

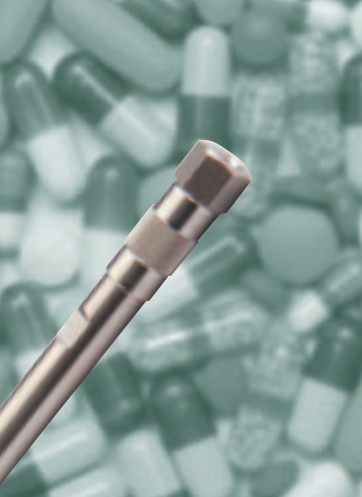
# ACE<sup>®</sup> Excel<sup>™</sup>

## Ultra Robust UHPLC Columns

- High efficiency 2 $\mu$ m particles
- Unique phases for rapid method development
- Compatible with UHPLC and HPLC systems
- HSC<sup>™</sup> High Stability Columns – ultra robust columns up to 1,000 bar (15,000psi)



**ACE<sup>®</sup> Excel<sup>™</sup>**  
UHPLC Columns



# ACE<sup>®</sup> Excel<sup>™</sup> UHPLC Columns

Designed to take full advantage of low dispersion, ultra-high pressure UPLC<sup>®</sup> and UHPLC instruments, the introduction of ACE<sup>®</sup> Excel<sup>™</sup> UHPLC columns gives chromatographers more choices to achieve better results.

**Ultra robust columns – Unique phases – High efficiency 2µm particles**

## NEW High Efficiency 2µm ACE Particles

ACE Excel UHPLC columns are available in a new high efficiency 2µm particle size. Selectivity is unchanged from existing 3µm, 5µm and 10µm ACE HPLC phases. Excellent peak shape, great column-to-column reproducibility and exceptional column ruggedness is now available to UPLC and UHPLC users with ACE Excel UHPLC columns.

## HSC<sup>™</sup> High Stability Columns

All ACE Excel UHPLC columns are manufactured using a proprietary HSC<sup>™</sup> (High Stability Column) manufacturing process that results in ultra robust UHPLC columns.

## Optimised UHPLC Hardware

ACE Excel columns utilise specially developed low dispersion hardware which enables high efficiency UHPLC separations up to a maximum pressure limit of 1,000 bar (15,000psi).

## Unique Stationary Phases

ACE Excel 2µm columns are available with C18-PFP and C18-AR "Extra Resolving Power" phases. These two unique phases offer multiple mechanisms of separation and have been specifically developed to provide alternative selectivity to C18 phases. ACE Excel 2µm columns are also available with C18, C8, C4, CN, AQ, Phenyl and Silica phases.

**ACE<sup>®</sup>** Stationary Phases Virtually Eliminate the Negative Effects of Silanols on UHPLC and HPLC Separations



## Better UHPLC Results

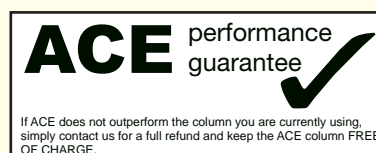
The introduction of ACE Excel UHPLC columns means chromatographers now have more choices within their reach to achieve better results with their UPLC and UHPLC instruments.

## Performance Boost for HPLC Instrumentation

ACE Excel 2µm UHPLC columns provide significantly lower back pressure than other UPLC and UHPLC columns packed with <2µm particles. Therefore ACE Excel 2µm columns may also be used on HPLC systems to provide a performance boost compared to standard HPLC columns (subject to HPLC system pressure limitations).

## Maximise Column Lifetime/Reduce Analysis Costs

High performance, coupled with the lower back pressures of ACE Excel UHPLC columns, allow you to maximise UHPLC column lifetime, making ACE Excel UHPLC columns an excellent first choice when you need a cost effective, robust, high performance UHPLC solution.



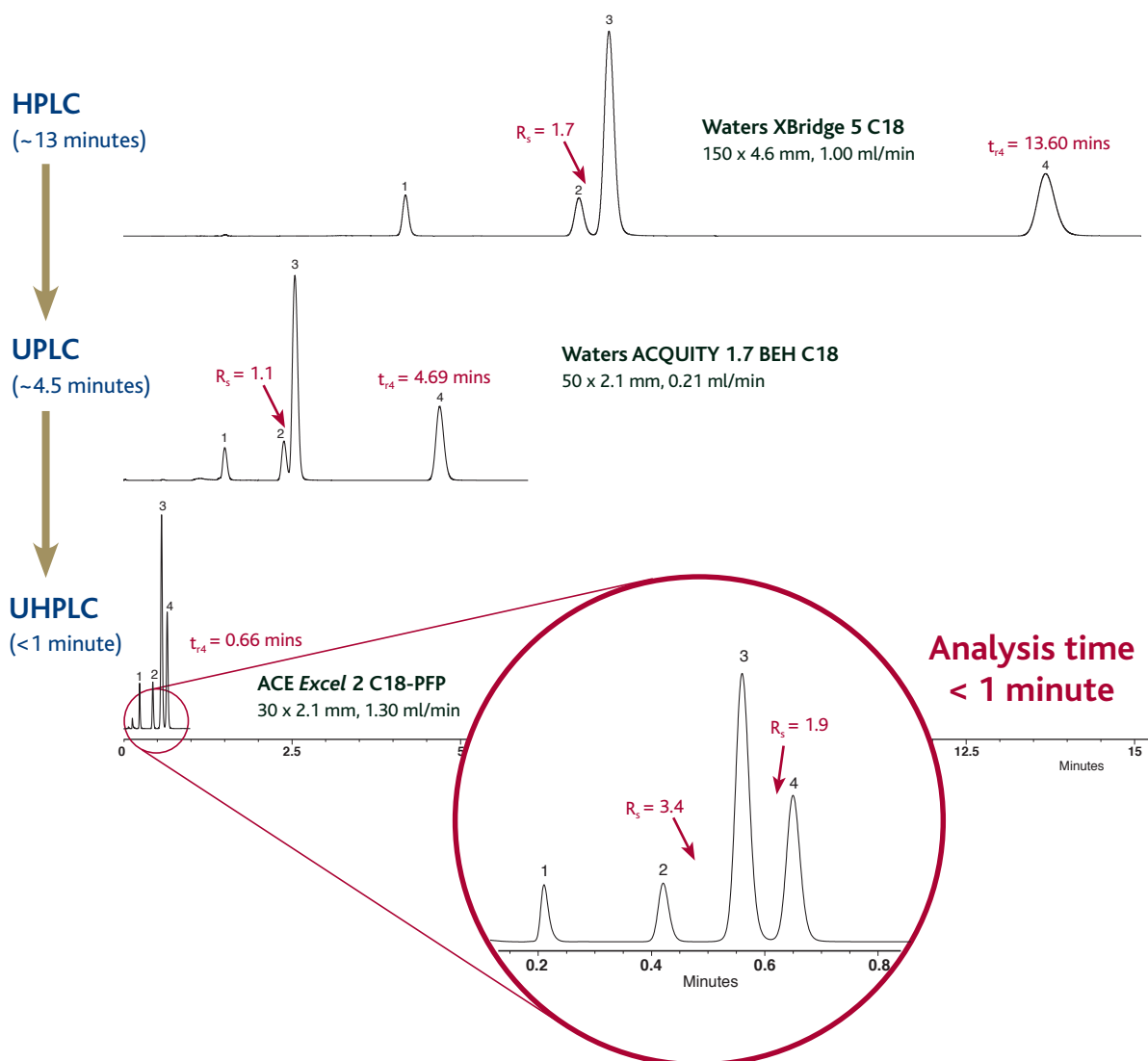
# High speed, high resolution, UHPLC separations

