

U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

pH Flexibility Expands Robustness and Reproducibility

Gemini columns are rugged reversed phase HPLC columns that offer extended lifetime at extreme pH conditions and excellent stability for reproducible, high efficiency separations.

- Take full advantage of high and low pH conditions (pH 1-12) to manipulate selectivity
- Expect longer column lifetime with patented TWIN-NX™ technology
- For analytical and preparative separations of basic and acidic compounds

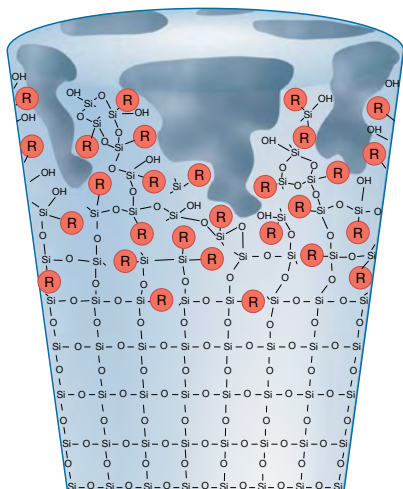
Phase	Description	USP Classification
NX-C18	The most rugged Gemini column, offering 5 times the durability of previous generation hybrid columns	L1
C6-Phenyl	A low bleed phenyl phase. For UV and MS detection, which offers an aromatic selectivity complementary to C18 phases	L11
C18	Selectivity, high structural integrity and increased loadability for preparative and purification applications in pre-packed columns and bulk media	L1



TWIN™ (Two-In-One) Technology

Gemini C18 and C6-Phenyl

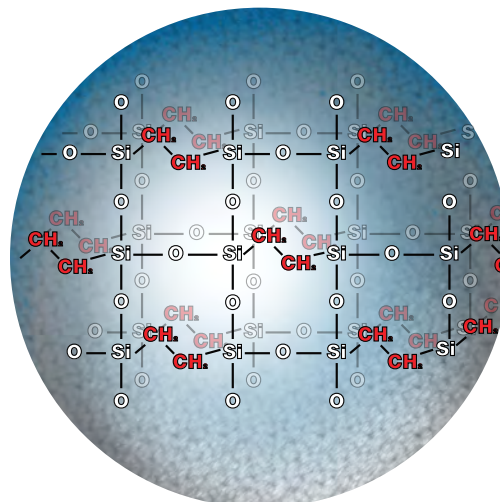
During the final stage of silica manufacturing a unique silica-organic layer is grafted to create a completely new composite particle. Since the internal base silica is unaltered by this manufacturing process, the particle retains its mechanical strength and rigidity along with excellent efficiency, while the silica-organic shell protects the particle from chemical attack.



Second-Generation TWIN-NX Technology

Gemini NX-C18

TWIN-NX technology uses an improved patented organo-silica grafting process which incorporates highly stabilizing ethylene cross-linking. These organic groups are evenly incorporated into the grafted layers on the silica surface while maintaining a pure silica core. This not only provides resistance to high pH attack, but also maintains the high efficiency and mechanical strength of a silica particle.



U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Gemini NX-C18

- pH stable 1-12 for durability
- Consistent performance in both volatile and non-volatile buffers
- High sample loading capacity for metabolite identification and preparative purification

