Applications where a typical C18 column does not provide adequate separation

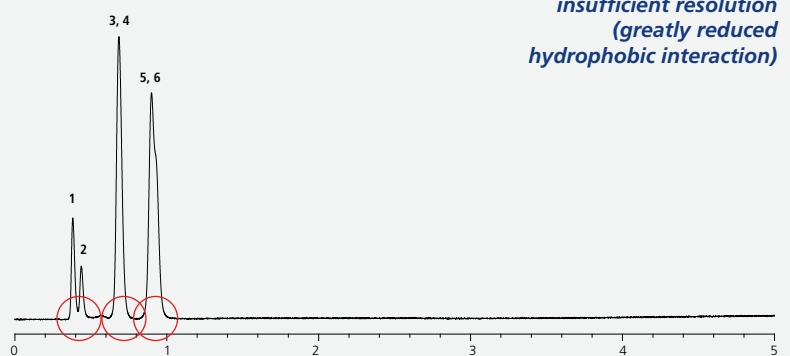
As an orthogonal phase in method development

**Fig. 1 - ACE CN-ES Provides Alternative Selectivity** Application # 1701

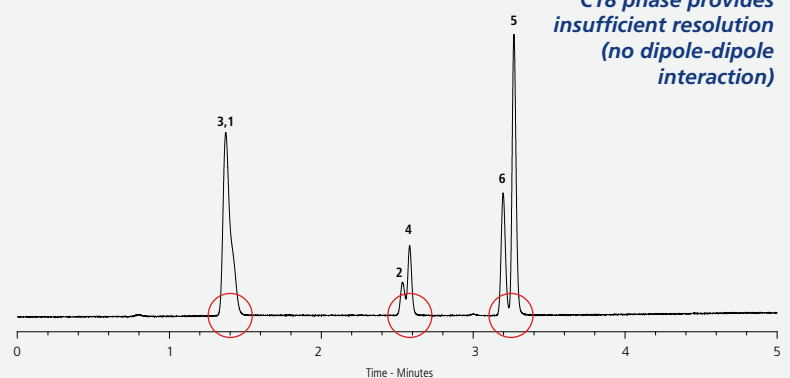
### ACE Excel 3 CN-ES



### ACE Excel 3 CN



### ACE Excel 3 C18



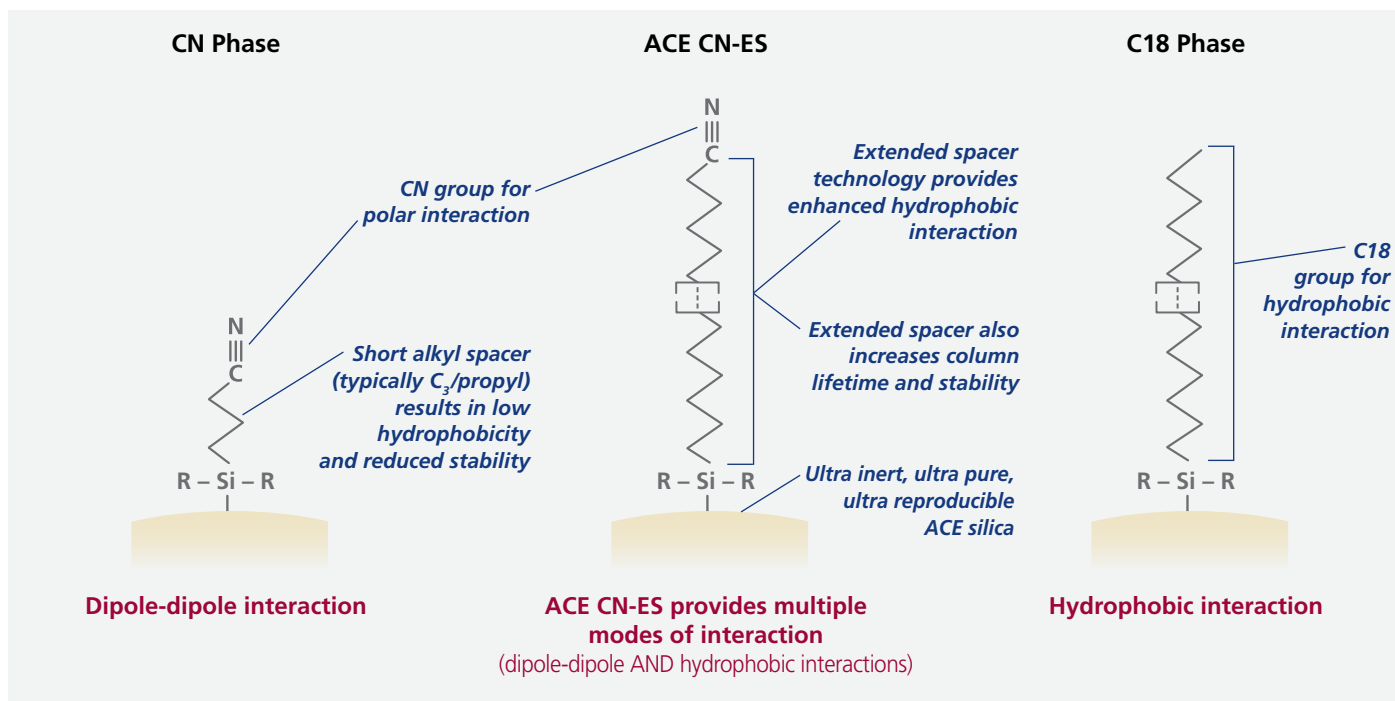
Sample: 1) metronidazole 2) benzyl alcohol 3) hydrochlorothiazide 4) vanillin  
 5) methyl paraben 6) 1,2-dinitrobenzene  
 Mobile Phase: A = 0.1% formic acid in H<sub>2</sub>O B = 0.1% formic acid in 90:10 MeOH/H<sub>2</sub>O  
 Gradient: 3 - 100% B in 5 minutes  
 Column Dimensions: 50 x 2.1mm Flow Rate: 0.60ml/min  
 Temperature: 40°C Wavelength: 254nm