## ACE® Excel™ 2µm UHPLC columns

- Fully compatible with all commercial UPLC and UHPLC instruments
- Brings renowned ACE HPLC columns' advantages to UHPLC columns
- Delivers a high level of reliability and ruggedness
- Offers easy scalability from UHPLC to HPLC to preparative HPLC
- Provides users of UPLC/UHPLC with additional choices in stationary phases, including the powerful C18-AR and C18-PFP phases

**Figure 1: ACE® Excel™ unique stationary phase columns provide alternative selectivity with high speed, high resolution separations** Application #1500 – HPLC to UHPLC Optimisation

Sample: 1) 1,2-dimethoxybenzene 2) 1,3-dimethoxybenzene 3) 1,3,5-trimethoxybenzene 4) toluene  
Mobile Phase: MeOH/H<sub>2</sub>O (50:50 v/v) Temperature: 40°C Detection: UV, 210 nm



Comparative data may not be representative of all applications.  
Please see p.10 for acknowledgement of trademarks.

Scaling this separation from HPLC (XBridge) to UPLC (ACQUITY BEH) whilst retaining the C18 bonded phase has limitations due to the reduced resolution of the critical pair 2 and 3.

The unique selectivity of the ACE Excel C18-PFP provides enhanced resolution of peaks 2 and 3, enabling column length to be further reduced and flow rate elevated, resulting in an analysis time of < 1 minute.

# All the well known advantages of ACE® HPLC columns are now available for UHPLC

## ACE® Excel™ Advantages

- Excellent peak shape for basic and acidic compounds
- Exceptional column-to-column reproducibility
- Rugged and reliable day-to-day performance and superb column lifetime

### Leverage the power of bonded phase selectivity and combine it with UHPLC efficiency and speed

C18 bonded phases are the most popular phases for HPLC/UHPLC because they offer good retention and selectivity for a wide variety of sample types. In addition, they are perceived to be more rugged and reliable than other bonded phases. C18 bonded phases depend mainly on hydrophobic interactions (and occasionally shape selectivity) to achieve satisfactory separations. Although versatile, C18 phases offer a limited number of separation mechanisms and this may lead to less than optimum separations in some cases and complete lack of resolution of important peak pairs in others.

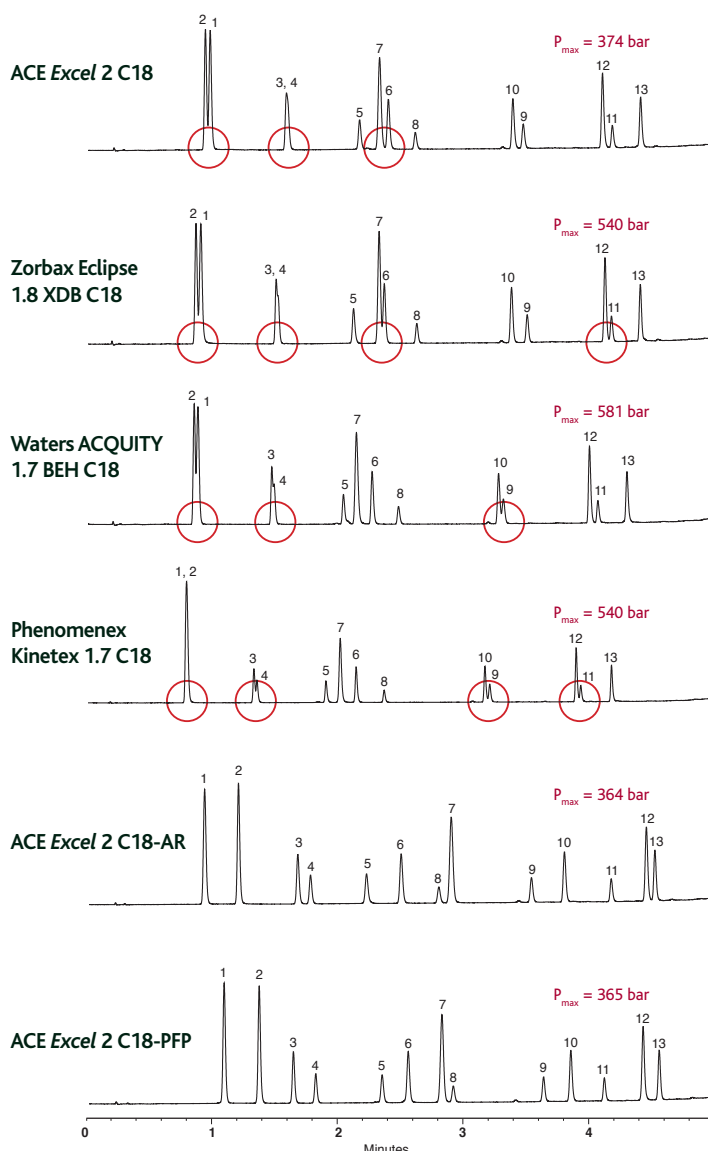
ACE columns have led the way in offering C18 bonded phases with the advantage of 'extra selectivity'. C18-AR and C18-PFP bonded phases have proved to be extremely powerful tools to use in leveraging this 'extra selectivity' to achieve separations that may not be possible with 'standard' C18 bonded phases. These 'extra selectivity' phases are not meant to replace 'standard' C18 bonded phases, but rather complement them and so provide chromatographers with powerful, additional mechanisms of separation that can be used to achieve better overall chromatographic results.

The introduction of ACE Excel UHPLC columns means that chromatographers now have more choices within their reach to achieve better results with their UPLC and UHPLC instruments.

