T3 Binding Enables HPLC to UPLC Transfer

Since Atlantis T3 HPLC and ACQUITY UPLC HSS T3 columns are true UPLC-certified columns, the T3 bonding HPLC methods can be transferred to UPLC methods. Because Atlantis and HSS particles are different substrates, some method modification and optimization may be required. A compelling benefit of UPLC technology is the ease and speed at which this method optimization can occur since UPLC technology offers greater resolution in less time.

Moving from XBridge HPLC to ACQUITY UPLC BEH columns is nearly identical, but the higher particle surface area in the UPLC method means that it is easier to transfer methods from HPLC to UPLC while maintaining method performance.

The additional UPLC selectivity choices provide and facilitate rapid development of robust methods.

Additional Choices for UPLC Separations

Chromatographers continue to embrace UPLC technology as the separation technology of the future. Additional UPLC column chemistries that provide complementary selectivity are needed to provide applications-specific solutions. When combined with the ultra-resolution of UPLC, these new UPLC column chemistries will enable the development of fast, robust methods in less time. ACQUITY UPLC HSS T3 columns offer another selective, choice for UPLC separations.

Reduced-Phase UPLC Chemistry Choices: Cofactors, Acid Derivatives in Ethers

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ATLANTIS T3 AND ACQUITY UPLC HSS T3 COLUMNS

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LONG COLUMN LIFETIMES AT LOW pH

The creation of highly reactive, reversibly bonded C8 columns for polar compound retention involves bonding at a liquid density that is less hydrophilic and, therefore, more compatible with the weak, highly aqueous mobile phase required for retaining polar compounds. One disadvantage of this liquid bonding procedure is bonded phase hydrolysis under low pH (pH 2) operating conditions resulting in a gradual loss of compound retention, changes in selectivity and increased peak tailing. Atlantis T3 columns are uniquely and specifically designed to offer superior polar compound retention and aqueous compatibility while also providing enhanced column performance, lifetime, peak shape and stability.

To learn more about T3 bonding and polar compound retention, please refer to Waters white paper entitled: Not Just for Polar Compounds.

Features of the ACQUITY UPLC HSS T3 columns include:

- Superior polar compound retention and aqueous mobile phase compatibility
- Extreme mechanical stability
- Superior low pH stability
- No mobile phase optimization required
- High pore volume for excellent peak shape
- Long column lifetimes
- Improved retention and performance over a wider pH range
- Superior performance over a wide range of mobile phases
- Excellent peak shape for bases
- High pH mobile phase compatibility

ACQUITY UPLC HSS T3 columns for Polar Compound Retention

ACQUITY UPLC HSS T3 columns utilize T3 bonding in order to retain and separate polar compounds. ACQUITY UPLC HSS T3 columns possess the superior polar compound retention, aqueous mobile phase compatibility and high pH stability required for polar compounds. When compared to ACQUITY UPLC BEH C8 columns, compounds are more strongly retained as ACQUITY UPLC HSS T3 columns. Features of the ACQUITY UPLC HSS T3 columns include:

- Superior polar and non-polar compound retention
- Aqueous mobile phase compatibility
- Ultra water 95:5 mobile phase
- Excellent peak shape performance

ACQUITY UPLC HSS T3 column resists compounds longer than ACQUITY UPLC BEH C8 columns.

A universal reversed-phase polar compound retention column

Large organizations are looking to narrow or limit the number of column choices available to their separation scientists. This world-class column “harmonization” can provide more predictable, controlled consumable costs, simplified method transfer between laboratories, locations around the world and prescreened ELSD columns for various performance parameters.

With good retention of, and selectivity for, neutral, hydrophobic compounds, Phenomenex® Synergi™ 2μm Hydro-RP and Phenomenex® Synergi™ Polar-RP can be considered as a more universal alternative to traditional C8 and Phenomenex® Synergi™ 5μm C8 columns.

ACQUITY UPLC HSS T3 columns do more than just retain and separate polar compounds.

T3 bonding allows Atlantis T3 columns to provide long column lifetimes under harsh, low pH conditions.