**ACE** performance guarantee ✓

If ACE does not outperform the column you are currently using, simply contact us for a full refund and keep the ACE column FREE OF CHARGE.

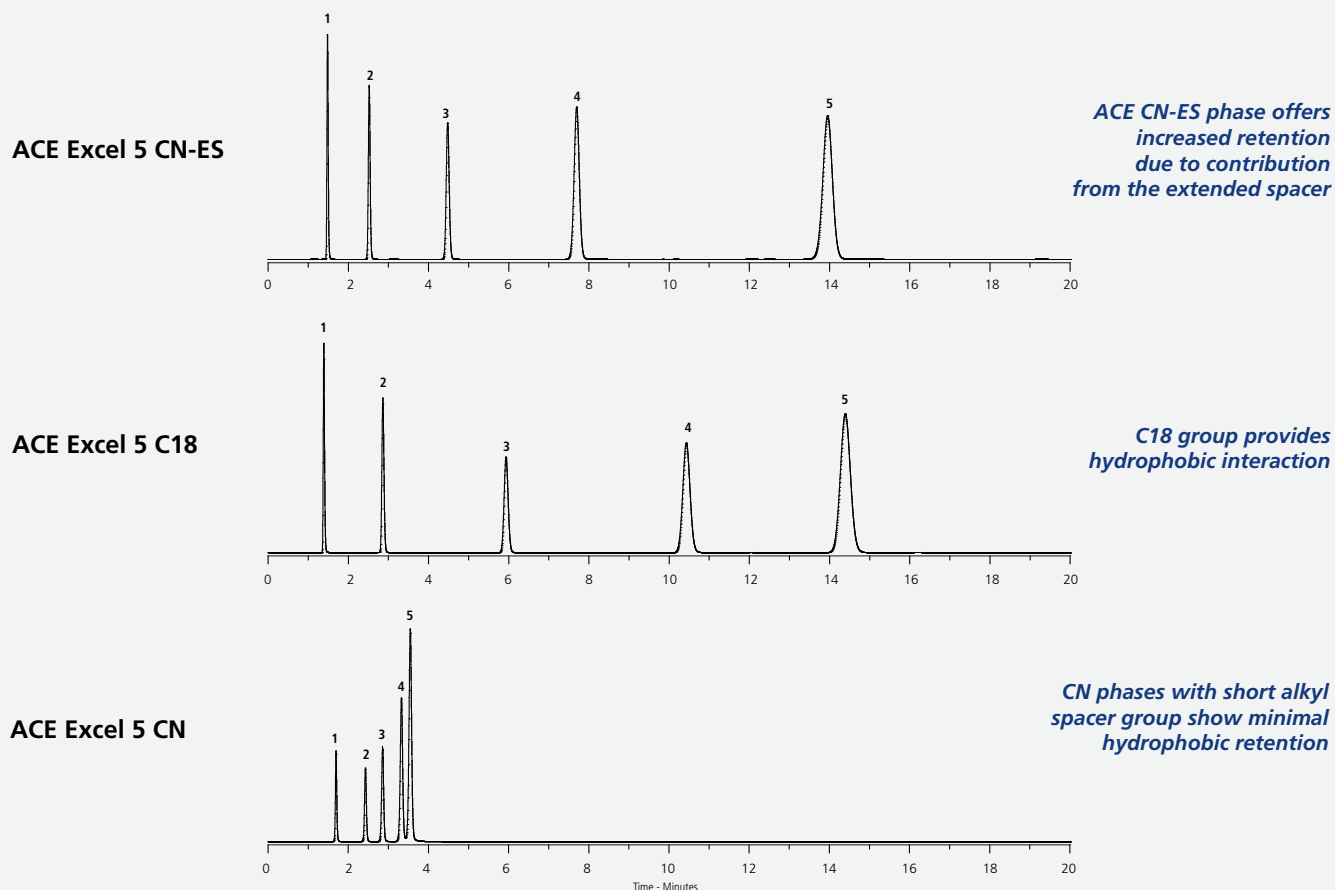
## Why does ACE CN-ES provide alternative selectivity?