Gemini NX-C18

USP: L1

LC-MS
Certified

pH Stability: 1.0 – 12.0

Particle Size: 3 µm, 5 µm, and 10 µm

Phase: C18

Application: Small molecules, basic compounds

Strength: Extremely durable pH stable particle

Pore Size (Å): 110

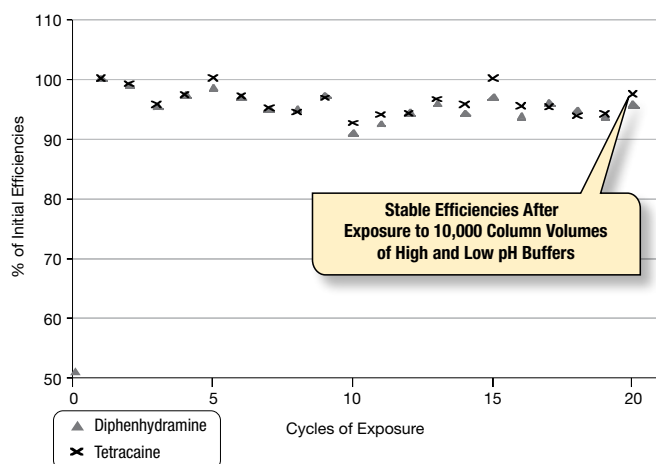
Surface Area (m²/g): 375

Carbon Load %: 14

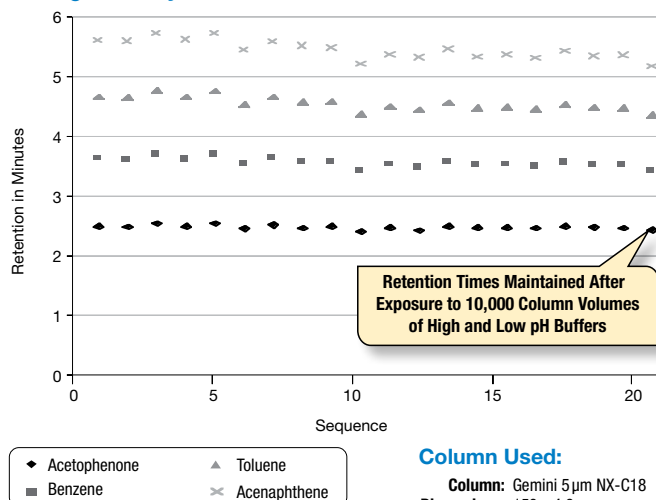
End Capping: TMS

Gemini NX-C18 Tested for Extreme Durability in Changing Mobile Phase pH

Column Efficiencies Maintained in High pH Testing for 20 Cycles



Retention Times of Four Probes Maintained in Neutral pH Testing for 20 Cycles



Column Used:

Column: Gemini 5 µm NX-C18
Dimensions: 150 x 4.6 mm
Part No.: [00F-4454-E0](#)

Column Testing Cycle

Step 1

24x High pH Flush Procedures

Mobile Phase: A: 10 mM Ammonium Bicarbonate pH 10.5
B: Acetonitrile

Gradient: 5% to 95% B in 6 min Hold at 95% B for 2 min

Re-equilibrate: 5% B for 2 min

Flow Rate: 1.5 mL/min

Step 2

High pH Testing

Isocratic: 10 mM Ammonium Bicarbonate pH 10.5 / Acetonitrile (50:50)

Flow Rate: 1.5 mL/min

Detection: UV @ 230 nm

Samples: 1. Tetracaine
2. Diphenhydramine

Step 3

1x Neutral Flush Procedure

Mobile Phase: A: Water
B: Acetonitrile

Gradient: 5% B for 2 min
5% to 100% B in 3 min Hold at 100% B for 5 min

Flow Rate: 1.5 mL/min

Step 4

Neutral pH Testing

Isocratic: Water / Acetonitrile (35:65)

Flow Rate: 1.0 mL/min

Detection: UV @ 254 nm

Samples: 1. Acetophenone
2. Benzene
3. Toluene
4. Acenaphthene

Step 5

24x Low pH Flush Procedure

Mobile Phase: A: 0.5% Formic Acid in Water
B: 0.5% Formic Acid in Acetonitrile, pH 2.0

Gradient: 5% to 95% B in 6 min
Hold at 95% B for 2 min

Re-equilibrate: 5% B for 2 min

Flow Rate: 1.5 mL/min

Step 6

**Neutral pH Flush Repeats
Repeats for 20 Cycles**



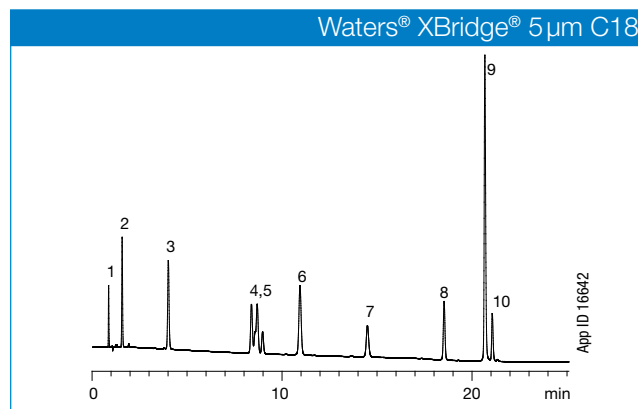
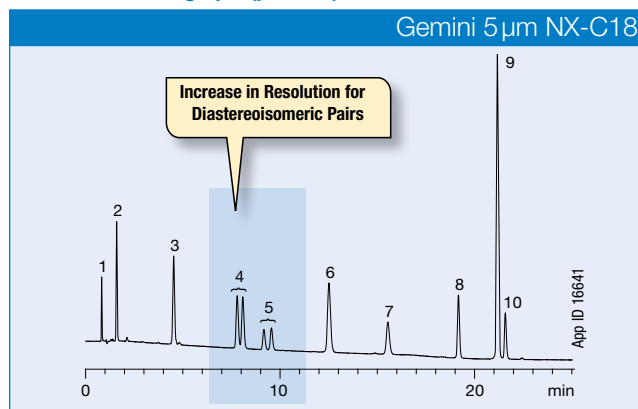
HPLC/UHPLC | GEMINI