Improvement in pH 7 Performance At pH 7, poor peak shape for anisotropically bound and chiralized columns is encountered when using intermediate liquid density C18 columns designed for polar compound retention. Poor peak shape is due to secondary interactions with unreacted silanols that remain present after bonding and endcapping. The proprietary T3 endcapping procedure reacts with more of these active silanols thereby dramatically improving peak shape for bases. Phenomenex® Silica columns are due to the dissolution of the silica particle substrate by the high pH mobile phase. The more effective and efficient T3 bonding helps “protect” the silica substrate from dissolution, thus preserving longer lifetime columns.

When compared to other nonpolar phase “polar compound retention” columns, Atlantis T3 columns provide superior pH 7 peak shape.

Acquisitions, versions.

Retention and Peak Shape Under 100% Aqueous Conditions

10 mM Ammonium Formate, pH 3.0, 30 ˚C

ACQUITY UPLC HSS T3 columns are the only manufacturer offering two UPLC-certified particles.

Not Just for Polar Compounds

Phenomenex Synergi™ 2μm Hydro-RP

Phenomenex Synergi™ Polar-RP

ACQUITY UPLC System with 2996 PDA

Instrument: ACQUITY UPLC System with 2996 PDA

Temperature: 30 ˚C

Injection Volume: 0.7 µL

Flow Rate: 0.438 mL/min

Gradient: 4 min

Acquisitions, versions.

Retention and Peak Shape Under 100% Aqueous Conditions

10 mM Ammonium Formate, pH 3.0, 30 ˚C

ACQUITY UPLC HSS T3 columns are a result of Waters new, advanced T3 bonding process. T3 bonding solution contains silane coupling agents which provide a stable, long-lasting T3 bonding layer. All ACQUITY UPLC HSS columns are designed for UPLC, and the ACQUITY UPLC HSS T3 particle is not an HPLC particle. High pore volume HPLC particles do not possess the superior polar compound retention, aqueous mobile phase compatibility necessary for the high column packing and operating pressures of UPLC technology. This rugged and unique UPLC-certified silica particle is specifically designed to withstand the demanding operation conditions encountered in UPLC separations.

ACQUITY UPLC HSS T3 columns for Polar Compound Retention

ACQUITY UPLC HSS T3 columns utilize T3 bonding in order to retain and separate polar compounds. ACQUITY UPLC HSS T3 columns possess the superior polar compound retention, aqueous mobile phase compatibility and high pH stability. Waters continues to develop new UPLC particles and chromatography to meet these ever-growing needs.

ACQUITY UPLC HSS T3 columns provide superior lifetime under low pH conditions while also possessing superior peak shape and selectivity.

The superior performance of Atlantis HILIC columns and the ACQUITY UPLC HILIC T3 columns is a result of Waters new, advanced T3 bonding process. T3 bonding solution contains silane coupling agents which provide a stable, long-lasting T3 bonding layer. All ACQUITY UPLC HILIC columns are designed for HILIC, and the ACQUITY UPLC HILIC T3 particle is not an HPLC particle. High pore volume HPLC particles do not possess the high pH mobile phase compatibility necessary for the high column packing and operating pressures of HPLC technology. This rugged and unique HPLC-certified silica particle is specifically designed to withstand the demanding operation conditions encountered in HPLC separations.

ACQUITY UPLC HILIC T3 columns are uniquely and specifically designed to offer superior polar compound retention and aqueous compatibility while also providing enhanced column performance, lifetime, peak shape and stability.

To learn more about T3 bonding and polar compound retention, please refer to Waters white paper entitled: Not Just for Polar Compounds.

Features of the ACQUITY UPLC HILIC T3 columns include:

- Superior polar compound retention and aqueous mobile phase compatibility
- Extreme mechanical stability
- Superior low pH stability
- No mobile phase optimization required
- High pore volume for excellent peak shape
- Long column lifetimes
- Superior performance over a wide range of mobile phases
- Excellent peak shape for bases
- High pH mobile phase compatibility

ACQUITY UPLC HILIC T3 columns are longer than ACQUITY UPLC BEH C8 columns.

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ACQUITY UPLC T3 columns are uniquely and specifically designed to offer superior polar compound retention and aqueous compatibility while also providing enhanced column performance, lifetime, peak shape and stability.