- Combines a polar CN group with an extended spacer that provides retention similar to a C18 column
- Extended spacer technology additionally provides increased column lifetime compared to traditional CN bonded phases with short alkyl spacer (typically C<sub>3</sub>/propyl)



## ACE CN-ES provides retention similar to a C18 column

Fig. 2 - Separation of Neutral Compounds under RP conditions Application # 1702

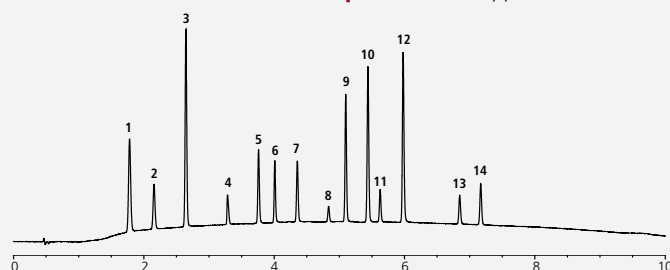


Sample: 1) uracil 2) dimethyl phthalate 3) toluene 4) biphenyl 5) phenanthrene Mobile Phase: 60:40 MeCN/H<sub>2</sub>O  
 Column Dimensions: 150 x 4.6mm Flow Rate: 1.00ml/min Temperature: 22°C Wavelength: 254nm

## Alternative Selectivity with MeOH or MeCN

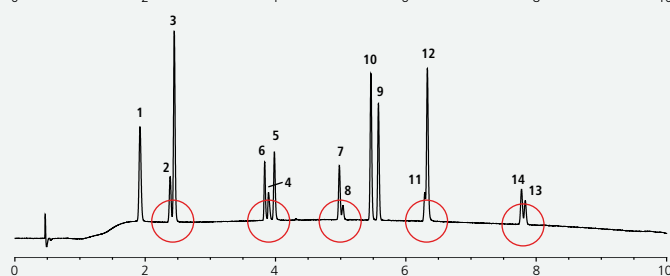
**Fig. 3 - Advantages of Multi-Mode Interactions on Separations** Application # 1703

ACE Excel 3 CN-ES



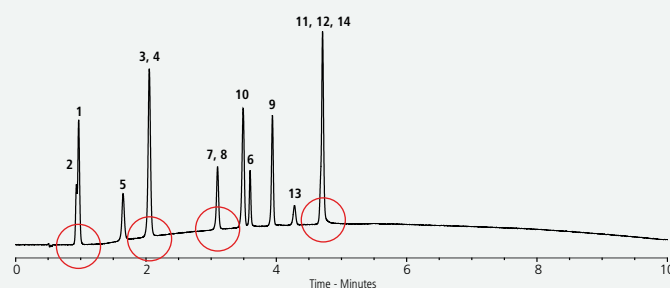
*Multi-Mode interaction with hydrophobic AND dipole-dipole interactions*