**Figure 2: ACE® Excel™ delivers excellent resolution and peak shape**  
Application #1501 – Pharmaceuticals and Related Compounds by UHPLC

Mobile Phase: A = 5 mM formic acid in H<sub>2</sub>O and B = 5 mM formic acid in MeOH  
Gradient: 3 to 100% B in 5 minutes  
Flow Rate: 0.6 ml/min  
Temperature: 40°C  
Detection: UV, 254 nm  
Column Dimensions: 50 x 2.1mm

1. paracetamol	8. 1,2,4-trimethoxybenzene
2. hydrochlorothiazide	9. ethylbenzoate
3. methylphenylsulphoxide	10. nimesulide
4. methylphenylsulphone	11. ibuprofen
5. aspirin	12. indomethacin
6. phenacetin	13. mefenamic acid
7. 1,3-dinitrobenzene	



Comparative data may not be representative of all applications. Please see p.10 for acknowledgement of trademarks.

The above example highlights that these leading C18 brands provide similar selectivity and fail to fully resolve the components under these conditions, with 2 or more critical pairs non baseline resolved in each case.

The unique selectivity of the ACE Excel C18-AR and the ACE Excel C18-PFP phases enable improved separations.

## Fully compatible with all commercial UPLC and UHPLC instruments

### Compatible with all UPLC and UHPLC Systems

ACE Excel UHPLC columns are designed to be fully compatible with all commercial UPLC and UHPLC instruments and have been engineered to benefit from the high flow rate, ultra-high pressure and low dispersion of these systems. ACE Excel columns provide chromatographers with more column choices so that even more value can be obtained from their UPLC/UHPLC instruments.

### Performance Boost for HPLC Systems

Owing to the optimal 2µm particle size and a rigorous classification protocol, column back pressure is significantly lower than for traditional UPLC and UHPLC columns packed with <2µm particles. Therefore ACE Excel 2µm columns may also be used on HPLC systems to provide a performance boost compared to standard HPLC columns, subject to HPLC system pressure limitations.

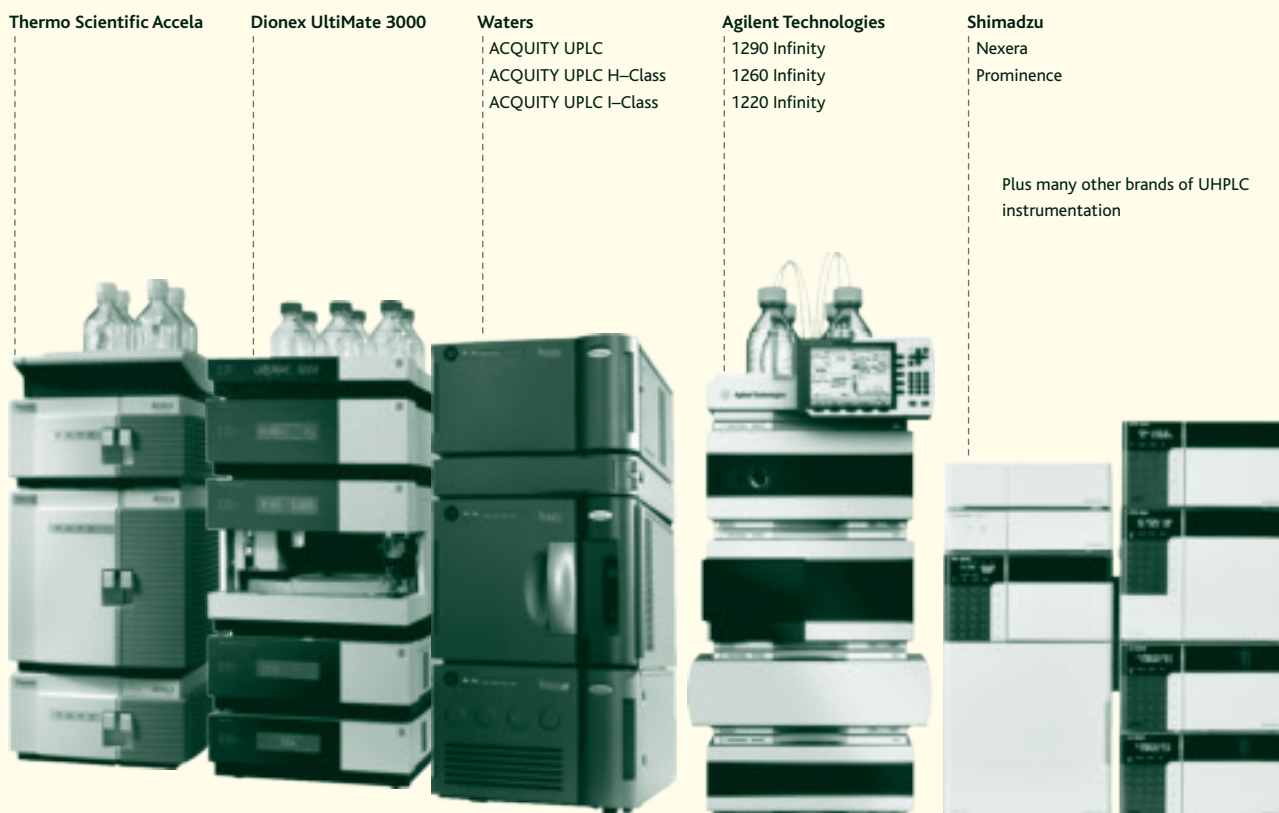
### ACE® Excel™ UHPLC columns are compatible with:

- Waters ACQUITY UPLC, ACQUITY UPLC H-Class, ACQUITY UPLC I-Class
- Agilent 1290 Infinity, 1260 Infinity, 1220 Infinity
- Thermo Scientific Accela
- Dionex UltiMate 3000
- Shimadzu Nexera, Prominence
- Plus many other brands of UHPLC instrumentation

### Connecting UHPLC Columns

ACE Excel UHPLC reusable column connectors are recommended as a universal fitting suitable for connecting columns to all UPLC and UHPLC systems (see page 9 for further details).

Figure 3: ACE Excel UHPLC columns are compatible with all commercial UPLC and UHPLC instruments



Please see p.10 for acknowledgement of trademarks

# Column-to-column reproducibility and ultra robust, reliable performance

## Excellent Reproducibility

Column-to-column reproducibility is affected by a number of factors including the production of the silica stationary phase support, the manufacture of the silane stationary phase, the bonding of the stationary phase to the support and the packing of the stationary phase into the column. The more tightly each stage of the column manufacturing process is controlled, the better the quality of the resultant column will be.

ACE columns are subjected to extensive controls at each stage of the manufacturing process, to ensure that ACE columns produce reliable, predictable high performance separations from column-to-column and batch-to-batch.