GeminiTM pH Flexible LC Columns

U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Gemini NX-C18 (cont'd)

Polar Bases at High pH (pH 10.5)



Y-axis normalized for all chromatograms.

Polar Bases (Beta Blockers) at High pH

Conditions for all columns:

Dimensions: 150 x 4.6 mm

Mobile Phase: A: 10 mM Ammonium Bicarbonate pH 10.5
B: Acetonitrile

Gradient: A/B (85:15) to (70:30) in 15 min to (50:50) in 5 min, Hold for 5 min

Flow Rate: 1.5 mL/min

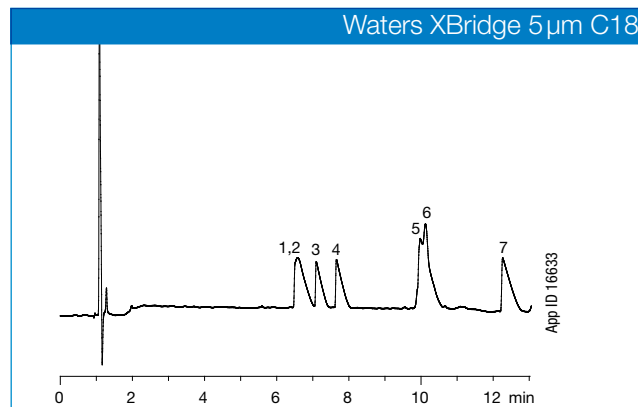
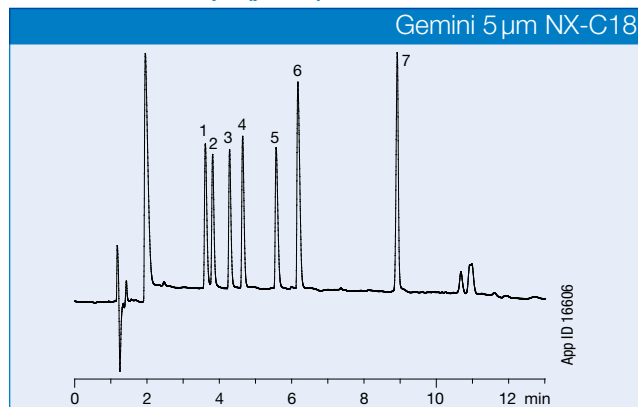
Temperature: Ambient

Detection: UV @ 230 nm

- Sample:**
1. Bisoprolol Contaminant
 2. Sotalol
 3. Atenolol
 4. Labetalol (Diastereoisomeric Pair)
 5. Nadolol (Diastereoisomeric Pair)
 6. Pindolol
 7. Metoprolol
 8. Bisoprolol
 9. Propranolol
 10. Alprenolol



Polar Bases at Low pH (pH 2.7)



Y-axis normalized for all chromatograms.

Polar Bases (Antihistamines) in Formic Acid

Conditions for all columns:

Dimensions: 150 x 4.6 mm

Mobile Phase: A: 0.1 % Formic Acid in Water
B: 0.1 % Formic Acid in Acetonitrile

Gradient: A/B (90:10) to (50:50) in 10 min

Flow Rate: 1.5 mL/min

Temperature: Ambient

Detection: UV @ 210 nm

- Sample:**
1. Pyrilamine
 2. Tripropenamine
 3. Chlorpheniramine
 4. Brompheniramine
 5. Chloropyramine
 6. Diphenhydramine
 7. Loratadine

Comparative chromatograms may not be representative of all applications.