ACE Excel 3 C18



*Hydrophobic interaction (no dipole-dipole interaction)*

ACE Excel 3 CN

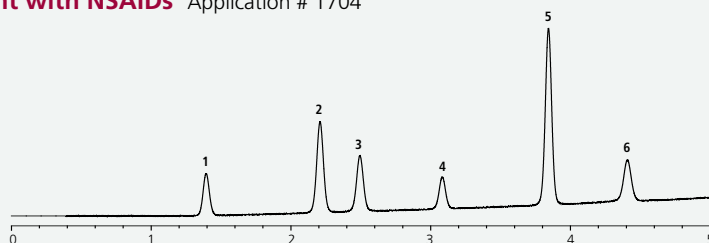


*Dipole-dipole interaction (reduced hydrophobic interaction)*

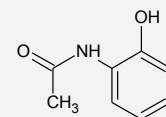
Sample: 1) 1,3-dihydroxybenzene 2) catechol 3) hydrochlorothiazide 4) oxyphenolol 5) salicylic acid 6) myricetin 7) piroxicam 8) 1,2-dinitrobenzene 9) tolmetin 10) 1-naphthol 11) piperine 12) diflunisal 13) propylbenzene 14) 1,2,3-trichlorobenzene Mobile Phase: A = 0.1% formic acid in H<sub>2</sub>O B = 0.1% formic acid in MeCN Gradient: 3 - 100% B in 10 minutes Column Dimensions: 100 x 2.1mm Flow Rate: 0.60ml/min Temperature: 40°C Wavelength: 210nm

**Fig. 4 - Fast Gradient with NSAIDs** Application # 1704

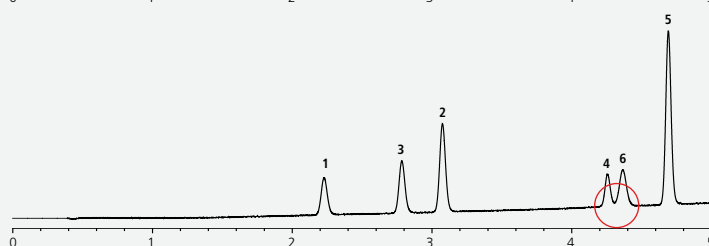
ACE Excel 3 CN-ES



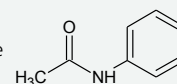
2-Acetamidophenol



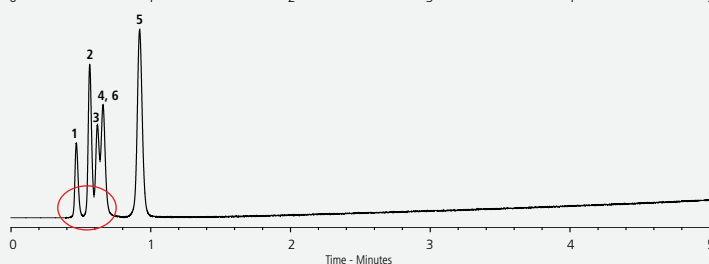
ACE Excel 3 C18



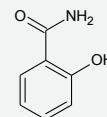
Acetanilide



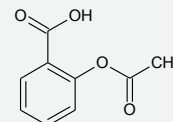
ACE Excel 3 CN



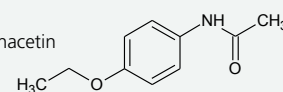
Salicylamide



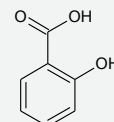
Aspirin



Phenacetin



Salicylic acid

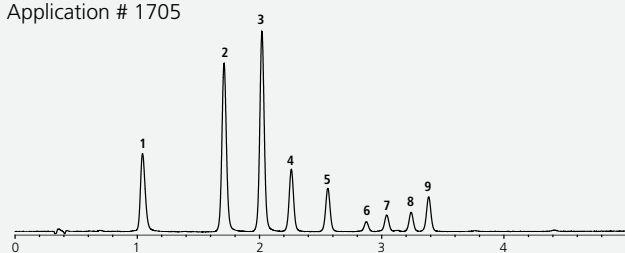


Sample: 1) 2-acetamidophenol 2) acetanilide 3) salicylamide 4) aspirin 5) phenacetin 6) salicylic acid Mobile Phase: A = 0.1% formic acid in H<sub>2</sub>O B = 0.1% formic acid in MeOH Gradient: 5 - 38% B in 3.75 minutes, hold at 38% B until 5 minutes Column Dimensions: 50 x 2.1mm Flow Rate: 0.60ml/min Temperature: 40°C Wavelength: 240nm