## HSC™ High Stability Columns

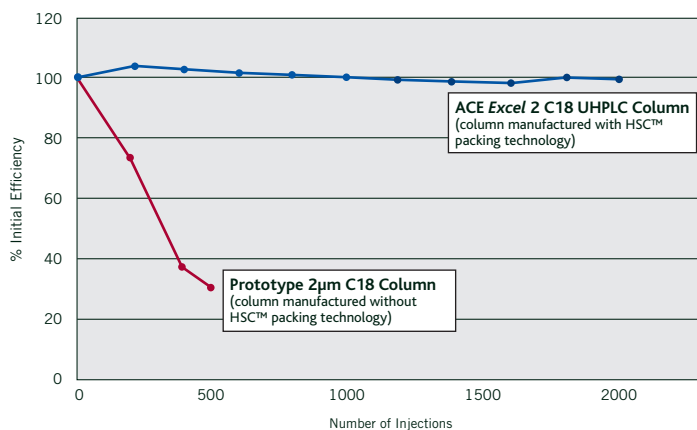
All ACE Excel UHPLC columns are manufactured using a proprietary HSC™ (High Stability Column) packing technology, which results in ultra robust columns.

Not only are ACE Excel columns packed exceptionally well, they incorporate an inlet frit design that reduces the risk of plugging.

It is still recommended that you filter samples and mobile phases as you would with any UHPLC column, but ACE Excel columns provide the same levels of durability and lifetime that you would expect from HPLC columns.

Figure 4 illustrates the excellent column lifetime provided by an ACE Excel column under searching fast gradient UHPLC conditions.

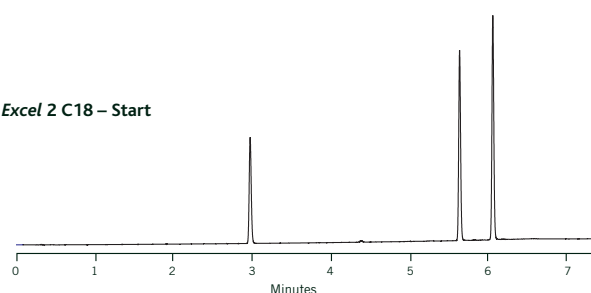
Figure 4: ACE® Excel™ UHPLC columns are exceptionally durable  
Application #1506



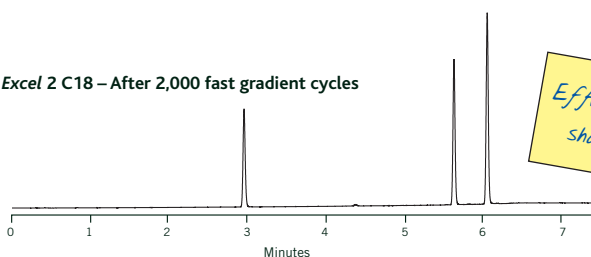
### Fast Gradient Conditions:

Column Dimensions: 100 x 2.1 mm Flow Rate: 0.73 ml/min  $P_{max} = 1,000$  bar (15,000psi)  
Mobile Phase: A = 0.1% formic acid in H<sub>2</sub>O B = 0.1% formic acid in MeOH  
Gradient: 20% to 90%B in 6 minutes, 1 minute hold  
90% to 20%B in 1 minute, 2 minutes re-equilibration hold

ACE Excel 2 C18 – Start



ACE Excel 2 C18 – After 2,000 fast gradient cycles



*Efficiency and peak shape unchanged*

A 100 x 2.1mm ACE Excel 2µm C18 UHPLC column manufactured using the proprietary HSC™ (High Stability Column) packing technology was subjected to a gradient cycle incorporating a  $P_{max}$  of 1,000 bar (15,000psi). After over 2000 cycles, the column efficiency, peak shape and retention times were essentially unchanged.

In contrast a Prototype 2µm C18 column manufactured from the same silica but without the proprietary HSC™ column packing technology was seen to rapidly deteriorate.

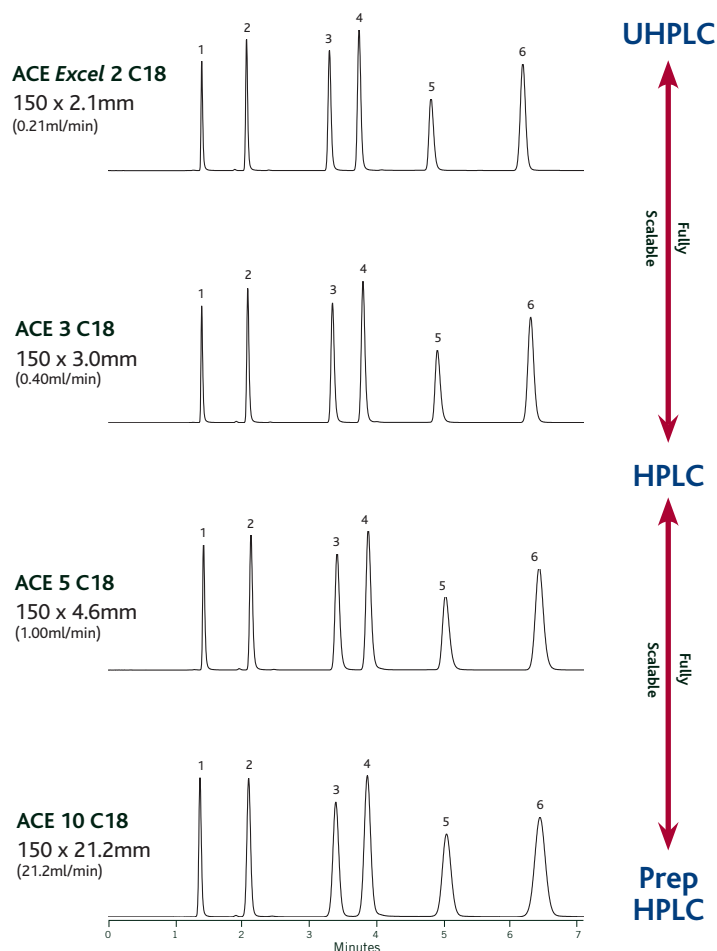
# Easy scalability from UHPLC to HPLC to Preparative HPLC

**Figure 5: Selectivity is preserved and assured when scaling ACE® stationary phases from UHPLC (2µm) to HPLC (3µm and 5µm) to preparative HPLC (10µm)**

Application # 1502 – Reproducible Scale-up

Mobile Phase: 35:65 MeCN/0.1%TFA in H<sub>2</sub>O  
Temperature: 22°C  
Wavelength: 254 nm

1) uracil  
2) 4-hydroxybenzoic acid  
3) acetylsalicylic acid  
4) benzoic acid  
5) 2-hydroxybenzoic acid  
6) ethyl paraben



These chromatograms of a test sample run under the same mobile phase conditions on an ACE Excel 2µm C18 UHPLC column, an ACE 3µm C18 HPLC column, an ACE 5µm C18 HPLC column and an ACE 10µm C18 preparative HPLC column illustrate the consistent selectivity inherent in all ACE stationary phases, regardless of particle size. This permits easier transfer of methods from UHPLC to HPLC or HPLC to UHPLC. It also makes it easier to scale-up from analytical to preparative applications.

All ACE Excel UHPLC columns are available in larger particle size equivalents and larger non-analytical dimensions.

For ACE stationary phases, the same controls that ensure highly reproducible columns from batch-to-batch also ensure that you can transfer methods more easily from UHPLC to HPLC, or vice-versa, or scale-up to preparative applications when needed to isolate or purify a target compound. The column efficiency will, of course, change, but the selectivity will be predictably the same.



# C18

## Mechanisms of Separation

Hydrophobic binding interactions

Shape selectivity

## Strength of Interaction

Strong

Weak

## Target Analytes

Analytes differing in hydrophobicity

Polar, moderately polar and nonpolar analytes

Uncharged acids and bases

Ionized acids or bases using ion-pairing

## Recommended Applications

Analytes differing in hydrophobicity

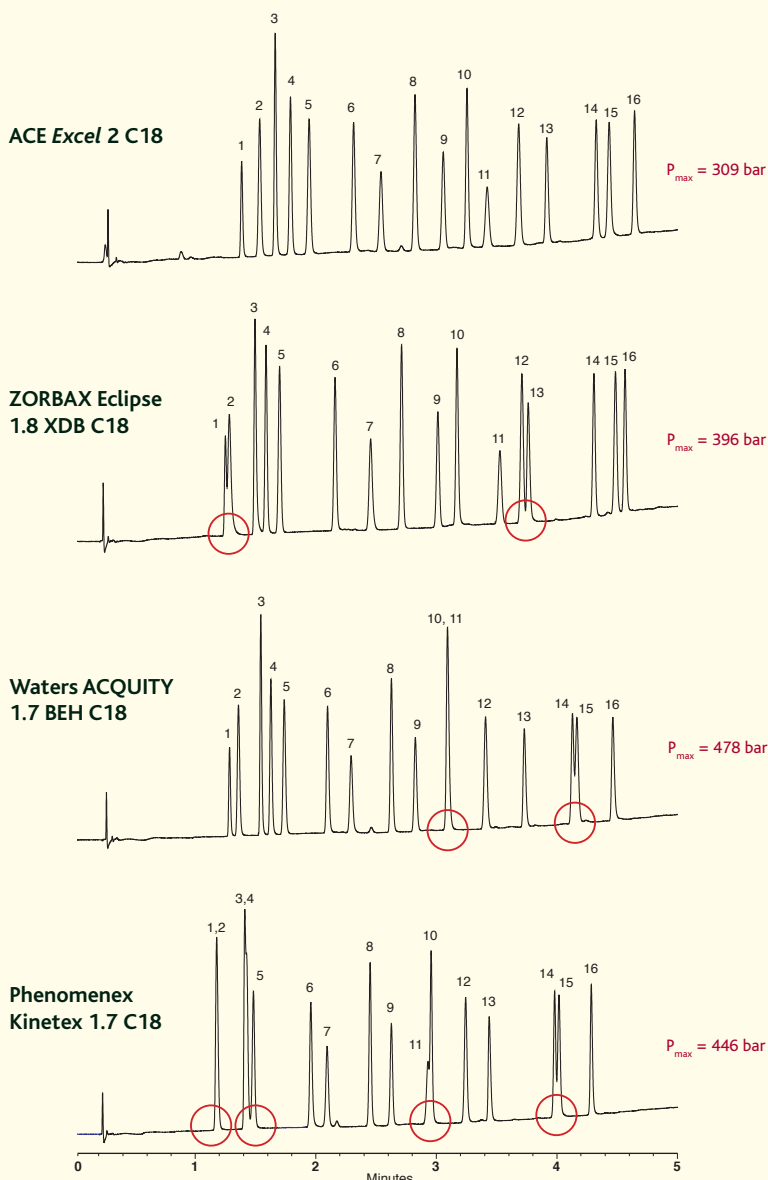
Homologous compounds differing by -CH<sub>2</sub>

Ideal starting point for method development

**Figure 6: Comparison of selectivity and characteristics of ACE<sup>®</sup> Excel<sup>™</sup> 2µm C18 to other manufacturers' columns**  
Application #1503 – Rapid UHPLC Screening of 16 Pharmaceuticals and Related Compounds

Mobile Phase: A = 20 mM KH<sub>2</sub>PO<sub>4</sub>, pH 2.7 and B = 20 mM KH<sub>2</sub>PO<sub>4</sub>, pH 2.7 in MeOH/H<sub>2</sub>O (65:35 v/v)  
Gradient: 3 to 100% B in 5 minutes  
Flow Rate: 0.6 ml/min  
Temperature: 60°C  
Detection: UV, 214 nm  
Column Dimensions: 50 x 2.1mm

1. N-acetylprocainamide	9. 1,2-dimethoxybenzene
2. 3-hydroxybenzoic acid	10. furosemide
3. pindolol	11. anisole
4. methylphenylsulphoxide	12. methylbenzoate
5. benzylalcohol	13. remacemide
6. quinoxaline	14. nimesulide
7. 1,4-dinitrobenzene	15. ethylbenzoate
8. phenacetin	16. diflunisal



Comparative data may not be representative of all applications.  
Please see p.10 for acknowledgement of trademarks

In this example the ACE Excel C18 UHPLC column provides retention and selectivity similar to the other C18 UHPLC columns (although there may be slight selectivity differences between different C18 phases). Under these conditions, these slight differences allow the ACE Excel C18 to fully separate all 16 components of interest.

As with all ACE HPLC columns, ACE Excel UHPLC columns also deliver excellent peak shape for your analytes. Additionally, owing to the optimal 2µm particle size and a rigorous classification protocol, back pressure for all ACE Excel UHPLC columns is significantly lower than for these leading UHPLC columns packed with <2µm particles.

### Further Information;

An HPLC product brochure discussing ACE C18 and all ACE phases is available.  
Contact your distributor to request your copy or visit [www.ace-hplc.com](http://www.ace-hplc.com) for further details.



# C18-AR

(C18 with integral Phenyl functionality)

## Mechanisms of Separation

$\pi$ - $\pi$  interactions

## Strength of Interaction

Strong

Dipole-dipole interactions

Moderate

Hydrophobic binding interactions

Strong

Shape selectivity

Moderate

## Target Analytes

Analytes with  $\pi$  bonding and conjugated systems

Analytes with electron delocalization and electron-withdrawing groups, such as halogens, nitro groups, ketones, esters and acids

Analytes with different dipole moments

Analytes differing in hydrophobicity

Polar, moderately polar and nonpolar analytes

Uncharged acids and bases

## Recommended Applications

Analytes differing in hydrophobicity, homologous compounds differing by  $-\text{CH}_2$

Stereoisomers

Steroids

Substituted aromatics

Sulphur containing compounds

Suitable for use in up to 100% aqueous mobile phase conditions

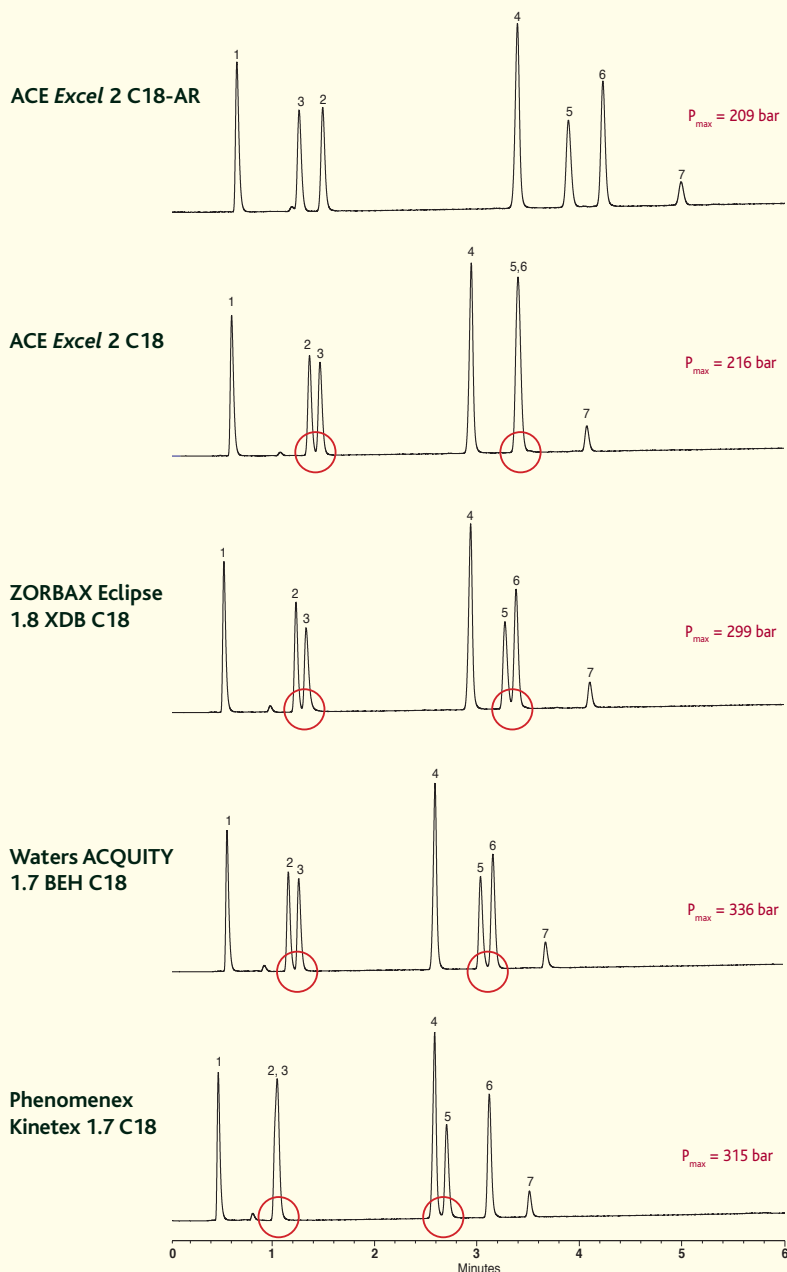
Particularly recommended for applications where a C18 does not provide an adequate separation

Figure 7: Leveraging the unique ACE<sup>®</sup> Excel<sup>™</sup> C18-AR selectivity

Application #1504 – Water Soluble Vitamins by UHPLC

Mobile Phase: A = 20 mM  $\text{KH}_2\text{PO}_4$ , pH 2.7 and  
B = 20 mM  $\text{KH}_2\text{PO}_4$ , pH 2.7 in MeOH/ $\text{H}_2\text{O}$  (50:50 v/v)  
Gradient: 20 to 70% B in 5 minutes  
Flow Rate: 0.31 ml/min  
Temperature: 40°C  
Detection: UV, 205 nm  
Column Dimensions: 50 x 2.1mm

1. pyridoxine
2. p-aminobenzoic acid
3. pantothenic acid
4. folic acid
5. d-biotin
6. cyanocobalamin
7. riboflavin



Comparative data may not be representative of all applications.  
Please see p.10 for acknowledgement of trademarks

This test illustrates that the leading C18 UHPLC column brands shown above do not readily separate these water soluble vitamins under the conditions stated.

The additional mechanisms of separation provided by the ACE Excel 2  $\mu\text{m}$  C18-AR generate a better separation for both peak pairs, with resolution significantly improved under these conditions. Optimisation of both column dimensions and evaluation conditions, to further reduce analysis time, is now possible.

### Further Information;

A product bulletin discussing the unique ACE C18-AR phase is now available.  
Contact your distributor to request your copy or visit [www.ace-hplc.com](http://www.ace-hplc.com) for further details.

# C18-PFP

(C18 with integral PFP functionality)

## Mechanisms of Separation

## Strength of Interaction

$\pi$ - $\pi$ interactions	Strong
Dipole-dipole interactions	Strong
Hydrophobic binding interactions	Strong
Shape selectivity	Strong

## Target Analytes

Analytes with  $\pi$  bonding

Analytes with electron donating groups, such as phenols, aromatic ethers and amines

Analytes with proton donor groups

Analytes with different dipole moments

Analytes differing in hydrophobicity

Polar, moderately polar and nonpolar analytes

Uncharged acids and bases

## Recommended Applications

Structural isomers

Steroids

Taxanes

Substituted aromatics

Analytes differing in hydrophobicity, homologous compounds differing by  $-\text{CH}_2$

Suitable for use in up to 100% aqueous mobile phase conditions

Particularly recommended for applications where a C18 does not provide an adequate separation

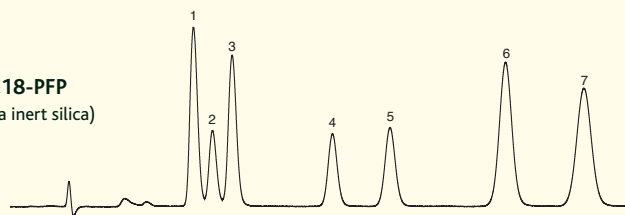
Figure 8: Leveraging the unique ACE<sup>®</sup> Excel<sup>™</sup> C18-PFP selectivity

Application #1505 – Structural Isomers by UHPLC

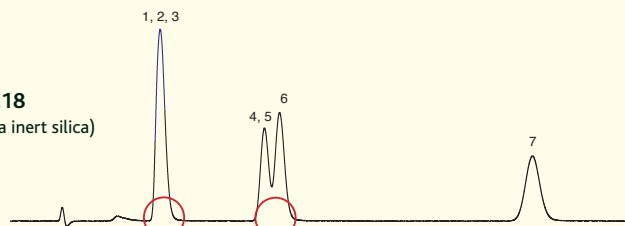
Mobile Phase: MeOH/H<sub>2</sub>O (50:50 v/v)  
Flow Rate: 0.21 mL/min  
Temperature: 40 °C  
Column Dimensions: 50 x 2.1mm