Gemini[™] pH Flexible LC Columns

U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Gemini C18

- Increased loading and retention of basic compounds
- Silica efficiency and mechanical strength
- pH stable 1-12 for durability

Gemini C18

USP: L1

LC-MS
Certified

pH Stability: 1.0 – 12.0

Particle Size: 3 µm, 5 µm, and 10 µm

Phase: C18

Application: Small molecules, basic compounds

Strength: Wide pH stability, high efficiency

Pore Size (Å): 110

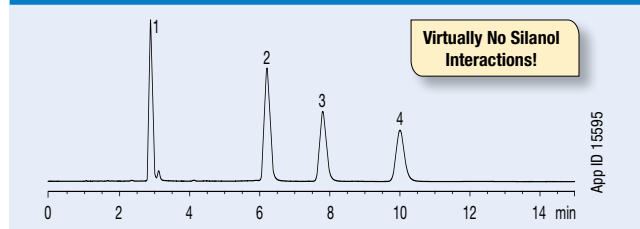
Surface Area (m²/g): 375

Carbon Load %: 14

End Capping: TMS

Chromatographic Comparisons

Gemini 5 µm C18 110 Å



Tricyclic Antidepressants at Neutral pH

Conditions for all columns:

Dimensions: 150 x 4.6 mm

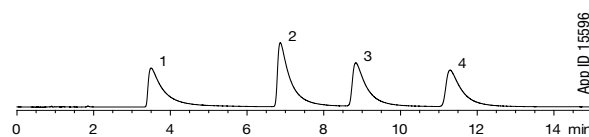
Mobile Phase: 20 mM Phosphate buffer pH 7.0/Acetonitrile/
Methanol (30:35:35)

Flow Rate: 1.5 mL/min

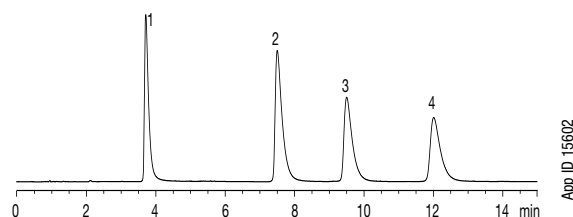
Detection: UV @ 254 nm

Sample: 1. Nortriptyline
2. Imipramine
3. Amitriptyline
4. Clomipramine

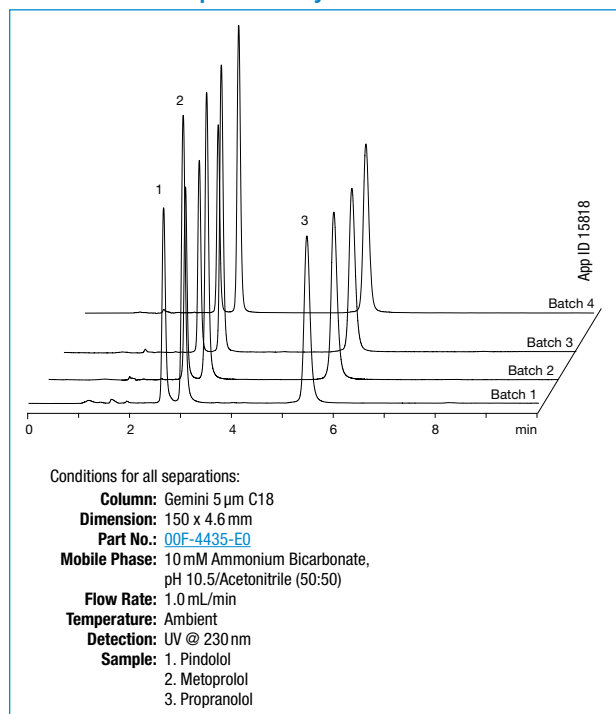
Agilent Technologies[®] ZORBAX[®] 5 µm Extend-C18 80 Å



Advanced Chromatography Technologies[®] ACE[®] 5 µm C18 100 Å



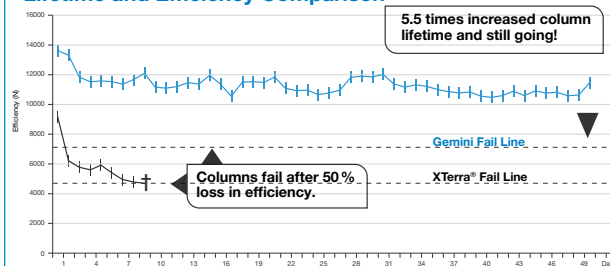
Batch-to-Batch Reproducibility



Extended Column Lifetime

The TWIN[™] Technology engineering of Gemini provides stability and increased column lifetime. Whether used under isocratic or gradient conditions, Gemini columns out-perform and outlasts pH stable columns. This is illustrated below.