## Exploit Enhanced Selectivity for UHPLC

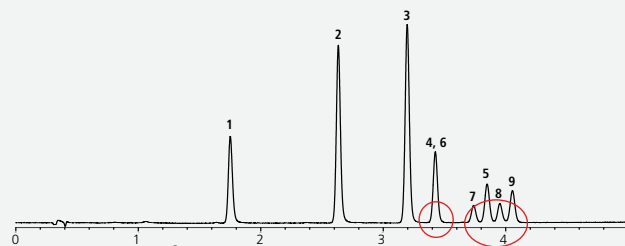
**Fig. 5 - Steroids by UHPLC** Application # 1705

**ACE Excel 2 CN-ES**



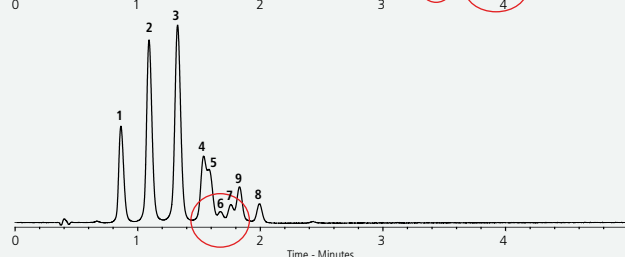
*ACE CN-ES provides complete separation due to hydrophobic AND dipole-dipole interactions*

**ACE Excel 2 C18**



*C18 phase provides insufficient resolution (no dipole-dipole interaction)*

**ACE Excel 2 CN**



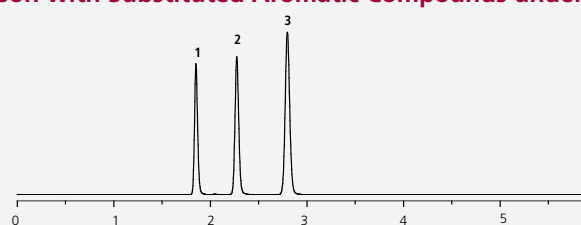
*CN phase shows insufficient resolution (reduced hydrophobic interaction)*

Sample: 1) cortisone 2) corticosterone 3) 11 $\alpha$ -hydroxyprogesterone 4) cortisone-21-acetate 5) 11-ketoprogesterone 6)  $\beta$ -estradiol 7) 17 $\alpha$ -estradiol 8) 17 $\alpha$ -ethynylestradiol 9) estrone  
 Mobile Phase: A = 0.1% formic acid in H<sub>2</sub>O B = 0.1% formic acid in MeCN Gradient: 25 – 52.5% B in 5 minutes  
 Column Dimensions: 50 x 2.1mm Flow Rate: 0.40ml/min Temperature: 40°C Wavelength: 260nm

## ACE CN-ES is additionally compatible with Normal Phase conditions

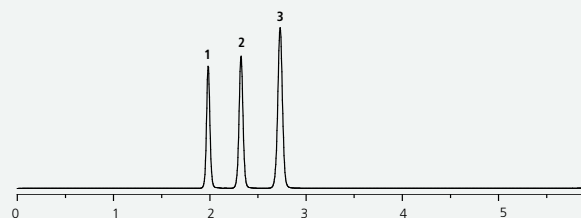
**Fig. 6 - Retention Comparison with Substituted Aromatic Compounds under NP Conditions** Application # 1706

**ACE Excel 5 CN-ES**



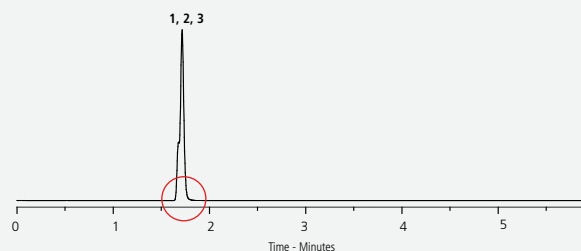
*ACE CN-ES provides separation similar to a CN column*

**ACE Excel 5 CN**



*Dipole-dipole interaction provides separation*

**ACE Excel 5 C18**



*No dipole-dipole interaction to enable separation*

Sample: 1) butylbenzene 2) methyl benzoate 3) nitrobenzene Mobile Phase: 90:10 heptane/ethyl acetate  
 Column Dimensions: 150 x 4.6mm Flow Rate: 1.00ml/min Temperature: 22°C Wavelength: 254nm