1. 1,2,3-trimethoxybenzene  
2. 1,2-dimethoxybenzene  
3. 1,2,4-trimethoxybenzene  
4. methoxybenzene  
5. 1,3-dimethoxybenzene  
6. 1,3,5-trimethoxybenzene  
7. toluene

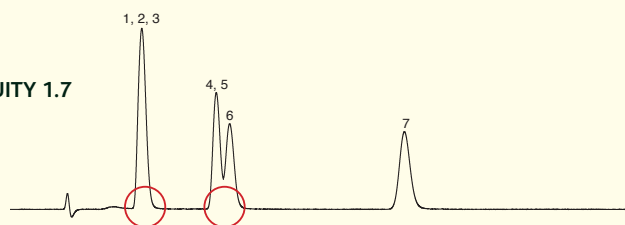
ACE Excel 2 C18-PFP  
(fully porous ultra inert silica)



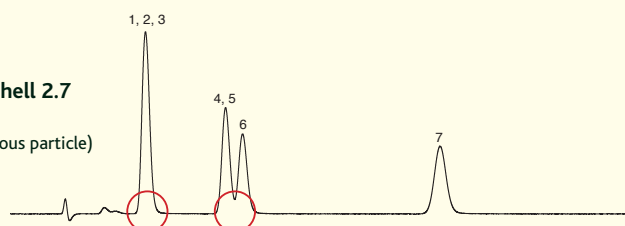
ACE Excel 2 C18  
(fully porous ultra inert silica)



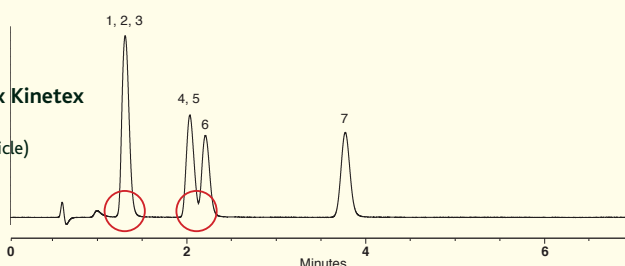
Waters ACQUITY 1.7  
BEH C18  
(hybrid particle)



Agilent Poroshell 2.7  
120 EC C18  
(superficially porous particle)



Phenomenex Kinetex  
2.6 C18  
(core-shell particle)



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This test illustrates that under these conditions, the leading C18 UHPLC column brands shown do not readily separate these structural isomers and that, irrespective of the nature of their particle construction, it is the surface bonded phase effects that dominate. In particular, the hydrophobic binding interaction appears to offer no selectivity for separating peaks 1, 2 and 3 and offers only poor resolution of peaks 4, 5 and 6.

The ACE Excel C18-PFP provides the additional selectivity needed to separate the co-eluting analytes under these conditions. It is believed that this additional selectivity is provided by a powerful combination of the strong  $\pi$ - $\pi$  and dipole-dipole interactions, coupled with the strong shape selectivity and hydrophobic character offered by the unique C18-PFP phase.

### Further Information;

A product bulletin discussing the unique ACE C18-PFP phase is now available.

Contact your distributor to request your copy or visit [www.ace-hplc.com](http://www.ace-hplc.com) for further details.

## Phase 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	USP Listing	100% Aqueous Compatibility
C18	Octadecyl (C18)	Yes	2 <sup>a</sup>	100	300	15.5	1.5-10.0 <sup>b</sup>	L1	-
C18-AR	C18 with integral Phenyl	Yes	2 <sup>a</sup>	100	300	15.5	1.5-10.0 <sup>b</sup>	L1	Yes <sup>c</sup>
C18-PFP	C18 with integral PFP	Yes	2 <sup>a</sup>	100	300	14.3	1.5-10.0 <sup>b</sup>	L1	Yes <sup>c</sup>
C8	Octyl	Yes	2 <sup>a</sup>	100	300	9.0	1.5-10.0 <sup>b</sup>	L7	-
C4	Butyl	Yes	2 <sup>a</sup>	100	300	5.5	1.5-10.0 <sup>b</sup>	L26	-
CN	Cyano	Yes	2 <sup>a</sup>	100	300	5.5	2.0-8.0 <sup>b</sup>	L10	-
Phenyl	Phenyl	Yes	2 <sup>a</sup>	100	300	9.5	1.5-10.0 <sup>b</sup>	L11	-
AQ	Proprietary	Yes	2 <sup>a</sup>	100	300	14.0	1.5-10.0 <sup>b</sup>	L1	Yes <sup>c</sup>
SIL	-	-	2 <sup>a</sup>	100	300	-	1.5-8.0 <sup>b</sup>	L3	-

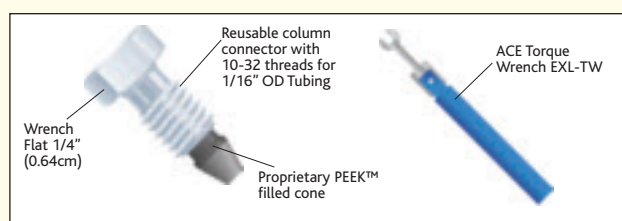
<sup>a</sup> ACE Excel UHPLC columns are also available with 3µm and 5µm particle sizes. ACE HPLC columns are also available with 3µm, 5µm and 10µm particle sizes.

<sup>b</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 – contact your distributor to request your FREE copy.

<sup>c</sup> These ACE phases may be used with up to 100% aqueous mobile phase without retention loss caused by pore dewetting/phase collapse effects.

## ACE® UHPLC Reusable Column Connector

- Pressure rating >1700bar (>25000psi)
- Compatible with all UHPLC systems
- Compatible with all UHPLC column brands
- Eliminates Poor Connections
- Unique Reusable Design



**For further information and to receive a FREE product bulletin, please contact your local distributor**

All UHPLC column brands require correct installation in order to realise maximum column efficiency. To avoid problems, the use of permanently swaged fittings is not recommended, as these 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 UHPLC Column Connectors are reusable and enable UHPLC columns to be correctly installed every time. Their unique design ensures that they maintain pressure rating with repeated use, yet do not permanently swage onto the inlet tubing. To maximise the lifetime of the fitting, the use of an ACE Torque Wrench (p/n EXL-TW) is required.

Standard ACE HPLC PEEK finger-tight connectors (p/n ACE-FT, pressure rated to 350bar/5000psi) may be used at the outlet end of the UHPLC column, where pressure demands are lower but a correct connection remains important.