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**LONG COLUMN LIFETIMES AT LOW pH**

The creation of highly efficient, reversed-phase C18 columns for polar compound retention involves bonding at a ligand density that is less hydrophilic, and therefore, more compatible with the weak, highly hydrophobic mobile phase required for retaining polar compounds. One drawback of this ligand bonding procedure is bonded-phase hydrophilic under low pH (pH 2) operating conditions resulting in a gradual loss of compound retention, changes in selectivity and hydrolysis under low pH (i.e., pH 2) operating conditions resulting in a gradual loss of compound retention, changes in selectivity and hydrolysis.

**NEW T3 BONDING TECHNOLOGY**

Atlantis T3 columns provide 100% aqueous compatibility, superior polar compound retention and excellent peak shape for acids, bases and bases.

**A UNIVERSAL REVERSIBLE PHASE POLAR COMPOUND RETENTION COLUMN**

Large organizations, leading to venture or limit the number of column chemistries available to their separations scientists. This versatile LC column “harmonization” can provide more predictably, controlled consolute carbons. A rapid method route between lab-lab locations around the world and prescreened LC columns for various performance parameters.

**With post-materials and selectivity for neutral, hydrophobic compounds as well as polar analytes and superior performance over a wider pH range.** Atlantic T3 columns exhibit considerable selectivity so in a more universal alternative to traditional C18 reversed-phases LC columns.

**IMPROVED pH 7 PERFORMANCE**

At pH 7, peak shape for anion-exchange based and chromed columns is encountered when using intermediate ligand density C18 columns designed for polar compound retention. Poor peak shape is due to secondary interactions with uncoated silica that remain present after bonding and endcapping. The proprietary T3 endcapping procedure reacts with more of these active silanols thereby dramatically improving peak shape for bases. "Harmonized" columns from Waters are due to the dissolution of the silica particle substrate by the high pH mobile phase. The more effective and efficient T3 bonding helps "protect" the silica substrate from dissolution, thus prolonging longer column lifetimes.

**IMPRESSIVE pH 7 PERFORMANCE**

When compared to other "reversed-phase" polar compound retention columns, "Atlantis T3 columns provide superior pH 7 peak shape.

**ACQUITY UPLC HSS COLUMNS**

As chromatographers around the world continue to realize the benefits of UPLC technology, in their application areas, Waters continues to develop new UPLC particles and chemistries to meet their ever-growing needs.

ACQUITY UPLC HSS (High-Speed Separation) columns consist of the most highly C18 silica particle designed, tested and interchanged for an applications up to 1000 psi (70 MPa) but the ACQUITY UPLC HSS particle is not an UPLC particle. High performance UPLC particles do not promise the chemical stability necessary is within the high column packing and operating pressures of UPLC technology. This rugged and unique UPLC-certified silica particle is specifically designed to withstand the demanding operating conditions encountered in UPLC separations.

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The superior performance of Atlantis T3 UPLC columns and the ACQUITY UPLC HSS T3 columns is a result of Waters’ new, advanced T3 bonding process. T3 bonding solves a retention and selectivity problem at a liquid density that promotes polar compound retention and aqueous mobile phase compatibility. The proprietary T3 endcapping process is much more effective than traditional endcapping methods using trimethyl silane (TMS) endcapping. The unique combination of bonding and endcapping provides superior polar compound retention and aqueous compatibility, while also enhancing column performance, lifetime, peak shape and stability.

To learn more about T3 bonding and polar compound retention, please refer to Waters white papers entitled "Improving Peak Shape for Bases at pH 7" and "Superior Low pH Stability".

**LONG COLUMN LIFETIMES AT LOW pH**

The creation of high strength, reverse-phase C18 columns for polar compound retention involves bonding at a liquid density that is less hydrophilic and, therefore, more compatible with the weak, highly aqueous mobile phase required for retention of polar compounds. One disadvantage of this ligand bonding procedure is bonded phase hydrolysis under low pH (i.e., pH 2) operating conditions resulting in peak shape deterioration. Most traditional column manufacturers are aware of the silica particle sublimation by the high pH mobile phase. The more effective and efficient T3 bonding helps "protect" the silica substrate from dissolution, thus providing longer lifetime columns.