Lifetime and Efficiency Comparison**



**Efficiency and lifetime comparison based on average of two columns each run in parallel.

Conditions for all columns:

Columns: Gemini 5 µm C18

Waters[®] XTerra[®] 5 µm MS C18

Dimensions: 150 x 4.6 mm

Mobile Phase: Acetonitrile/50 mM Methylpyrrolidine
Buffer, pH 11.5 (50:50)

Flow Rate: 1 mL/min

Temperature: Ambient

Detection: UV @ 254 nm

Sample: Diphenhydramine

The comparative data presented here may not be representative for all applications.

Gemini[®] pH Flexible LC Columns

U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Gemini C6-Phenyl

- pH stable 1-12 for durability
- Great aromatic selectivity
- Extremely low UV and MS bleed

Gemini C6-Phenyl

USP: L11

LC-MS
Certified

pH Stability: 1.0 – 12.0

Particle Size: 3 µm and 5 µm

Phase: Phenyl with C6 linker

Application: Aromatic, polar, or basic compounds

Strength: High aromatic selectivity with exceptional peak shape even in neutral conditions. Extremely low bleed phenyl column.

Pore Size (Å): 110

Surface Area (m²/g): 375

Carbon Load %: 12

End Capping: TMS

Enhanced Performance for Aromatic Compounds

Sulfa Drug Application

Resolution	Pursuit 5 µm DiPhenyl	Gemini 5 µm C6-Phenyl
RS _{1,2}	1.0	4.0
RS _{2,3}	9.8	16.0

Conditions for all columns:

Dimensions: 150 x 4.6 mm

Mobile Phase: 0.1 % Formic Acid in Water/
Methanol (70:30)

Flow Rate: 1.0 mL/min

Temperature: Ambient

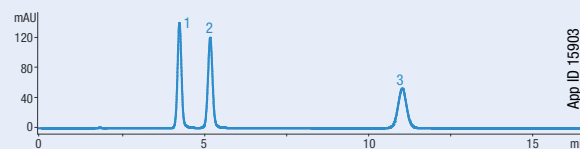
Detection: UV @ 254 nm

Sample: 1. Sulfathiazole

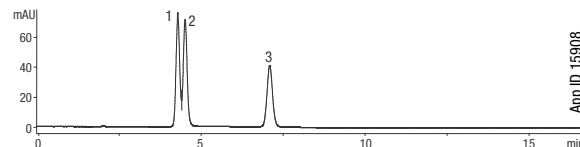
2. Sulfamerazine

3. Sulfamethoxazole

Phenomenex Gemini 5 µm C6-Phenyl

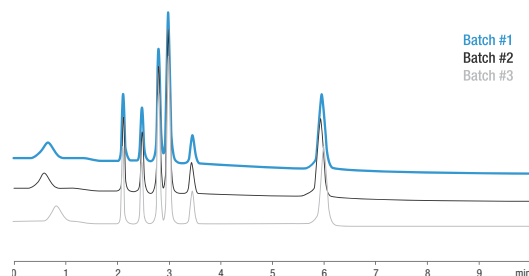


Agilent Technologies® Pursuit® 5 µm DiPhenyl



Reproducible Phenyl Phase

Aliphatic Acid Application



Conditions for all columns:

Column: Gemini 5 µm C6-Phenyl

Dimensions: 150 x 4.6 mm

Part No.: 00F-4444-EO

Mobile Phase: 20 mM Phosphate buffer,
pH 2.5/Methanol (97:3)

Flow Rate: 1.0 mL/min

Temperature: Ambient

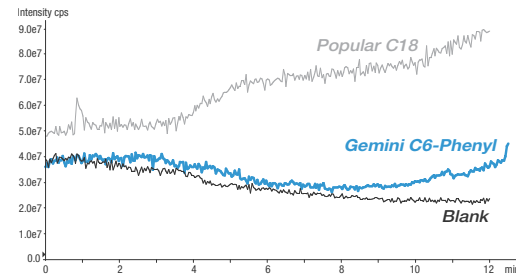
Detection: UV @ 220 nm

Sample: 1. Tartaric Acid 4. Acetic Acid

2. Malic Acid 5. Citric Acid

3. Lactic Acid 6. Propionic Acid

Low Bleed Phenyl Phase



Conditions for all columns:

Dimensions: 150 x 3.0 mm

Mobile Phase: A: 0.1 % Formic acid in Water

B: 0.1 % Formic acid in Acetonitrile

Gradient: 5 % B to 95 % B in 10 min, then hold
95 % B for 2 min

Flow Rate: 0.6 mL/min

Temperature: Ambient

MS Detection: ESI + ion mode,

M/Z 100-700

Comparative chromatograms may not be representative for all applications.

Gemini[™] pH Flexible LC Columns

U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Gemini C8(3)

The Material Developed for High pH Insulin Purification

Many products can separate human insulin and its degradant, while few can withstand high pH caustic washes for aggregate removal. Now, there is a clear media choice. Gemini C8(3) provides the needed separation, the needed low/high pH robustness, and the overall consistency in terms of efficiency and retention cycle to cycle. You don't have to choose between consistent performance or robustness; Gemini C8(3) was developed to give you the best of both worlds.

Gemini C8(3)

pH Stability: 1.0 – 12.0

Particle Size: 10 µm

Phase: C8

Application: Small molecules, peptides, proteins, oligonucleotides

Strength: Elevated pH stability; Increased reproducibility; Enhanced robustness

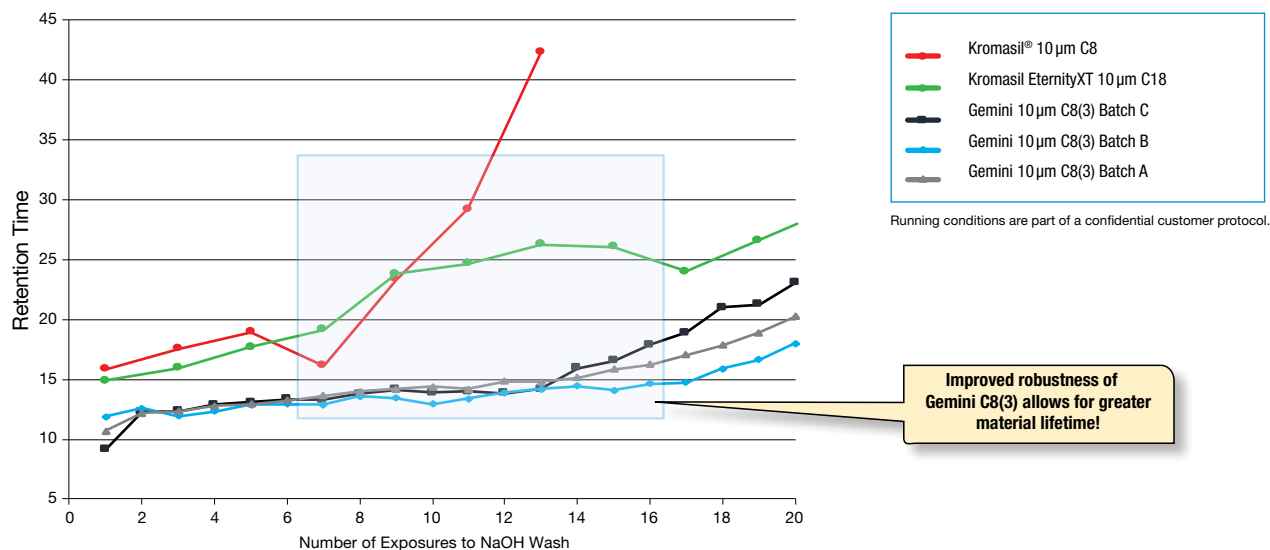
Pore Size (Å): 100

Surface Area (m²/g): 400

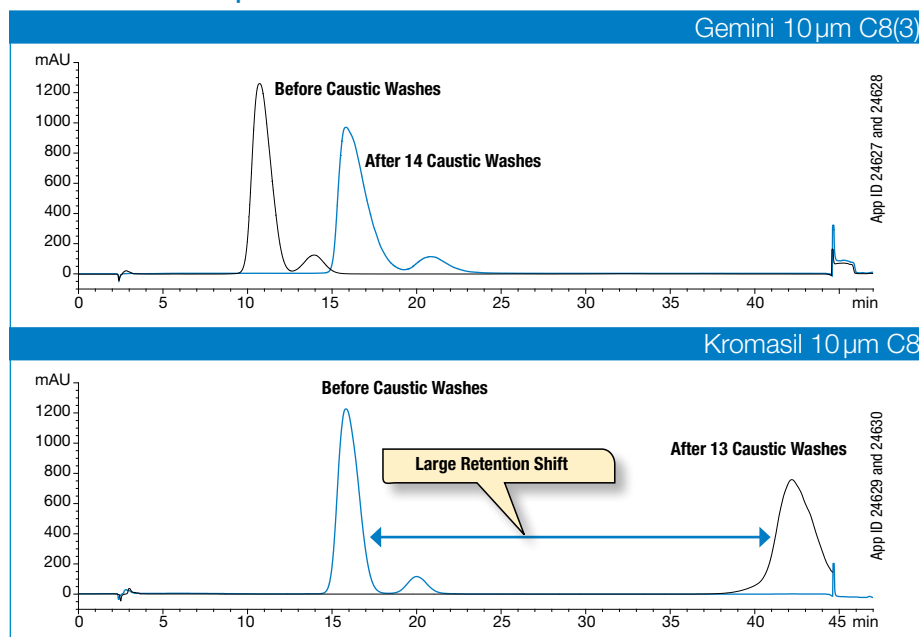
Carbon Load %: 13

End Capping: TMS

Insulin Retention vs. Exposures to NaOH Wash



Insulin Retention Comparison



Comparative separations may not be representative of all applications.

Gemini™ pH Flexible LC Columns

U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Ordering Information