## ACE Excel 2µm C18 Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-101-0202U	EXL-101-0302U	EXL-101-3502U	EXL-101-0502U	EXL-101-7502U	EXL-101-1002U	EXL-101-1202U	EXL-101-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-101-0203U	EXL-101-0303U	EXL-101-3503U	EXL-101-0503U	EXL-101-7503U	EXL-101-1003U	EXL-101-1203U	EXL-101-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-101-0246U	EXL-101-0346U	EXL-101-3546U	EXL-101-0546U	EXL-101-7546U	EXL-101-1046U	EXL-101-1246U	EXL-101-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm C18-AR Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-109-0202U	EXL-109-0302U	EXL-109-3502U	EXL-109-0502U	EXL-109-7502U	EXL-109-1002U	EXL-109-1202U	EXL-109-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-109-0203U	EXL-109-0303U	EXL-109-3503U	EXL-109-0503U	EXL-109-7503U	EXL-109-1003U	EXL-109-1203U	EXL-109-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-109-0246U	EXL-109-0346U	EXL-109-3546U	EXL-109-0546U	EXL-109-7546U	EXL-109-1046U	EXL-109-1246U	EXL-109-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm C18-PFP Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-1010-0202U	EXL-1010-0302U	EXL-1010-3502U	EXL-1010-0502U	EXL-1010-7502U	EXL-1010-1002U	EXL-1010-1202U	EXL-1010-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-1010-0203U	EXL-1010-0303U	EXL-1010-3503U	EXL-1010-0503U	EXL-1010-7503U	EXL-1010-1003U	EXL-1010-1203U	EXL-1010-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-1010-0246U	EXL-1010-0346U	EXL-1010-3546U	EXL-1010-0546U	EXL-1010-7546U	EXL-1010-1046U	EXL-1010-1246U	EXL-1010-1546U	EXL-CC <sup>1,2,3</sup>

<sup>1</sup> Also available as a 10pk p/n EXL-CC-10

<sup>2</sup> Torque wrench (p/n EXL-TW) is required

<sup>3</sup> Starter kit available (p/n EXL-CCSK) containing 4x EXL-CC plus 1x EXL-TW

## ACE Excel 2µm C8 Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-102-0202U	EXL-102-0302U	EXL-102-3502U	EXL-102-0502U	EXL-102-7502U	EXL-102-1002U	EXL-102-1202U	EXL-102-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-102-0203U	EXL-102-0303U	EXL-102-3503U	EXL-102-0503U	EXL-102-7503U	EXL-102-1003U	EXL-102-1203U	EXL-102-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-102-0246U	EXL-102-0346U	EXL-102-3546U	EXL-102-0546U	EXL-102-7546U	EXL-102-1046U	EXL-102-1246U	EXL-102-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm C4 Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-103-0202U	EXL-103-0302U	EXL-103-3502U	EXL-103-0502U	EXL-103-7502U	EXL-103-1002U	EXL-103-1202U	EXL-103-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-103-0203U	EXL-103-0303U	EXL-103-3503U	EXL-103-0503U	EXL-103-7503U	EXL-103-1003U	EXL-103-1203U	EXL-103-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-103-0246U	EXL-103-0346U	EXL-103-3546U	EXL-103-0546U	EXL-103-7546U	EXL-103-1046U	EXL-103-1246U	EXL-103-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm CN Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-104-0202U	EXL-104-0302U	EXL-104-3502U	EXL-104-0502U	EXL-104-7502U	EXL-104-1002U	EXL-104-1202U	EXL-104-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-104-0203U	EXL-104-0303U	EXL-104-3503U	EXL-104-0503U	EXL-104-7503U	EXL-104-1003U	EXL-104-1203U	EXL-104-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-104-0246U	EXL-104-0346U	EXL-104-3546U	EXL-104-0546U	EXL-104-7546U	EXL-104-1046U	EXL-104-1246U	EXL-104-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm Phenyl Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-105-0202U	EXL-105-0302U	EXL-105-3502U	EXL-105-0502U	EXL-105-7502U	EXL-105-1002U	EXL-105-1202U	EXL-105-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-105-0203U	EXL-105-0303U	EXL-105-3503U	EXL-105-0503U	EXL-105-7503U	EXL-105-1003U	EXL-105-1203U	EXL-105-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-105-0246U	EXL-105-0346U	EXL-105-3546U	EXL-105-0546U	EXL-105-7546U	EXL-105-1046U	EXL-105-1246U	EXL-105-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm AQ Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-106-0202U	EXL-106-0302U	EXL-106-3502U	EXL-106-0502U	EXL-106-7502U	EXL-106-1002U	EXL-106-1202U	EXL-106-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-106-0203U	EXL-106-0303U	EXL-106-3503U	EXL-106-0503U	EXL-106-7503U	EXL-106-1003U	EXL-106-1203U	EXL-106-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-106-0246U	EXL-106-0346U	EXL-106-3546U	EXL-106-0546U	EXL-106-7546U	EXL-106-1046U	EXL-106-1246U	EXL-106-1546U	EXL-CC <sup>1,2,3</sup>

## ACE Excel 2µm SIL Columns

Column Diameter	Column Length								UHPLC Connector
	20mm	30mm	35mm	50mm	75mm	100mm	125mm	150mm	
2.1mm	EXL-107-0202U	EXL-107-0302U	EXL-107-3502U	EXL-107-0502U	EXL-107-7502U	EXL-107-1002U	EXL-107-1202U	EXL-107-1502U	EXL-CC <sup>1,2,3</sup>
3.0mm	EXL-107-0203U	EXL-107-0303U	EXL-107-3503U	EXL-107-0503U	EXL-107-7503U	EXL-107-1003U	EXL-107-1203U	EXL-107-1503U	EXL-CC <sup>1,2,3</sup>
4.6mm	EXL-107-0246U	EXL-107-0346U	EXL-107-3546U	EXL-107-0546U	EXL-107-7546U	EXL-107-1046U	EXL-107-1246U	EXL-107-1546U	EXL-CC <sup>1,2,3</sup>

<sup>1</sup> Also available as a 10pk p/n EXL-CC10

<sup>2</sup> Torque wrench (p/n EXL-TW) is required

<sup>3</sup> Starter kit available (p/n EXL-CCSK) containing 4x EXL-CC plus 1x EXL-TW

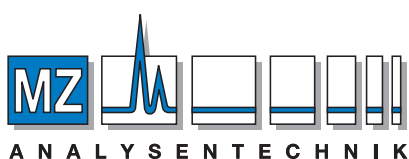
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Available from:



AUTHORIZED DISTRIBUTOR

MZ-Analysentechnik GmbH  
 Barcelona-Allee 17 • D-55129 Mainz  
 Tel +49 6131 880 96-0  
 Fax +49 6131 880 96-20  
 e-mail: info@mz-at.de  
 www.mz-at.de