**A UNIVERSAL REVERSED-PHASE POLAR COMPOUND RETENTION COLUMN**

Large organizations are looking to narrow or limit the number of column choices available to their separation scientists. This "harmonization" can provide more predictable, controlled results, and separate polar organic compounds. ACQUITY UPLC HSS T3 columns combine superior polar compound retention, aqueous mobile phase compatibility and ultra-low MS bleed of Atlantis T3 columns.

ACQUITY UPLC HSS T3 columns utilize T3 bonding in order to retain and separate polar compounds. ACQUITY UPLC HSS T3 columns possess the superior polar compound retention, aqueous mobile phase compatibility and ultra-low MS bleed of Atlantis T3 columns. When compared to ACQUITY BEH C18 columns, compounds are more strongly retained than ACQUITY UPLC HSS T3 columns. Pairs of the ACQUITY UPLC HSS T3 columns include:

- Superior polar and non-polar compound retention
- Aqueous mobile phase compatibility
- Ultra-low MS bleed
- Additional selection choice for UPLC separations.
T3 Bonding Enables HPLC to UPLC Transfer

Since Atlantis T3 HPLC and ACQUITY UPLC HSS T3 columns are the same T3 bonding, HPLC methods can be transferred to UPLC methods. Because Atlantis and HSS particles are different substrates, some method modifications and optimizations may be required. A compelling benefit of UPLC technology is the ease and speed with which this method optimization can occur since UPLC technology offers greater speed in less time.

Moving from XBridge to ACQUITY UPLC BEH columns is nearly seamless, as the high performance substrates differ only in particle size. However, because T3 bonding it should be straightforward to make simple adjustments to successfully transfer a separation from an Atlantis T3 HPLC column to an ACQUITY UPLC HSS T3 column.

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modification and/or optimization may be required. A compelling benefit of UPLC technology is the ease and speed at which this method optimization can occur since UPLC technology offers greater tolerability in less time. Migrating from HPLC to UPLC is often a daunting task, but this can be made easier by following similar guidelines to those of translating HPLC methods to UPLC methods. The following guidelines are the result of translating HPLC methods to UPLC methods with the Atlantis T3 columns. New methods for translating HPLC methods to UPLC methods to ACQUITY UPLC HSS T3 columns are also included. These methods are designed to provide selectivity and peak shape comparisons to Atlantis T3 HPLC columns in UPLC separations.

ORDERING INFORMATION

T3 Bonding Enables HPLC to UPLC Transfer

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ADDITIONAL CHOICES FOR UPLC SEPARATIONS

Chromatographers continue to embrace UPLC technology as the separation technology of the future. Additional UPLC columns that provide complementary selectivity are needed to provide applications-specific solutions. When combined with the ultra-resolution of UPLC, these new UPLC columns will enable the development of fast, robust methods in less time. ACQUITY UPLC HSS T3 columns offer another selectivity benefit of UPLC technology is the ease and speed at which this method optimization can occur since UPLC technology offers greater tolerability in less time. Migrating from HPLC to UPLC is often a daunting task, but this can be made easier by following similar guidelines to those of translating HPLC methods to UPLC methods. The following guidelines are the result of translating HPLC methods to UPLC methods with the Atlantis T3 columns. New methods for translating HPLC methods to UPLC methods to ACQUITY UPLC HSS T3 columns are also included. These methods are designed to provide selectivity and peak shape comparisons to Atlantis T3 HPLC columns in UPLC separations.

T3 Bonding allows for the transfer of HPLC methods to UPLC.

By using the T3-bonding chemistry, Waters is able to create a column chemistry that not only retains and separates highly polar compounds but also offers superior column performance across a wide range of conditions. ACQUITY UPLC HSS T3 columns are available in a similar range of diameters as Atlantis T3 HPLC columns but are also certified for use in UPLC separations while providing an additional UPLC chemistry choice.

The Atlantis T3 columns are designed to provide longer column lifetimes at low pH as well as improved peak shapes for amino-containing bases at pH 7. Waters has created a second generation UPLC, UPLC-T3, that has the fidelity and separation ability of Atlantis T3 but in a platform designed specifically for HPLC applications. ACQUITY UPLC HSS T3 columns utilize the same T3-bonding and provide similar attributes as Atlantis T3 HPLC columns.