3 µm Micro LC Columns (mm)			
Phases	50 x 0.30	150 x 0.30	50 x 0.50
C18	00B-4439-AC	00F-4439-AC	00B-4439-AF



For information on Micro LC Columns, Traps, and Fittings, see pp. 359-361

3 µm Microbore, Minibore and MidBore™ Columns (mm)										SecurityGuard™ Cartridges (mm)
Phases	50 x 1.0	20 x 2.0	30 x 2.0	50 x 2.0	100 x 2.0	150 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	4 x 2.0* /10pk
C18	00B-4439-AQ	00M-4439-BQ	00A-4439-BQ	00B-4439-BQ	00D-4439-BQ	00F-4439-BQ	00B-4439-YQ	00D-4439-YQ	00F-4439-YQ	AJ0-7596
C6-Phenyl	—	—	—	00B-4443-BQ	00D-4443-BQ	00F-4443-BQ	00B-4443-YQ	00D-4443-YQ	00F-4443-YQ	AJ0-7914
NX-C18	00B-4453-AQ	00M-4453-BQ	00A-4453-BQ	00B-4453-BQ	00D-4453-BQ	00F-4453-BQ	00B-4453-YQ	00D-4453-YQ	00F-4453-YQ	AJ0-8367

for ID: 2.0-3.0 mm

3 µm Analytical Columns (mm)						SecurityGuard™ Cartridges (mm)
Phases	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0* /10pk
C18	00A-4439-EQ	00B-4439-EQ	00D-4439-EQ	00F-4439-EQ	00G-4439-EQ	AJ0-7597
C6-Phenyl	00A-4443-EQ	00B-4443-EQ	00D-4443-EQ	00F-4443-EQ	00G-4443-EQ	AJ0-7915
NX-C18	—	00B-4453-EQ	00D-4453-EQ	00F-4453-EQ	00G-4453-EQ	AJ0-8368

for ID: 3.2-8.0 mm



5 µm Minibore and MidBore Columns (mm)								SecurityGuard™ Cartridges (mm)	
Phases	30 x 2.0	50 x 2.0	150 x 2.0	250 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	250 x 3.0	4 x 2.0* /10pk
C18	00A-4435-BQ	00B-4435-BQ	00F-4435-BQ	00G-4435-BQ	00B-4435-YQ	00D-4435-YQ	00F-4435-YQ	00G-4435-YQ	AJ0-7596
C6-Phenyl	—	00B-4444-BQ	00F-4444-BQ	—	—	—	—	00G-4444-YQ	AJ0-7914
NX-C18	00A-4454-BQ	00B-4454-BQ	00F-4454-BQ	—	00B-4454-YQ	00D-4454-YQ	00F-4454-YQ	00G-4454-YQ	AJ0-8367

for ID: 2.0-3.0 mm

5 µm Analytical Columns (mm)						SecurityGuard™ Cartridges (mm)
Phases	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0* /10pk
C18	00A-4435-EQ	00B-4435-EQ	00D-4435-EQ	00F-4435-EQ	00G-4435-EQ	AJ0-7597
C6-Phenyl	—	00B-4444-EQ	00D-4444-EQ	00F-4444-EQ	00G-4444-EQ	AJ0-7915
NX-C18	—	00B-4454-EQ	00D-4454-EQ	00F-4454-EQ	00G-4454-EQ	AJ0-8368

for ID: 3.2-8.0 mm

5 µm Semi-Prep Columns (mm)			SecurityGuard™ Cartridges (mm)
Phases	150 x 10	250 x 10	10 x 10* /3pk
C18	00F-4435-NQ	00G-4435-NQ	AJ0-7598
C6-Phenyl	—	00G-4444-NQ	AJ0-9156
NX-C18	00F-4454-NQ	00G-4454-NQ	AJ0-8369

for ID: 9-16 mm



Axia™ Packed Preparative Columns (mm)							SecurityGuard™ Cartridges (mm)	
Phases	50 x 21.2	100 x 21.2	150 x 21.2	250 x 21.2	50 x 30	75 x 30	15 x 21.2**	15 x 30.0*
5 µm							/ea	/ea
C18	00B-4435-PQ-AX	00D-4435-PQ-AX	00F-4435-PQ-AX	00G-4435-PQ-AX	00B-4435-UQ-AX	—	AJ0-7846	AJ0-8308
C6-Phenyl	—	00D-4444-PQ-AX	00F-4444-PQ-AX	00G-4444-PQ-AX	—	—	AJ0-9157	AJ0-9158
NX-C18	00B-4454-PQ-AX	00D-4454-PQ-AX	00F-4454-PQ-AX	00G-4454-PQ-AX	00B-4454-UQ-AX	00C-4454-UQ-AX	AJ0-8370	AJ0-8371
10 µm							/ea	/ea
C18	—	00D-4436-PQ-AX	00F-4436-PQ-AX	00G-4436-PQ-AX	—	—	AJ0-7846	AJ0-8308
NX-C18	00B-4455-PQ-AX	00D-4455-PQ-AX	00F-4455-PQ-AX	00G-4455-PQ-AX	—	—	AJ0-8370	AJ0-8371
C8(3)	—	—	—	00G-4763-PQ-AX	—	—	—	—

for ID: 18-29 mm

30-49 mm

Axia™ Packed Preparative Columns (mm) continued						SecurityGuard™ Cartridges (mm)	
Phases	100 x 30	150 x 30	250 x 30	100 x 50	150 x 50	250 x 50	15 x 30.0*
5 µm							/ea
C18	00D-4435-U0-AX	00F-4435-U0-AX	00G-4435-U0-AX	—	—	—	AJ0-8308
NX-C18	00D-4454-U0-AX	00F-4454-U0-AX	00G-4454-U0-AX	—	—	—	AJ0-8371
10 µm							/ea
C18	00D-4436-U0-AX	00F-4436-U0-AX	00G-4436-U0-AX	—	00F-4436-V0-AX	00G-4436-V0-AX	AJ0-8308
NX-C18	00D-4455-U0-AX	00F-4455-U0-AX	00G-4455-U0-AX	00D-4455-V0-AX	00F-4455-V0-AX	00G-4455-V0-AX	AJ0-8371
C8(3)	—	—	00G-4763-U0-AX	—	—	00G-4763-V0-AX	—

for ID: 30-49 mm

For UHPLC system connections, see SecurityLINK™

UHPLC fingertight fitting system on pp. 336-337

For PREP Columns & Bulk Media, see pp. 383-401

For SecurityGuard Holders and Cartridges, see pp. 330-335

For MercuryMS LC-MS Columns, Cartridges, and Cartridge Holders, Inquire.

*SecurityGuard™ Analytical Cartridges require holder, Part No.: [KJ0-4282](#)

†SemiPrep SecurityGuard™ Cartridges require holder, Part No.: [AJ0-9281](#)

**PREP SecurityGuard™ Cartridges require holder, Part No.: [AJ0-8223](#)

◆PREP SecurityGuard™ Cartridges require holder, Part No.: [AJ0-8277](#)