## Product Availability and Specifications

Phase	Functional Group	Endcapped	Particle Size (µm)	Pore Size (Å)	Surface Area (m <sup>2</sup> /g)	Carbon Load (%)	Maximum pH Range	100% Aqueous Compatible	USP Listing
ACE CN-ES	Cyano with proprietary extended alkyl spacer	Yes	2, 3, 5, 10	100	300	12.6	2.0-8.0 <sup>a</sup>	Yes	L10

<sup>a</sup>For optimum column lifetime, a pH range of 2-8 is recommended. To increase column lifetime at higher pH, organic buffers, low buffer concentrations, high % organic solvent and low temperatures must be considered. Further information is contained within "A Guide to HPLC and LC/MS Buffer Selection" by John Dolan – please contact your distributor to request your FREE copy or visit [www.ace-hplc.com](http://www.ace-hplc.com).

### ACE Excel 2µm CN-ES UHPLC/HPLC Columns (supplied in dual compatible UHPLC/HPLC "Excel" hardware format with 1000bar/15000psi pressure limit)

Column Diameter	Column Length							
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm
2.1mm	EXL-1013-0202U	EXL-1013-0302U	EXL-1013-3502U	EXL-1013-0502U	EXL-1013-7502U	EXL-1013-1002U	EXL-1013-1202U	EXL-1013-1502U
3.0mm	EXL-1013-0203U	EXL-1013-0303U	EXL-1013-3503U	EXL-1013-0503U	EXL-1013-7503U	EXL-1013-1003U	EXL-1013-1203U	EXL-1013-1503U
4.6mm	EXL-1013-0246U	EXL-1013-0346U	EXL-1013-3546U	EXL-1013-0546U	EXL-1013-7546U	EXL-1013-1046U	EXL-1013-1246U	EXL-1013-1546U

### ACE Excel 3µm CN-ES UHPLC/HPLC Columns (supplied in dual compatible UHPLC/HPLC "Excel" hardware format with 1000bar/15000psi pressure limit)

Column Diameter	Column Length								
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	250mm
2.1mm	EXL-1113-0202U	EXL-1113-0302U	EXL-1113-3502U	EXL-1113-0502U	EXL-1113-7502U	EXL-1113-1002U	EXL-1113-1202U	EXL-1113-1502U	EXL-1113-2502U
3.0mm	EXL-1113-0203U	EXL-1113-0303U	EXL-1113-3503U	EXL-1113-0503U	EXL-1113-7503U	EXL-1113-1003U	EXL-1113-1203U	EXL-1113-1503U	EXL-1113-2503U
4.6mm	EXL-1113-0246U	EXL-1113-0346U	EXL-1113-3546U	EXL-1113-0546U	EXL-1113-7546U	EXL-1113-1046U	EXL-1113-1246U	EXL-1113-1546U	EXL-1113-2546U

### ACE Excel 5µm CN-ES UHPLC/HPLC Columns (supplied in dual compatible UHPLC/HPLC "Excel" hardware format with 1000bar/15000psi pressure limit)

Column Diameter	Column Length								
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	250mm
2.1mm	EXL-1213-0202U	EXL-1213-0302U	EXL-1213-3502U	EXL-1213-0502U	EXL-1213-7502U	EXL-1213-1002U	EXL-1213-1202U	EXL-1213-1502U	EXL-1213-2502U
3.0mm	EXL-1213-0203U	EXL-1213-0303U	EXL-1213-3503U	EXL-1213-0503U	EXL-1213-7503U	EXL-1213-1003U	EXL-1213-1203U	EXL-1213-1503U	EXL-1213-2503U
4.6mm	EXL-1213-0246U	EXL-1213-0346U	EXL-1213-3546U	EXL-1213-0546U	EXL-1213-7546U	EXL-1213-1046U	EXL-1213-1246U	EXL-1213-1546U	EXL-1213-2546U

### ACE 5µm CN-ES Semi-Prep and Preparative HPLC Columns (supplied in HPLC hardware format with 275bar/4000psi pressure limit)

Column Diameter	Column Length					
	50mm	75mm	100mm	125mm	150mm	250mm
7.75mm	ACE-1213-0508	ACE-1213-7508	ACE-1213-1008	ACE-1213-1208	ACE-1213-1508	ACE-1213-2508
10mm	ACE-1213-0510	ACE-1213-7510	ACE-1213-1010	ACE-1213-1210	ACE-1213-1510	ACE-1213-2510
21.2mm	ACE-1213-0520	ACE-1213-7520	ACE-1213-1020	ACE-1213-1220	ACE-1213-1520	ACE-1213-2520

### ACE 10µm CN-ES Analytical, Semi-Prep and Preparative HPLC Columns (supplied in HPLC hardware format with 275bar/4000psi pressure limit)

Column Diameter	Column Length					
	50mm	75mm	100mm	125mm	150mm	250mm
4.6mm	ACE-1313-0546	ACE-1313-7546	ACE-1313-1046	ACE-1313-1246	ACE-1313-1546	ACE-1313-2546
7.75mm	ACE-1313-0508	ACE-1313-7508	ACE-1313-1008	ACE-1313-1208	ACE-1313-1508	ACE-1313-2508
10mm	ACE-1313-0510	ACE-1313-7510	ACE-1313-1010	ACE-1313-1210	ACE-1313-1510	ACE-1313-2510
21.2mm	ACE-1313-0520	ACE-1313-7520	ACE-1313-1020	ACE-1313-1220	ACE-1313-1520	ACE-1313-2520
30mm	ACE-1313-0530	ACE-1313-7530	ACE-1313-1030	-	ACE-1313-1530	ACE-1313-2530

### ACE CN-ES Capillary and Nano HPLC Columns

ACE CN-ES capillary and nano columns are available in 1mm, 0.5mm (500µm), 300µm, 100µm and 75µm internal diameters with 3µm, 5µm and 10µm particle sizes. Please enquire for further information.

## UHPLC and HPLC Method Development Kits



Method development kits enable the optimum bonded phase for an application to be identified. ACE columns are available with a unique range of highly selective phases in 2µm, 3µm, 5µm and 10µm particle sizes, specially developed for challenging UHPLC and HPLC applications.

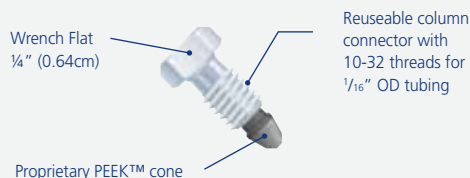
The availability of a range of phases offering complementary selectivity enables resolution to be maximised, improves the chances of impurity detection and increases the speed at which methods can be systematically developed.

Please enquire for further information.

## UHPLC and HPLC Column Accessories

### UHPLC Column Connectors

- Pressure rating >1700 bar (>25000 psi)
- Compatible with all UHPLC systems<sup>1</sup>
- Compatible with all UHPLC column brands
- Eliminates poor connections
- Innovative reusable design



**ACE Excel UHPLC Column Connector**  
(p/n EXL-CC10, 10 pack)

All UHPLC column brands require correct installation in order to realise maximum column efficiency. To avoid connection problems, permanently swaged fittings are not recommended as they do not allow free movement between the tubing, fitting and column inlet on installation. This can result in a poorly connected column that shows unexpected peak tailing due to the introduction of extra column volume (dead volume) to the system. Alternatively, a leak at the inlet fitting connection may be observed.

ACE Excel UHPLC Column Connectors (p/n EXL-CC10, 10 pack) enable the inlet end of UHPLC columns to be correctly installed every time. Their unique reusable design ensures that they maintain a 1700 bar (25000 psi) pressure rating with repeated use, yet do not permanently swage onto the inlet tubing. To maximise the lifetime of the fitting, the use of torque wrench (p/n EXL-TW) is required.

At the outlet end of the UHPLC column (where pressure demands are lower but a correct connection remains important), ACE Fingertight HPLC Column Connectors (p/n ACE-CC10, 10 pack, see overleaf) may alternatively be used.

<sup>1</sup>**Note:** For inlet connections onto a Waters Acquity system (containing a Waters Acquity 1/8" fitting and ferrule on the inlet tubing) the use of a pre-column filter incorporating the unique Waters Acquity column port profile is alternatively recommended (p/n EXL-PCF10/ACQ - 10 pack) to ensure maximum compatibility with the Waters Acquity system fittings.

### UHPLC Pre-column Filters

To further extend column lifetime under UHPLC conditions up to 15000 psi (1000 bar), ACE Excel UHPLC Pre-column filters are recommended. By one estimate, over 70% of the failures of UHPLC and HPLC columns are caused by inlet frit plugging. Due to their ultra low dispersion design, column performance and retention remain unaffected, whilst the column inlet is protected from blockage. ACE Excel UHPLC Pre-column filters can be installed on any brand of UHPLC column in seconds. Simply finger tighten initially, then wrench tighten a further 1/4 turn.

Two UHPLC pre-column filter options are available, for compatibility with all UHPLC systems:

- ACE Excel UHPLC Pre-column Filters (p/n EXL-PCF10, 10 pack) are compatible with almost all UHPLC system configurations.
- For inlet connections onto a Waters Acquity system (containing a Waters Acquity 1/16" fitting and ferrule on the inlet tubing) the use of a pre-column filter incorporating the Waters Acquity column port profile is alternatively recommended (p/n EXL-PCF10/ACQ - 10 pack) to ensure maximum compatibility.

- 1000 bar (15000 psi) pressure rating
- Eliminates poor connections
- Compatible with all UHPLC column brands
- Compatible with all UHPLC systems including Waters Acquity<sup>1</sup>



**ACE Excel UHPLC Pre-Column Filter**  
(p/n EXL-PCF10, 10 pack)

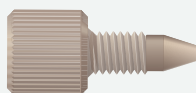


**ACE Excel UHPLC Pre-Column Filter**  
(Waters Acquity System Compatible)  
(p/n EXL-PCF10/ACQ, 10 pack)

## UHPLC and HPLC Column Accessories (continued)

### HPLC Column Connectors

- Fingertight to 350 bar (5000 psi)
- Reuseable and simple to install
- Eliminates poor connections
- Compatible with all HPLC column brands and instruments



ACE Fingertight HPLC Column Connector  
(p/n ACE-CC10, 10 pack)

ACE Fingertight HPLC Column Connectors (p/n ACE-CC10, 10 pack) are recommended for the connection of both the inlet and outlet ends of HPLC columns.

Manufactured from premium quality PEEK™, the fittings simply hand tighten to provide a perfect column connection, and are pressure rated to 350 bar/5000 psi.

ACE Fingertight HPLC Column Connectors may additionally be used at the outlet end of UHPLC columns, where pressure demands are lower but a correct connection remains important.

### HPLC Guard Cartridges

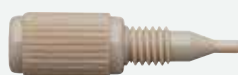
- Pressure rated to 275 bar (4000 psi)
- Simple to install and exchange
- Increase HPLC column lifetime

Guard cartridges are recommended to prevent both inlet frit blockage and irreversible sample adsorption onto the top of the column. Guard cartridges are available for all ACE HPLC columns from nano and capillary dimensions through to preparative scale.

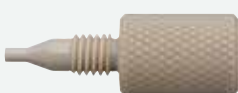
For assistance identifying the appropriate guard for the column selected, please contact our Technical Support Department at [info@ace-hplc.com](mailto:info@ace-hplc.com)

### HPLC Pre-column Filters

- Pressure rated to 350 bar (5000 psi)
- Simple to install and replace
- Effective low cost column protection
- Compatible with all HPLC column brands



ACE Analytical HPLC Pre-column Filter  
(p/n ACE-CS210, 10 pack)



ACE Microbore HPLC Pre-column Filter  
(p/n ACE-HP210, 10 pack)

As an alternative to guard cartridges, pre-column filters may be used to protect the column inlet frit from blockage. Due to their ultra low dispersion design, column performance and retention remain unaffected.

ACE HPLC pre-column filters utilise a PEEK™ fingertight design that connects directly into any 1/16" 10-32 internal thread column inlet, and are thus compatible with all HPLC column brands.

For 3.0 - 4.6mm id HPLC columns, the use of ACE Analytical HPLC Pre-column Filters (p/n ACE-CS210, 10 pack) are recommended. For 2.1mm id HPLC columns, the use of ACE Microbore HPLC Pre-column Filters (p/n ACE-HP210, 10 pack) are recommended.

ACE HPLC pre-column filters are simply hand tightened into the column inlet to achieve a pressure rating of 350 bar (5000 psi). If higher pressure rating is required, ACE Excel UHPLC Pre-column Filters (suitable for use up to 1000 bar/15000 psi) are alternatively recommended.

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**ACE® UHPLC and HPLC columns are available through our international distributor network**  
Available from:

