

2006/07 Edition

# CLINICAL/ FORENSICS

Products & Applications for GC & HPLC



Turning Visions into Reality™

[www.restek.com](http://www.restek.com)

**Introduction**

In the clinical and forensic markets, chromatography encompasses a wide range of application areas, including:

- hospital & forensic toxicology
- drugs of abuse
- alcohol & driving
- workplace drug testing (illicit drugs)
- drug abuse in sports (steroids, stimulants, analgesics, hormones, diuretics, narcotics)
- therapeutic drug monitoring (prescription drugs)
- natural toxins (hallucinogenic mushrooms)
- pesticide poisoning
- volatile substance abuse (adhesives, dry cleaning/degreasing agents, hydrocarbon fuels, solvents, paint strippers/thinner, vasodilators)
- solid drug identification

Example chromatograms for a variety of these applications, obtained using Restek GC and HPLC columns and accessories, are illustrated in this guide.

Throughout this guide you also will find references to application notes that detail specific analyses, technical guides that explain various analytical techniques, product information pieces that highlight aspects of our products, and reference books that offer detailed information on topics from sample preparation to chromatographic methods. All Restek publications are available free on request; order by contacting our Technical Service Department, our Customer Service Department, or your Restek distributor by e-mail, telephone, or fax, and providing the literature catalog numbers for the publications you want. For fastest access, you can review and download these publications from our website. For prices for reference books, refer to our general catalog or website - or simply call our Customer Service Department.



Kristi brings 18 years of experience in GC and 4 years of experience in HPLC to her role as our principal clinical and forensic applications chemist. She holds a B.S. in chemistry from Lock Haven University, Lock Haven, PA.

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**Kristi Sellers**  
Clinical/Forensic  
Innovations Chemist

## three **simple** words...

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### **Execution**

On-time delivery of products and services.

### Exceeding your expectations

Restek's vision is to be the company that chromatographers trust by providing the highest quality, in everything we do.

### **Innovation**

We will soon reach our goal of 100% employee ownership.

Turning visions into reality.

As owners, our success depends on your success.

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List is accurate to the best of our knowledge at the time of printing. Consult individual manufacturers or other sources for specific information.

# Arson Accelerants

**Arson Accelerants**  
 Analyses of fire debris for accelerants commonly are performed on non-polar columns, like the Rtx®-1 column. Thick film columns give better resolution for the low boiling point compounds that are components of gasoline. Thinner film columns provide better resolution and shorter analysis times for higher molecular weight compounds in diesel fuels. However, by choosing the appropriate column dimensions and analytical parameters, a wide range of petroleum products can be tested for on a single column.

Accelerants in fire debris are identified through chromatographic pattern comparison. Accelerants and that have been exposed to high heat exhibit a "weathered" pattern. Large proportions of the lower boiling components in any accelerant will have disappeared in samples that have undergone severe weathering. We have an extensive line of petroleum products that have been weathered to various stages of weight loss to aid in the identification of accelerants in fire debris.

## free literature

*Weathered Petroleum Analytical Reference Materials*

**lit. cat.# 59215**

*Fire Debris Analysis*

**lit. cat.# 59574**

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

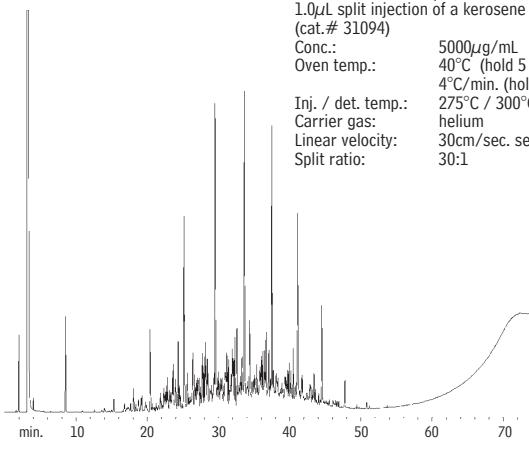
### Kerosene

#### Rtx®-1

GC

30m, 0.32mm ID, 1.5 $\mu$ m Rtx®-1 (cat.# 10169)  
 1.0 $\mu$ L split injection of a kerosene standard  
 (cat.# 31094)

Conc.: 5000 $\mu$ g/mL  
 Oven temp.: 40°C (hold 5 min.) to 300°C @ 4°C/min. (hold 5 min.)  
 Inj. / det. temp.: 275°C / 300°C  
 Carrier gas: helium  
 Linear velocity: 30cm/sec. set @ 40°C  
 Split ratio: 30:1



GC\_MS00274

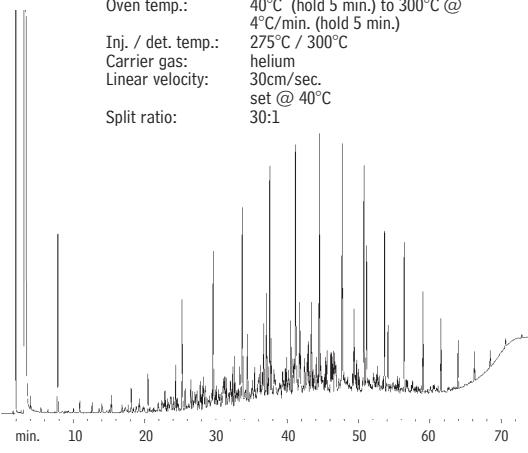
### Diesel Fuel

#### Rtx®-1

GC

30m, 0.32mm ID, 1.5 $\mu$ m Rtx®-1 (cat.# 10169)  
 1.0 $\mu$ L split injection of a diesel fuel #2 standard (cat.# 31093)

Conc.: 5000 $\mu$ g/mL  
 Oven temp.: 40°C (hold 5 min.) to 300°C @ 4°C/min. (hold 5 min.)  
 Inj. / det. temp.: 275°C / 300°C  
 Carrier gas: helium  
 Linear velocity: 30cm/sec. set @ 40°C  
 Split ratio: 30:1



GC\_MS00275

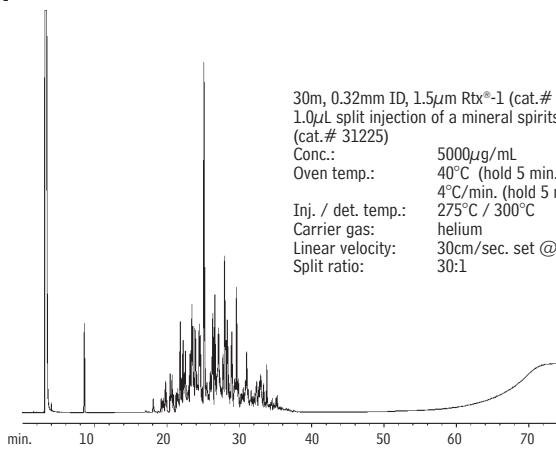
### Mineral Spirits

#### Rtx®-1

GC

30m, 0.32mm ID, 1.5 $\mu$ m Rtx®-1 (cat.# 10169)  
 1.0 $\mu$ L split injection of a mineral spirits standard  
 (cat.# 31225)

Conc.: 5000 $\mu$ g/mL  
 Oven temp.: 40°C (hold 5 min.) to 300°C @ 4°C/min. (hold 5 min.)  
 Inj. / det. temp.: 275°C / 300°C  
 Carrier gas: helium  
 Linear velocity: 30cm/sec. set @ 40°C  
 Split ratio: 30:1



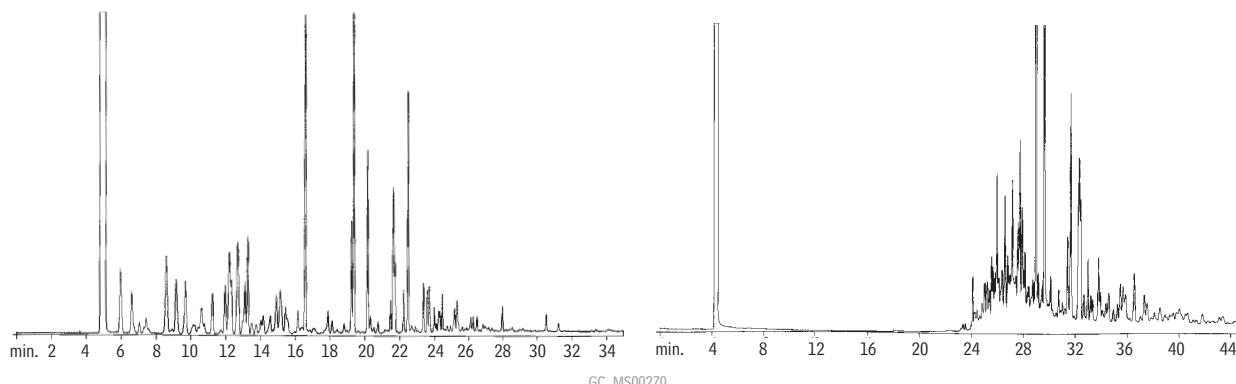
GC\_MS00276

GC

## Unleaded Gasoline Rtx<sup>®</sup>-1

Unweathered

99% Weathered

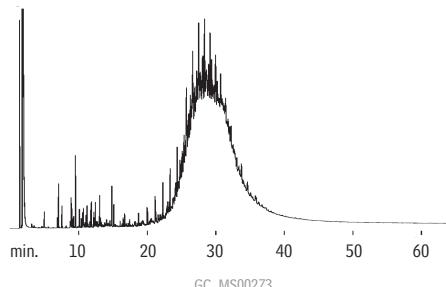
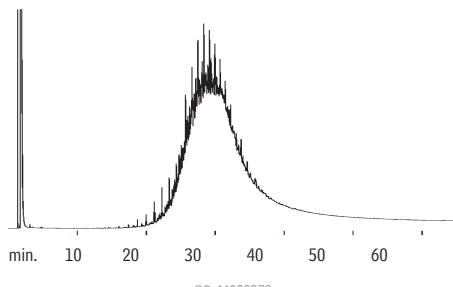


30m, 0.53mm ID, 1.50 $\mu$ m Rtx<sup>®</sup>-1 (cat.# 10170)  
 Oven temp.: 40°C (hold 3 min.) to 75°C @ 15°C/min. to 275°C @ 20°C/min. (hold 5 min.)  
 Inj./det. temp.: 250°C/285°C  
 Carrier gas: hydrogen  
 Linear velocity: 50cm/sec. set @ 40°C  
 FID sensitivity: 4.10 x 10<sup>5</sup> AFS  
 Split ratio: 30:1

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## Motor Oil Rtx<sup>®</sup>-5

## Motor Oil (Used) Rtx<sup>®</sup>-5



30m, 0.53mm ID, 1.0 $\mu$ m Rtx<sup>®</sup>-5 (cat.# 10255)  
 1.0 $\mu$ L split injection of Motor Oil Composite Standard (cat.# 31464)\*  
 Conc.: 50,000ppm  
 Oven temp.: 40°C (hold 2 min.) to 330°C @ 10°C/min. (hold 60 min.)  
 Inj./det. temp.: 300/330°C  
 Carrier gas: hydrogen  
 Linear velocity: 41cm/sec.  
 Split ratio: 3:1

30m, 0.25mm ID, 0.25 $\mu$ m Rtx<sup>®</sup>-5 (cat.# 10223)  
 1.0 $\mu$ L split injection of Used Motor Oil Composite Standard (cat.# 31465)\*  
 Conc.: 50,000ppm  
 Oven temp.: 40°C to 340°C @ 10°C/min. (hold 15 min.)  
 Inj./det. temp.: 250/340°C  
 Carrier gas: hydrogen  
 Linear velocity: 40cm/sec.  
 Split ratio: 15:1

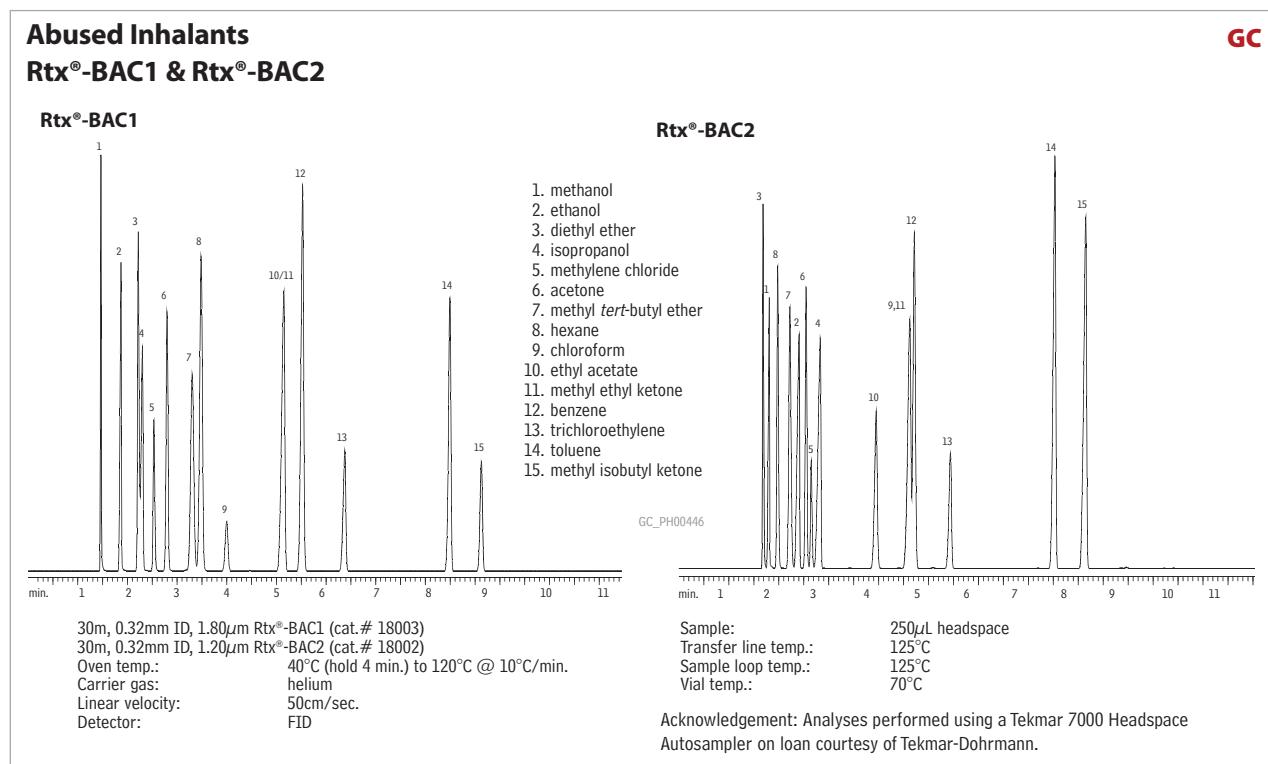
\*Prepared from an equal volume blend of 5w30, 10w30, 10w40, and 20w50 motor oil, precisely weighed to produce a mixture at 50,000 $\mu$ g/mL in methylene chloride.

\*Prepared from an equal volume blend from five gasoline powered vehicles, precisely weighed to produce a mixture at 50,000 $\mu$ g/mL in methylene chloride.

# Abused Inhalants; Anesthetics

## Abused Inhalants/ Anesthetics

Inhalant abuse can be detected during screening of whole blood, serum, or urine samples, using headspace (GC) with flame ionization detection (FID). Here, we used a GC equipped with an automated headspace sampler that simultaneously introduces a sample into two analytical columns. A dual-column configuration provides screening and confirmational data from the same injection. We used an Rtx®-BAC1 column (30m, 0.53mm ID, 3.00 $\mu$ m df) and an Rtx®-BAC2 column (30m, 0.53mm ID, 2.00 $\mu$ m df)—columns typically used in combination as a screening and confirmation column set for blood alcohol analysis. A useful extension of blood alcohol analysis using this column set is the detection of other volatile organic compounds (VOCs), such as those in inhalants and anesthetics.



## for more info

*GC Analysis of Commonly Abused Inhalants in Blood, Using Rtx®-BAC1 and Rtx®-BAC2 Columns*

lit. cat.# 59548

*A Technical Guide for Static Headspace Analysis, Using GC*

lit. cat.# 59895A

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## Abused Anesthetics

### Rtx®-BAC1 & Rtx®-BAC2

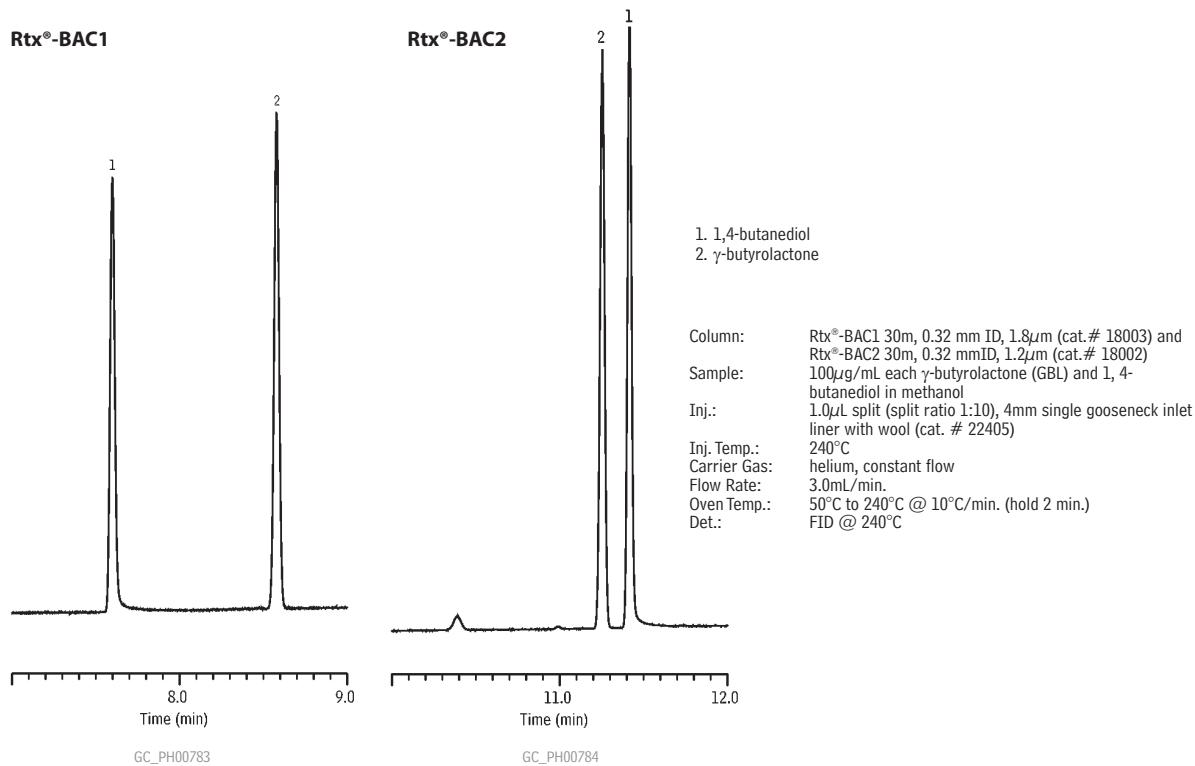
#### Rtx®-BAC1

#### Rtx®-BAC2

# Butyrolactone, Butanediols

GC

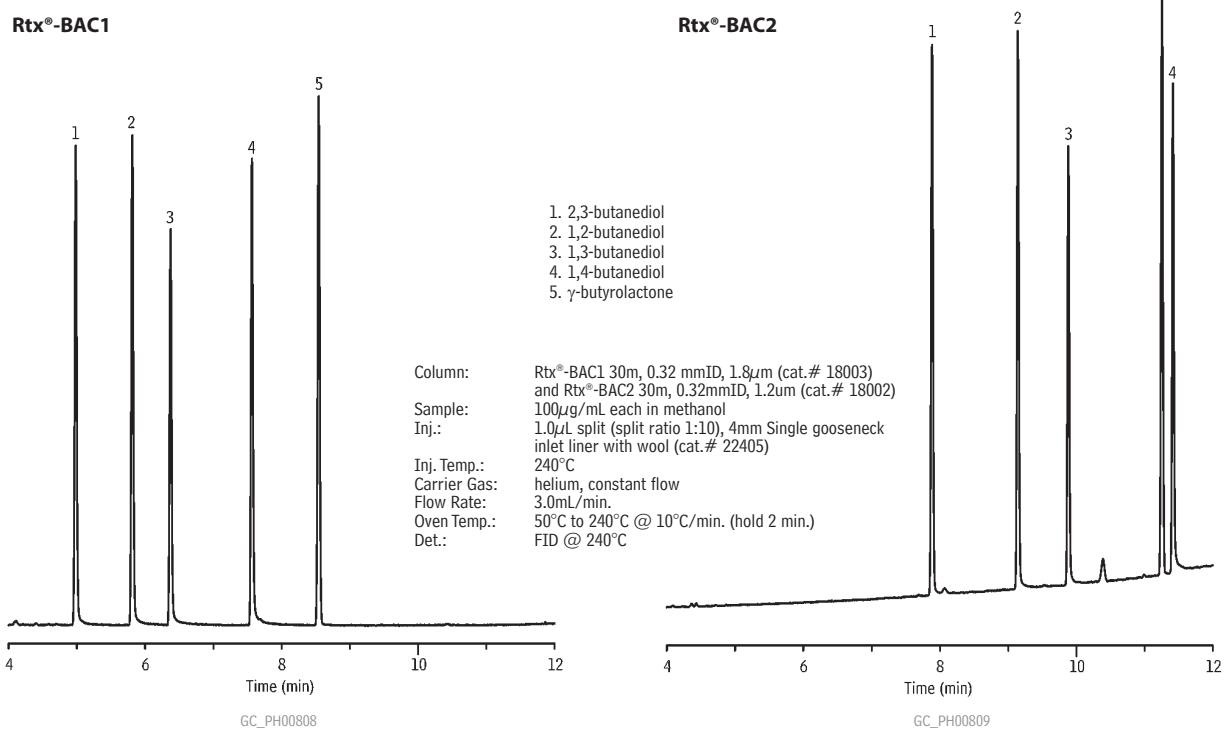
## $\gamma$ -butyrolactone & 1,4-butanediol Rtx<sup>®</sup>-BAC1 & Rtx<sup>®</sup>-BAC2



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## $\gamma$ -butyrolactone & 1,4-butanediol

GC

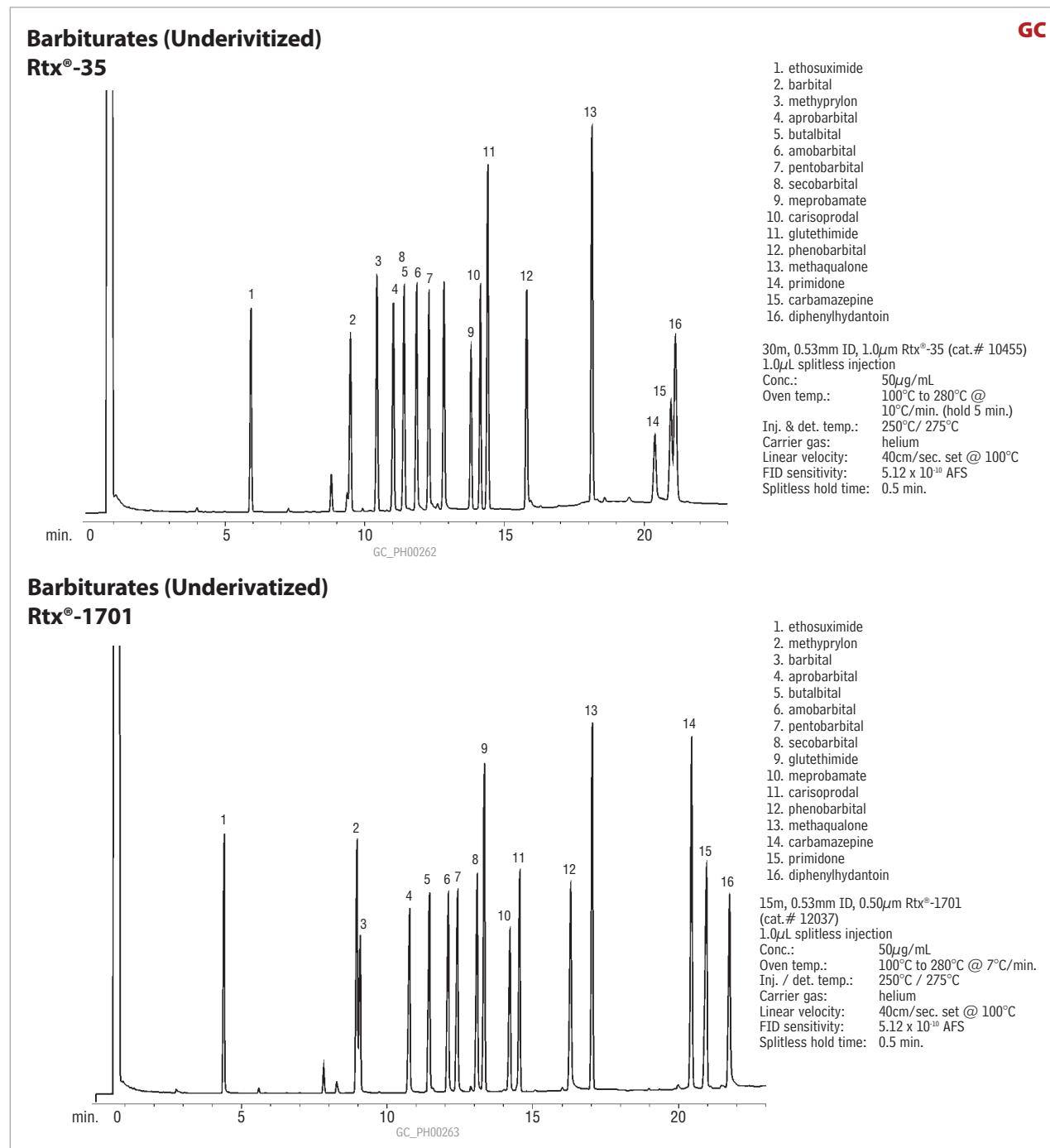


# Barbiturates

## Barbiturates

These acidic and neutral drugs normally are analyzed in their underivatized forms. Symmetric peaks and baseline resolution for many compounds can be achieved by using intermediate polarity Restek columns, Rtx®-35 and Rtx®-1701. In drug overdose or drug abuse testing, these two columns can be used in combination, in dual column analysis for screening and tentatively confirming the presence or absence of specific compounds. Differences in polarity for each stationary phase produce shifts in retention time and elution order. High thermal stability and low column bleed allow these drugs to be detected by FID with on-column concentrations in the low nanogram range. When analyzing underivatized barbiturates, a deactivated inlet liner should be used in the injection port to prevent adsorption onto the surface of the liner. Liners should be changed frequently to prevent the accumulation of non-volatile contamination.

To avert injection port adsorption problems, barbiturates also can be analyzed by gas chromatography in their derivatized forms. They can be derivitized on-column, using methylating reagents like TMAH or TMPAH.



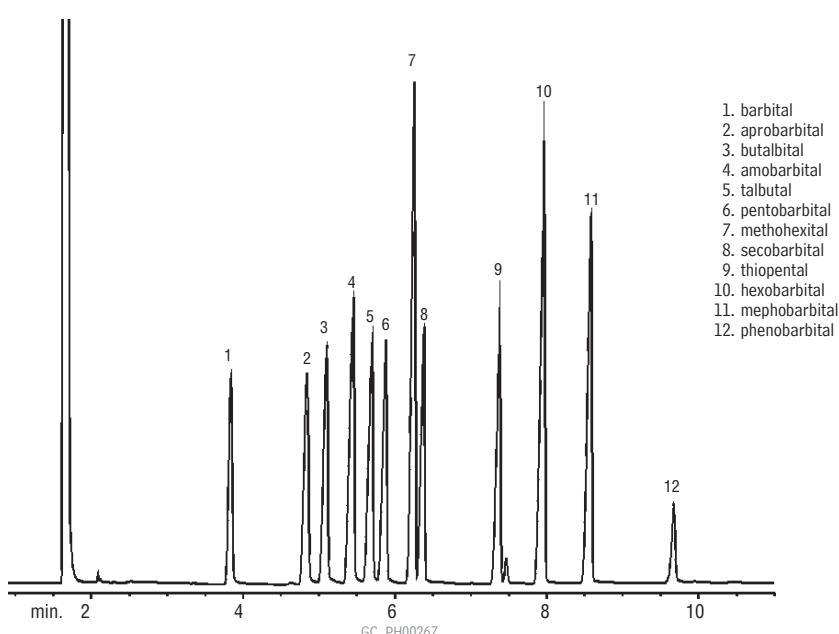
# Barbiturates; Benzodiazepines

GC

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## Barbiturates (Underivatized)

Rtx®-35

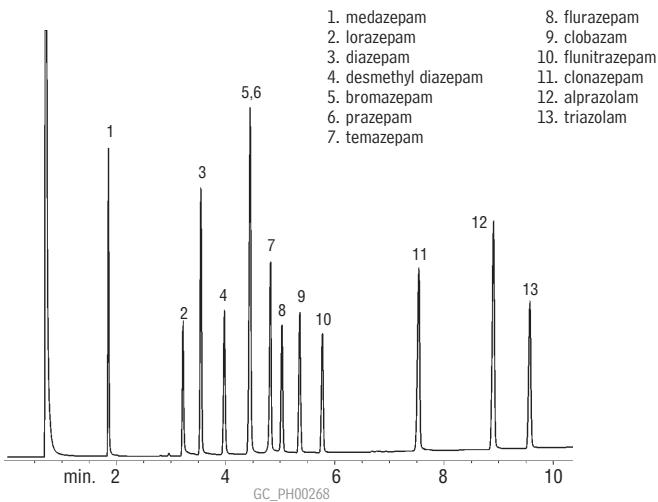


30m, 0.32mm ID, 0.50 $\mu$ m Rtx®-35 (cat.# 10439)  
 1.0 $\mu$ L split injection of barbiturates  
 Oven temp.: 210°C (hold 2 min.) to 300°C @ 7°C/min. (hold 2 min.)  
 Inj. & det. temp.: 300°C  
 Carrier gas: helium  
 Linear velocity: 35cm/sec. set @ 210°C  
 FID sensitivity: 5.12 x 10<sup>-10</sup> AFS  
 Split vent: 30:1

## Benzodiazepines (Underivatized)

Rtx®-200

GC



15m, 0.32mm ID, 0.25 $\mu$ m Rtx®-200 (cat.# 15021)  
 1.0 $\mu$ L split injection of benzodiazepines  
 Conc.: 15ng/component  
 Oven temp.: 225°C to 325°C @ 8°C/min.  
 Inj. / det. temp.: 250°C / 320°C  
 Carrier gas: helium  
 Linear velocity: 35cm/sec. set @ 225°C  
 FID sensitivity: 5.12 x 10<sup>-10</sup> AFS  
 Split ratio: 60:1

## Benzodiazepines

The Rtx®-200 stationary phase provides excellent resolution and peak shape for benzodiazepines. The unique selectivity of the Rtx®-200 trifluoropropyl methyl polymer helps to resolve this group of compounds, which are very closely related structurally. The high thermal stability of the stationary phase provides a stable baseline at high temperature, to facilitate analysis of picogram quantities of these materials.

## free literature

### Barbiturate Analysis

lit. cat.# 59575

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# Basic Drugs (Mixed)

## Mixed Basic Drugs

Many basic compounds can be screened for in any given analysis, using a single Restek column. Our bonded polysiloxane stationary phases exhibit low column bleed and high thermal stability while offering a variety of compositions that yield selective retention for specific analytes. Screening and confirmation for individual drugs can be performed simultaneously by using two dissimilar stationary phases in a dual column configuration.

Rtx®-5 and Rtx®-35 phases are 5% and 35% phenyl/methyl polysiloxanes, respectively. The Rtx®-5 column has been used as the primary analytical column by many laboratories and can resolve all 38 compounds in this mixture of basic drugs in less than 60 minutes. The higher phenyl content of the Rtx®-35 phase increases its polarity and retention of more polar compounds, resulting in several elution order and retention time shifts. Under the same conditions used for the Rtx®-5 column, the Rtx®-35 column also resolves all 38 basic drugs, with the exception of pyrilamine and bupivacaine.

Rtx®-200 is a trifluoropropyl polysiloxane that exhibits unique selectivity for compounds with lone pairs of electrons. This column displays very different retention times and elution orders in comparison to the Rtx®-5 or Rtx®-35 column. Under the same analytical conditions, several coelutions occur with the Rtx®-200 column, including: cotinine/caffeine, bupivacaine/chlorpromazine, bromazepam/prazepam, and flurazepam/papaverine.

Because all three columns can be operated under the same temperature program conditions, simultaneous dual column confirmation analysis can be accomplished by using either an Rtx®-35 column or an Rtx®-200 column in conjunction with an Rtx®-5 column. This increases qualitative and quantitative reliability without sacrificing analysis time.

### free literature

*Improved GC Analysis of Basic Organic Compounds Using Base Deactivated Columns & Liners.*

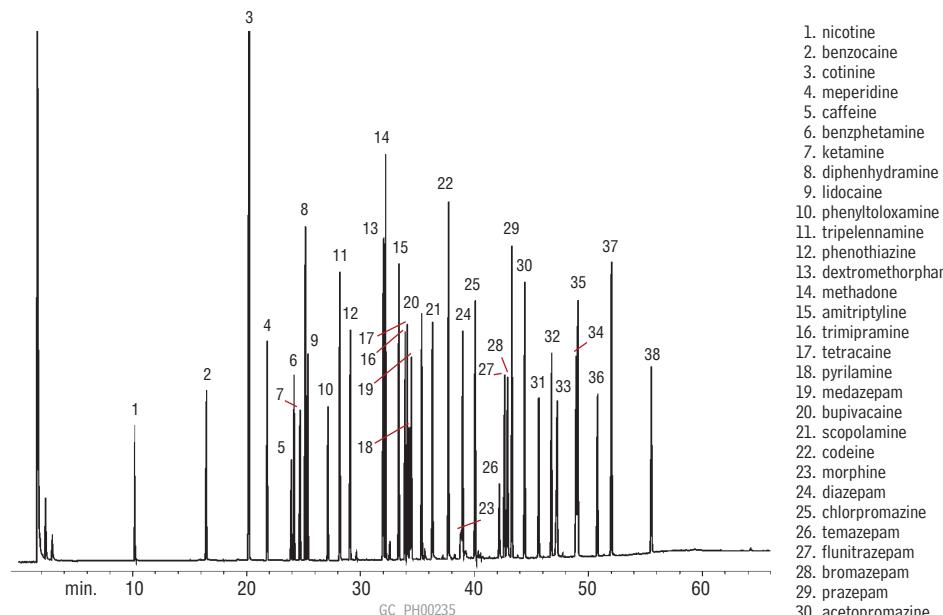
#### lit. cat.# 59108

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## Mixed Basic Drugs (Underivatized)

Rtx®-5

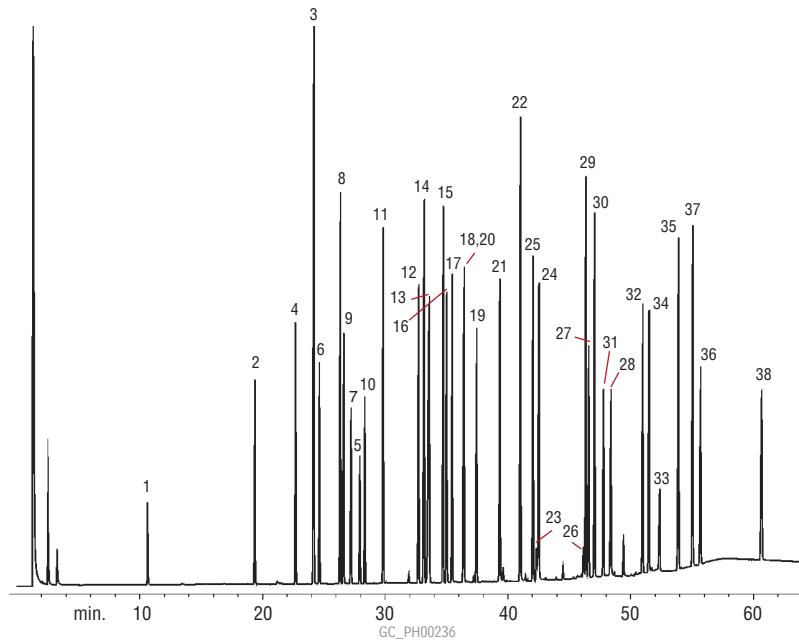
GC



30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-5 (cat.# 10223)  
1.0 $\mu$ L split injection of a basic drug sample.  
Conc.: 1000ng/ $\mu$ L  
Oven temp.: 100°C to 325°C @ 4°C/min. (hold 10 min.)  
Inj. / det. temp.: 250°C / 320°C  
Carrier gas: helium  
Linear velocity: 30cm/sec. set @ 100°C  
FID sensitivity: 1.28 x 10<sup>-10</sup> AFS  
Split ratio: 50:1

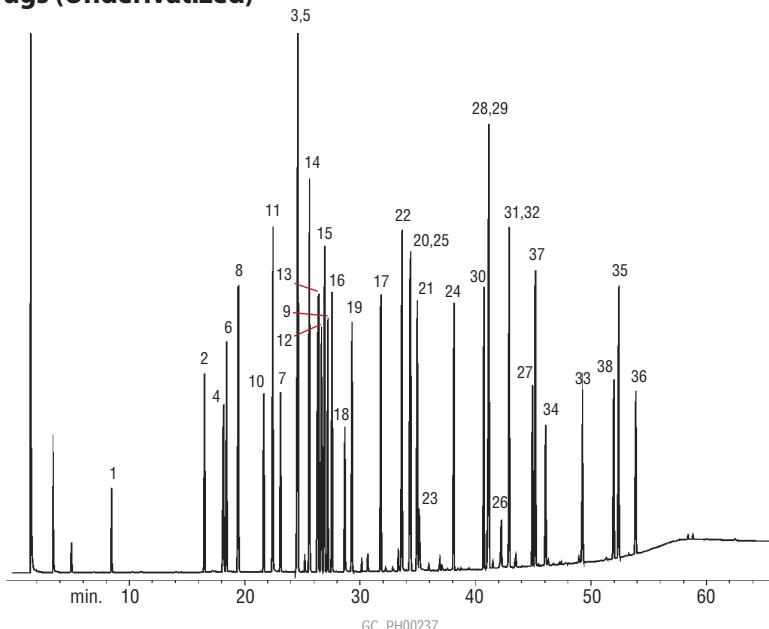
GC

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**Mixed Basic Drugs (Underivatized)**Rtx<sup>®</sup>-35

30m, 0.25mm ID, 0.25 $\mu$ m Rtx<sup>®</sup>-35 (cat.# 10423)  
1.0 $\mu$ L split injection of a basic drug mix (1mg/mL)  
Conc.: 1000ng/ $\mu$ L  
Oven temp.: 100°C to 325°C @ 4°C/min. (hold 10 min.)  
Inj. / det. temp.: 250°C / 320°C  
Carrier gas: helium  
Linear velocity: 30cm/sec. set @ 100°C  
FID sensitivity: 1.28 x 10<sup>-10</sup> AFS  
Split ratio: 50:1

1. nicotine
2. benzocaine
3. cotinine
4. meperidine
5. caffeine
6. benzphetamine
7. ketamine
8. diphenhydramine
9. lidocaine
10. phenyltoloxamine
11. tripeleannamine
12. phenothiazine
13. dextromethorphan
14. methadone
15. amitriptyline
16. trimipramine
17. tetracaine
18. pyrilamine
19. medazepam
20. bupivacaine
21. scopolamine
22. codeine
23. morphine
24. diazepam
25. chlorpromazine
26. temazepam
27. flunitrazepam
28. bromazepam
29. prazepam
30. acetopromazine
31. flurazepam
32. papaverine
33. clonazepam
34. haloperidol
35. alprazolam
36. triazolam
37. thioridazine
38. trazodone

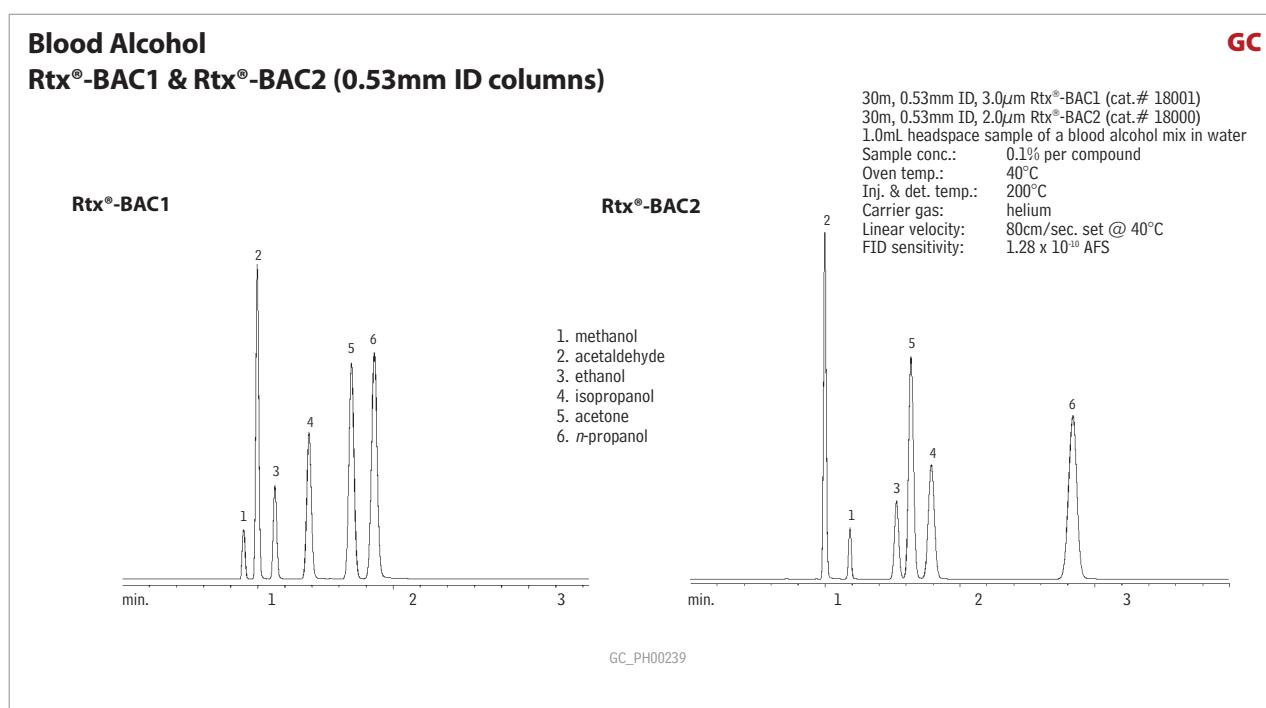
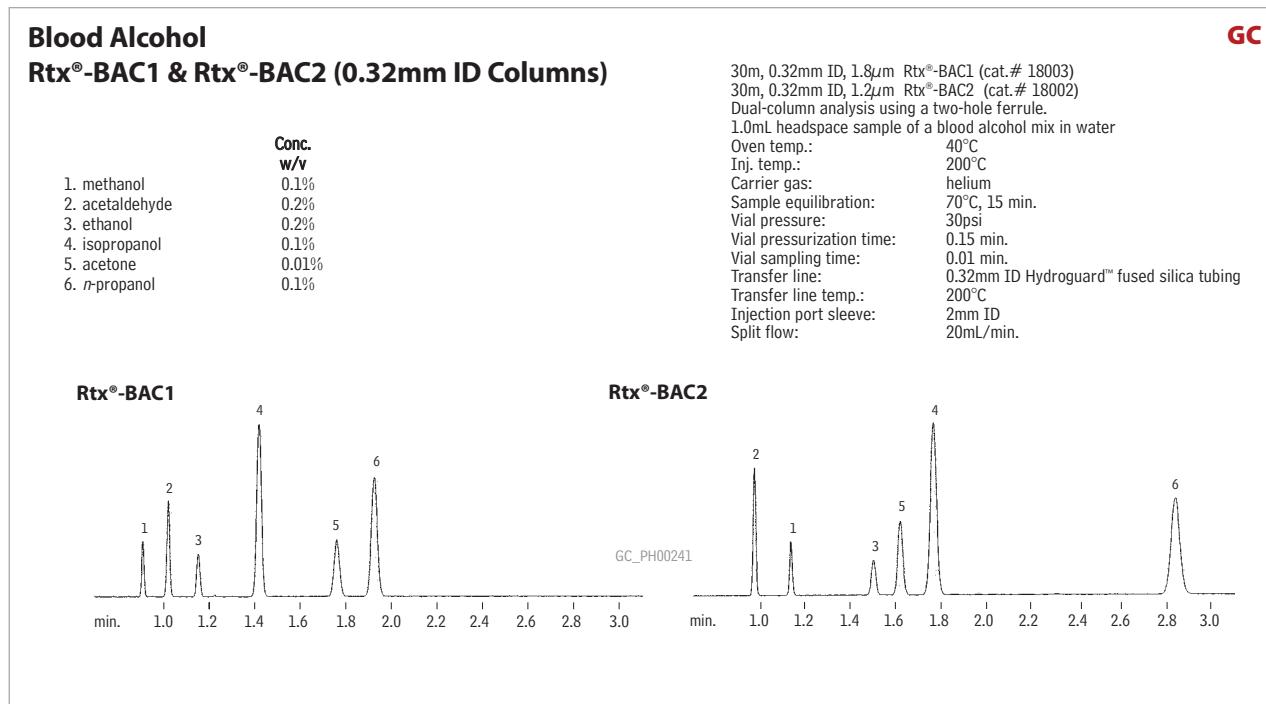
**Mixed Basic Drugs (Underivatized)**Rtx<sup>®</sup>-200

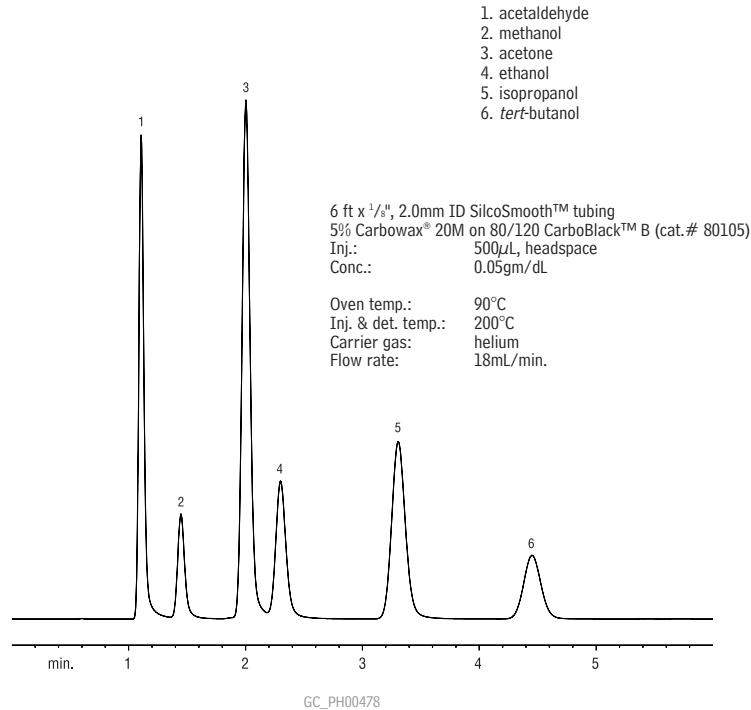
30m, 0.25mm ID, 0.25 $\mu$ m Rtx<sup>®</sup>-200 (cat.# 15023)  
1.0 $\mu$ L split injection of a basic drug mix (1mg/mL)  
Conc.: 1000ng/ $\mu$ L  
Oven temp.: 100°C to 325°C @ 4°C/min. (hold 10 min.)  
Inj. / det. temp.: 250°C / 320°C  
Carrier gas: helium  
Linear velocity: 30cm/sec. set @ 100°C  
FID sensitivity: 1.28 x 10<sup>-10</sup> AFS  
Split ratio: 50:1

# Blood Alcohol

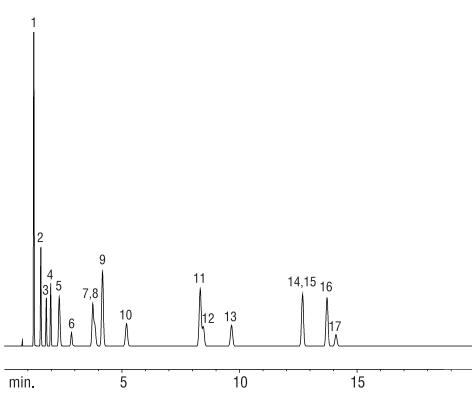
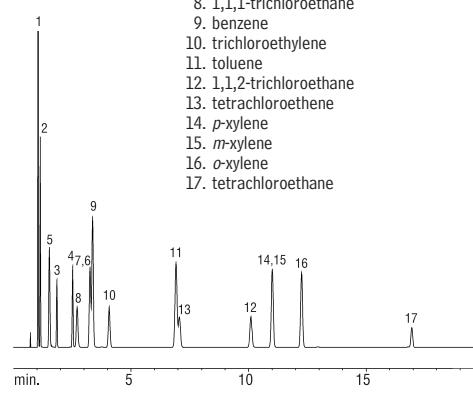
## Blood Alcohol

Resolution and analysis time are two critical factors to consider when developing an assay for ethanol and other volatiles in biological samples. We have developed two stationary phases specifically for blood alcohol analysis; each has the ability to baseline resolve all of the low molecular weight alcohols and their metabolites. Elution order of this analyte set differs on the two stationary phases, enabling screening and confirmation of volatile compounds to be performed with one injection. These columns also were designed for maximum sample throughput, with total analysis time under 3.5 minutes for an isothermal run. In addition to blood alcohol analysis, these columns can be used to test whole blood, serum, or urine for volatile compounds, using temperature programming.



**Blood Alcohol****5% Carbowax® 20M on 80/120 CarboBlack™ B****GC****did you know?**

Our Technical Service Department is staffed with more than 35 experienced chemists on rotating shifts from various departments. Whether your chromatography problem is simple or complex, call Restek's Technical Service Team at 1-800-356-1688 (ext. 4), or your Restek representative, and we will do everything we can to help you find a solution.

**Solvents****Rtx®-BAC1 & Rtx®-BAC2****GC****Rtx®-BAC1****Rtx®-BAC2**

- 1. ethyl chloride
- 2. diethyl ether
- 3. methylene chloride
- 4. acetonitrile
- 5. methyl *tert*-butyl ether
- 6. chloroform
- 7. methyl ethyl ketone
- 8. 1,1,1-trichloroethane
- 9. benzene
- 10. trichloroethylene
- 11. toluene
- 12. 1,1,2-trichloroethane
- 13. tetrachloroethene
- 14. *p*-xylene
- 15. *m*-xylene
- 16. *o*-xylene
- 17. tetrachloroethane

**free literature**

*Ethanol Analytical Reference Standards for Blood Alcohol Testing*

**lit. cat.# 59382**

*Dual-Column Conformation GC Analysis of Blood Alcohols Using Rtx®-BAC1 and Rtx®-BAC2 Columns Optimized for the Perkin Elmer HS 40 Headspace Autosampler*

**lit. cat.# 59598**

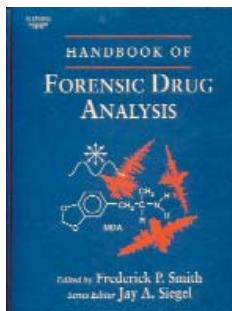
Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

30m, 0.53mm ID, 3.0 $\mu$ m Rtx®-BAC1 (cat.# 18001)  
30m, 0.53mm ID, 2.0 $\mu$ m Rtx®-BAC2 (cat.# 18000)  
1.0mL headspace sample  
Oven temp.: 40°C (hold 5 min.) to 240°C @ 5°C/min.  
Inj. & det. temp.: 240°C  
Carrier gas: helium  
Linear velocity: 65cm/sec.

# Cannabinoids; Opiates

## Cannabinoids

Analysis of cannabinoids includes screening for parent compounds as well as metabolites of the active constituents in marijuana. Derivatization is commonly employed to help improve peak shape and resolution. Derivatization also can aid in the identification of specific cannabinoids by GC/MS by producing unique high mass ion fragments. Columns with low bleed and high thermal stability are required for trace level analysis. Low polarity columns, like the Rtx®-5 column, provide sufficient resolution for derivatized cannabinoids without extending the run time unnecessarily.



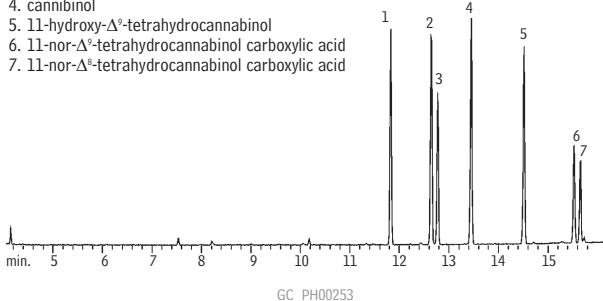
**Handbook of Forensic Drug Analysis**  
cat.# 23055 (ea.)

GC

## Cannabinoids (TMS Derivatives)

### Rtx®-5

1. cannabidiol
2. Δ<sup>9</sup>-tetrahydrocannabinol
3. Δ<sup>8</sup>-tetrahydrocannabinol
4. cannabinol
5. 11-hydroxy-Δ<sup>9</sup>-tetrahydrocannabinol
6. 11-nor-Δ<sup>9</sup>-tetrahydrocannabinol carboxylic acid
7. 11-nor-Δ<sup>8</sup>-tetrahydrocannabinol carboxylic acid



GC\_PH00253

15m, 0.25mm ID, 0.25μm Rtx®-5 (cat.# 10220)

1.0μL splitless injection of cannabinoids

Conc.: 100μg/mL

Oven temp.: 50°C (hold 0.5 min.) to 225°C @ 30°C/min., to 325°C @ 10°C/min.

Inj. temp.: 225°C

Interface temp.: 320°C

Det.: MSD

Ionization: EI

Carrier gas: helium

Scan range: 40-500 AMU

Linear velocity: 40cm/sec. set @ 50°C

Splitless hold time: 0.75 min.

## Opiates

Opiates are comprised of a multiple ring structure, substituted at various sites, producing compounds with different degrees of potency. When substitution is with a hydroxyl group, derivatization prior to analysis by GC is necessary to improve peak shape and response. Derivatization also can aid in the identification of opiates during GC/MS analysis by forming unique high mass ion fragments. An Rtx®-5 column can efficiently separate trimethylsilyl or fluoroacyl derivatives of the opiates.

## free literature

### Opiate Analysis

### lit. cat.# 59576

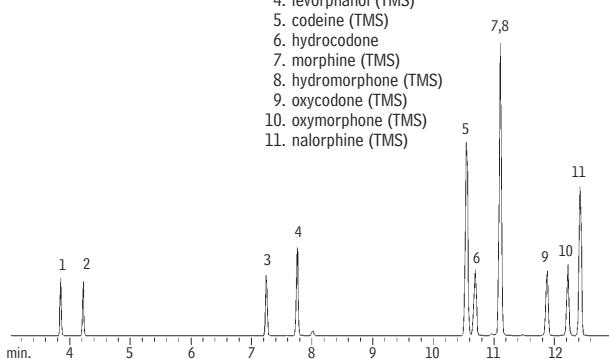
Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

GC

## Opiates (TMS Derivatives)

### Rtx®-5

1. meperidine
2. alphaprodine
3. methadone
4. levorphanol (TMS)
5. codeine (TMS)
6. hydrocodone
7. morphine (TMS)
8. hydromorphone (TMS)
9. oxycodone (TMS)
10. oxymorphone (TMS)
11. nalorphine (TMS)



GC\_PH00233

30m, 0.25mm ID, 0.25μm Rtx®-5 (cat.# 10223)

2.0μL split injection of opiates

Conc: 2000ng/μL

Oven temp.: 200°C to 325°C @ 7°C/min.

Inj. / det. temp.: 250°C / 300°C

Det. type: MS

Ionization: EI

Carrier gas: helium

Mode: full scan

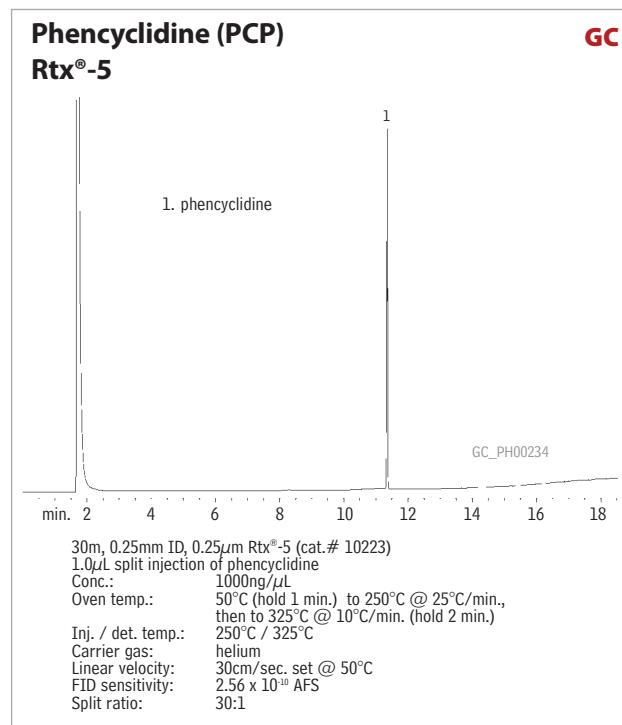
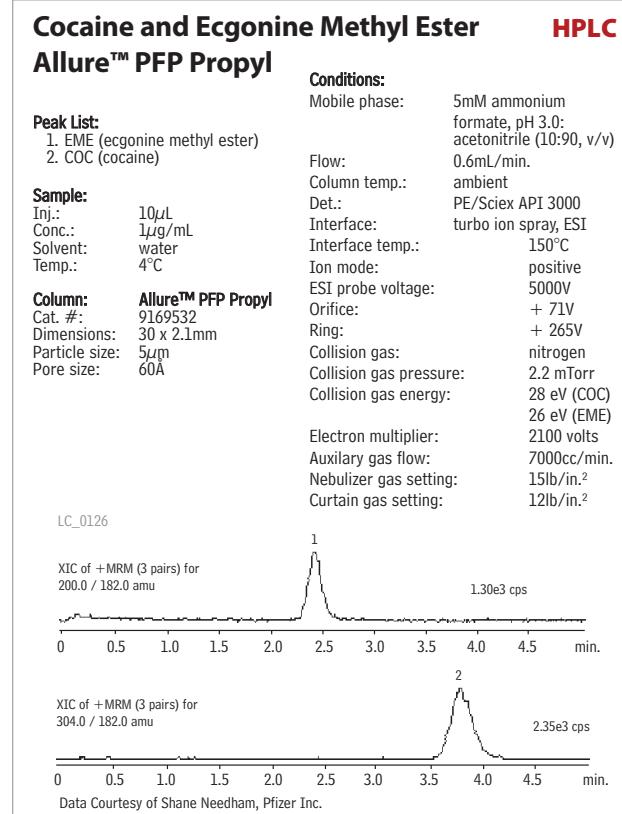
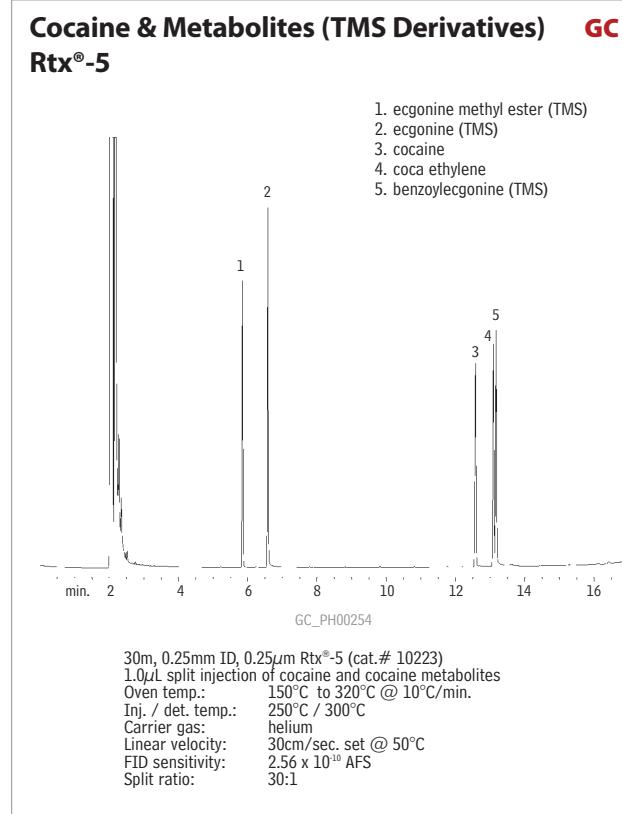
Linear velocity: 30cm/sec. set @ 200°C

Split ratio: 50:1

# Cocaine; Phencyclidine

## Cocaine

Benzoylecggonine is the major metabolite found in urine after cocaine abuse. Monitoring for benzoylecggonine is required in the testing protocol established by the Department of Health and Human Services and the National Institute on Drug Abuse. Benzoylecggonine and other cocaine metabolites should be derivatized prior to analysis. Parent cocaine and its derivatized metabolites can be analyzed together on an Rtx®-5 column with good peak shape and resolution. The analysis also can be accomplished by HPLC.



**Phencyclidine**  
Phencyclidine can be screened for using immunoassay techniques. However, prior to reporting positive results, the presence of phencyclidine should be confirmed by an alternative chemical test. Phencyclidine easily can be chromatographed on phenylmethyl stationary phases like Rtx®-5. Low picogram amounts of the drug can be detected by NPD or GC/MS.

## free literature

*HPLC Column Selection Guide*

**lit. cat.# 59454B**

*Allure™ PFP Propyl and Ultra PFP Columns Provide Improved Analyses of Basic Compounds*

**lit. cat.# 59118A**

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

# Glycols

## Ethylene Glycol

Ethylene glycol, a major component of automotive antifreeze products, is a poison to humans and animals. It can be analyzed by GC on an Rtx®-BAC1, Rtx®-BAC2, or Stabilwax® column.

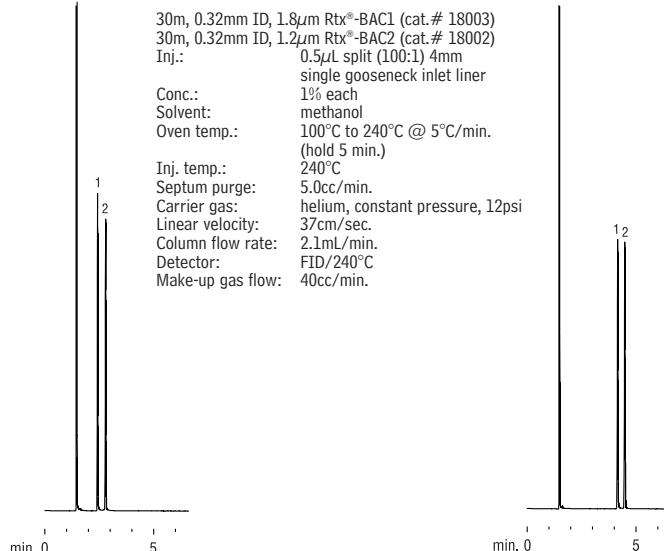
## Glycols

### Rtx®-BAC1 & Rtx®-BAC2

GC

#### Rtx®-BAC1

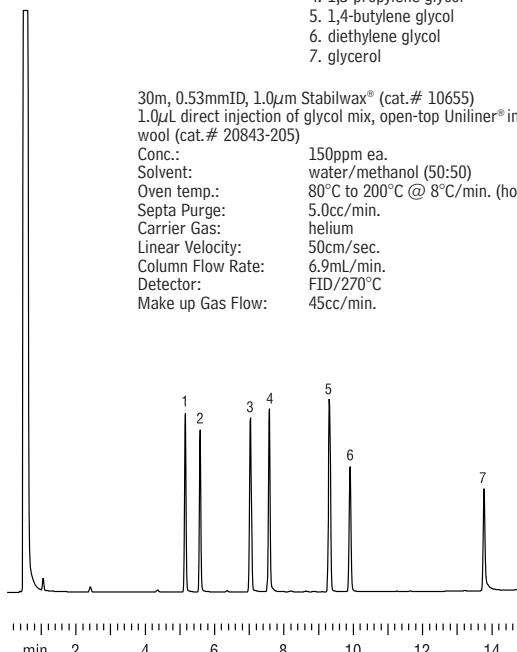
1. ethylene glycol
2. propylene glycol



GC\_EV00474

## Glycols Stabilwax®

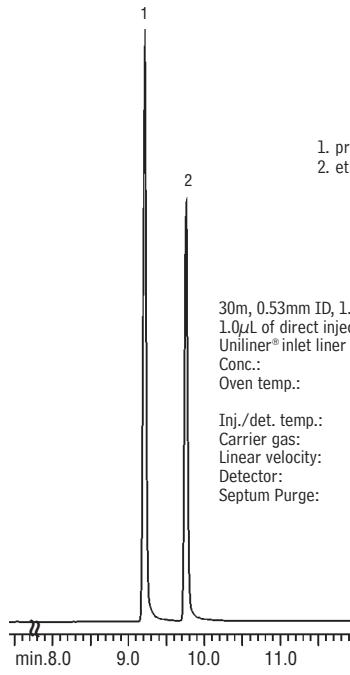
1. 1,2-propylene glycol
2. ethylene glycol
3. 1,3-butylene glycol
4. 1,3-propylene glycol
5. 1,4-butylene glycol
6. diethylene glycol
7. glycerol



GC\_EV00476

## Glycols Stabilwax®

1. propylene glycol
2. ethylene glycol



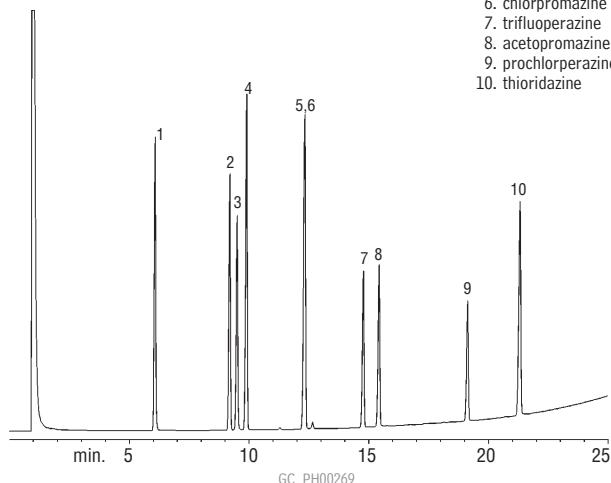
GC\_EV00546

# Phenothiazines; Sympathomimetic Amines

## Phenothiazines (Underivatized)

Rtx®-5

GC



15m, 0.32mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10236)  
1.0 $\mu$ L split injection of phenothiazines  
Conc.: 2000ng/ $\mu$ L

Oven temp.: 200°C to 325°C @ 5°C/min.  
Inj. / det. temp.: 250°C / 315°C  
Carrier gas: helium  
Linear velocity: 25cm/sec. set @ 200°C  
FID sensitivity: 2.56 x 10<sup>10</sup> AFS  
Split ratio: 30:1

## Phenothiazines

Phenothiazines are high molecular weight compounds based on a three ring structure. When analyzing phenothiazines by gas chromatography, retention times are typically long with elution temperatures at or near the maximum operating temperature of the column. Using shorter columns will help to reduce the effective elution temperature and overall analysis time.

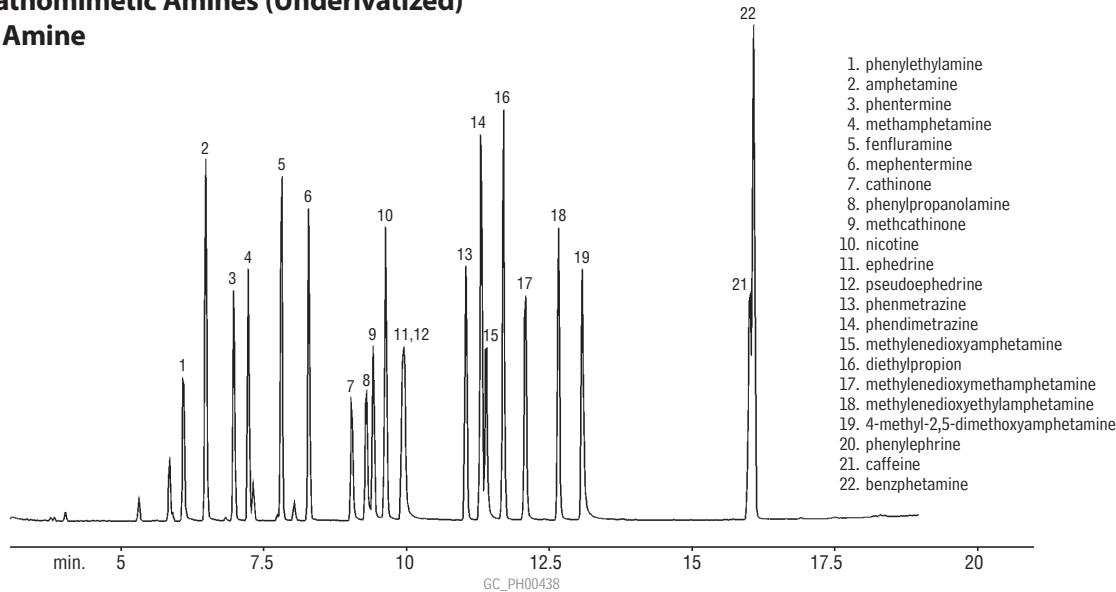
## Sympathomimetic Amines

Sympathomimetic amine drugs include both controlled and non-controlled substances based on phenylethylamine, with various functional groups substituted at key positions on the molecule. Active hydrogens on the amine portion of the molecule necessitate derivatization to improve peak shape and response. Acylating reagents have been used to produce less polar and less reactive compounds that chromatograph well on low polarity stationary phases like Rtx®-5. A carefully chosen derivatizing reagent can produce differences in relative retention time for specific compounds and help to resolve coelutions. Identification by GC/MS can be improved by using a reagent that produces unique high mass ion fragments. Deactivated vials, glassware and inlet liners should be used to maintain consistent recovery during sample preparation and analysis.

## Sympathomimetic Amines (Underivatized)

Rtx®-5 Amine

GC



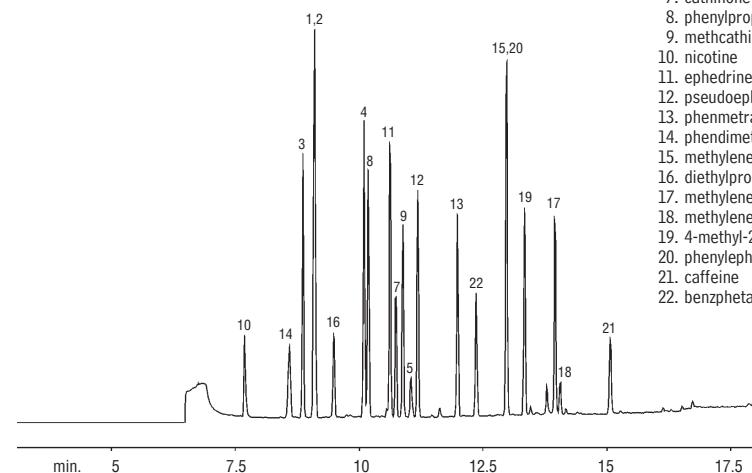
30m, 0.25mm ID, 0.50 $\mu$ m Rtx®-5 Amine (cat.# 12338)  
split mode, split vent flow rate 45mL/min.  
Oven temp.: 100°C to 310°C @ 10°C/min.

Varian 3400 GC coupled with Varian Saturn 2000 MS detector  
Mass spectroscopy data collected using a scan range of 40 amu through 600 amu.  
Ionization performed in the EI Auto mode.

# Sympathomimetic Amines

## Sympathomimetic Amines (Derivatized) Rtx®-200

GC



1. phenylethylamine
2. amphetamine
3. phentermine
4. methamphetamine
5. fenfluramine
6. mephentermine
7. cathinone
8. phenylpropanolamine
9. methcathinone
10. nicotine
11. ephedrine
12. pseudoephedrine
13. phenmetrazine
14. phendimetrazine
15. methylenedioxymethamphetamine
16. diethylpropion
17. methylenedioxymethamphetamine
18. methylenedioxymethylamphetamine
19. 4-methyl-2,5-dimethoxyamphetamine
20. phenylephrine
21. caffeine
22. benzphetamine

GC\_PH00439

30m, 0.25mm ID, 0.50 $\mu$ m Rtx®-200 (cat.# 15038)  
split mode, split vent flow rate 45mL/min.  
Oven temp.: 100°C to 310°C @ 10°C/min.

Varian 3400 GC coupled with Varian Saturn 2000 MS detector  
Mass spectroscopy data collected using a scan range of 40 amu through 600 amu.  
Ionization performed in the EI Auto mode.

### free literature

*High Performance Silica Products*

**lit. cat.# 59901**

*Operating Hints for Using Split/Splitless Injectors*

**lit. cat.# 59880A**

*Improved GC Analysis of Basic Organic Compounds Using Base Deactivated Columns & Liners.*

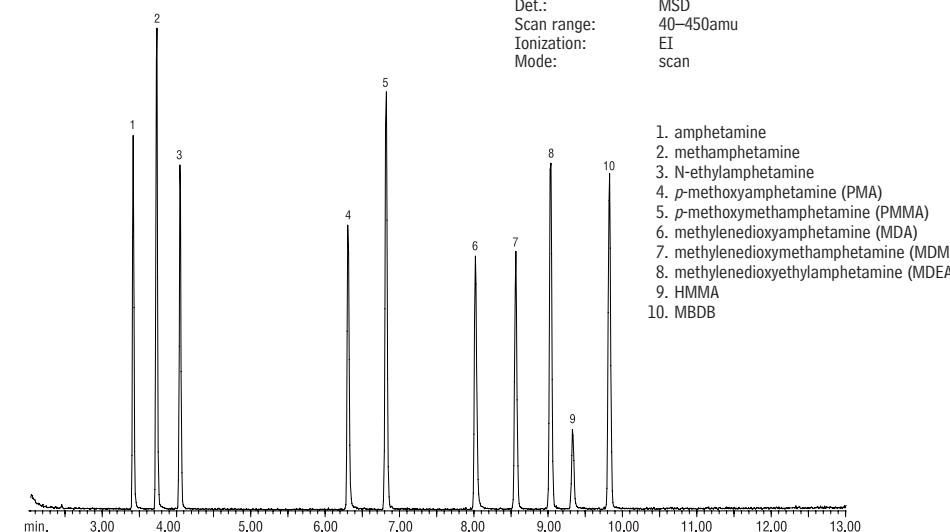
**lit. cat.# 59108**

*Genuine Restek Replacement Parts for Agilent GCs*

**lit. cat.# 59627E**

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

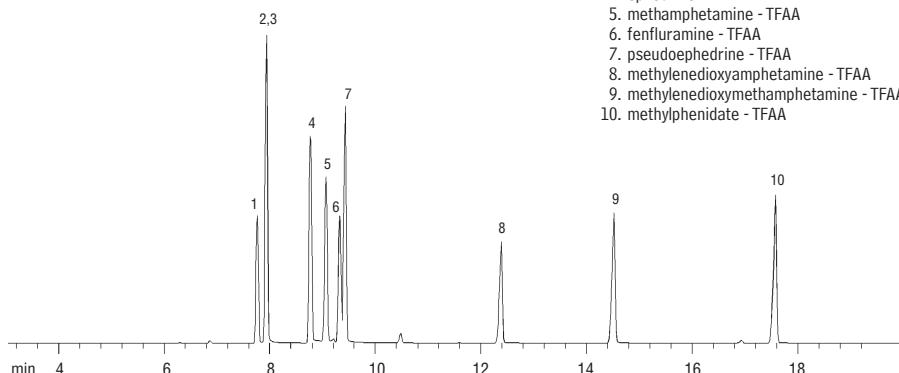
## Sympathomimetic Amines (Underivatized) Rtx®-35 Amine



Rtx®-35 Amine 30m, 0.25mm ID, 0.50 $\mu$ m (cat.# 11338)  
1.0 $\mu$ L split injection of underivatized sympathomimetic amines  
Conc. 100ng/ $\mu$ L  
Inj. temp: 250°C  
Carrier gas: helium  
Linear velocity: 30cm/sec.  
Oven temp.: 150°C to 240°C @ 7°C/min.  
Det.: MSD  
Scan range: 40–450amu  
Ionization: EI  
Mode: scan

1. amphetamine
2. methamphetamine
3. N-ethylamphetamine
4. p-methoxyamphetamine (PMA)
5. p-methoxymethamphetamine (PMMA)
6. methylenedioxymethamphetamine (MDA)
7. methylenedioxymethamphetamine (MDMA)
8. methylenedioxymethylamphetamine (MDEA)
9. HMMA
10. MBDB

GC\_PH00574

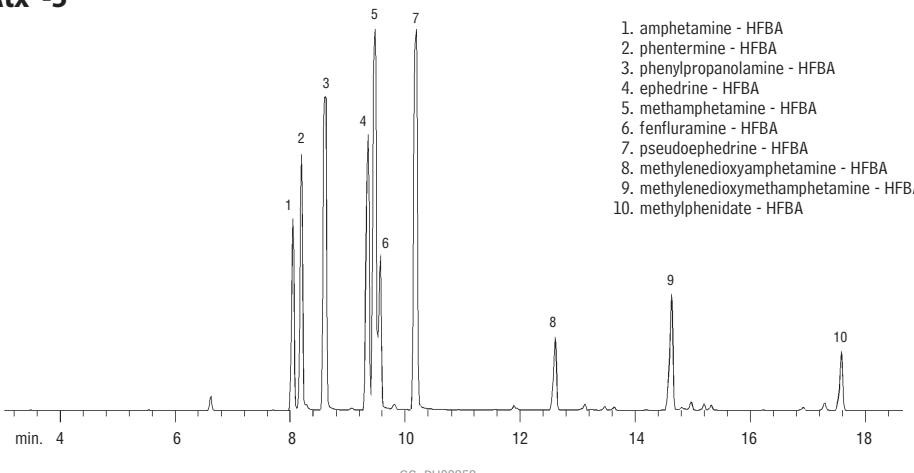
**Sympathomimetic Amines (TFAA Derivatives)****Rtx®-5****GC**

GC\_PH00251

30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-5 (cat.# 10223)  
 1.0 $\mu$ L splitless injection of derivatized sympathomimetic amines  
 Conc.: approximately 2.5ng/ $\mu$ L  
 Oven temp.: 40°C (hold 1 min.) to 150°C @ 30°C/min.,  
 to 300°C @ 5°C/min.  
 Inj. temp.: 225°C  
 Interface temp.: 275°C  
 Det.: MSD  
 Ionization: EI  
 Carrier gas: helium  
 Linear velocity: 20cm/sec. set @ 100°C  
 Splitless hold time: 1 min.

**free literature***GC Column Installation***lit. cat.# 59668A***USP Column Cross-Reference Chart***lit. cat.# 59253**

Call Restek at 800-356-1688 or  
 814-353-1300, ext. 5, or contact  
 your Restek representative,  
 to request your free copy!

**Sympathomimetic Amines (HFBA Derivatives)****Rtx®-5**

1. amphetamine - HFBA  
 2. phentermine - HFBA  
 3. phenylpropanolamine - HFBA  
 4. ephedrine - HFBA  
 5. methamphetamine - HFBA  
 6. fenfluramine - HFBA  
 7. pseudoephedrine - HFBA  
 8. methylenedioxymethamphetamine - HFBA  
 9. methylenedioxymethamphetamine - HFBA  
 10. methylphenidate - HFBA

30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-5 (cat.# 10223)  
 1.0 $\mu$ L splitless injection of sympathomimetic amines  
 Conc.: approximately 2.5ng/ $\mu$ L  
 Oven temp.: 40°C (hold 1 min.) to 150°C @ 30°C/min.,  
 to 300°C @ 5°C/min.  
 Inj. temp.: 225°C  
 Interface temp.: 275°C  
 Det.: MSD  
 Ionization: EI  
 Carrier gas: helium  
 Linear velocity: 20cm/sec. set @ 100°C  
 Splitless hold time: 1 min.

# Analgesic Formulations

## Analgesics

Popular components for multi-active analgesic formulations include aspirin, salicylic acid, salicylamide, acetaminophen, ibuprofen, naproxen, guaifenesin, codeine, oxycodone, hydrocodone, and caffeine. Many of these compounds can be analyzed simultaneously using high performance liquid chromatography (HPLC), thereby improving laboratory efficiency and productivity. With the selection of the proper LC phase, separation becomes a simple and manageable task that does not rely upon extensive preparation procedures or use of ion pairing agents, which often are described in pharmaceutical compenda.

Ultra C18, Ultra Phenyl, and Allure™ Basix HPLC column phases separate mixtures of these pharmaceuticals in a productive and cost effective manner. The selective chemistries of these phases provide powerful separation mechanisms.

## free literature

### *Improved HPLC Analysis of Analgesics*

lit. cat.# 59511A

Genuine Restek Replacement Parts for HPLC Systems

lit. cat.# 59012A

HPLC Tech Tips Wall Chart

lit. cat.# 59894A

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

## Acetaminophen and Narcotic Analgesics Allure™ Basix

HPLC

### Peak List:

1. acetaminophen
2. codeine
3. oxycodone
4. hydrocodone

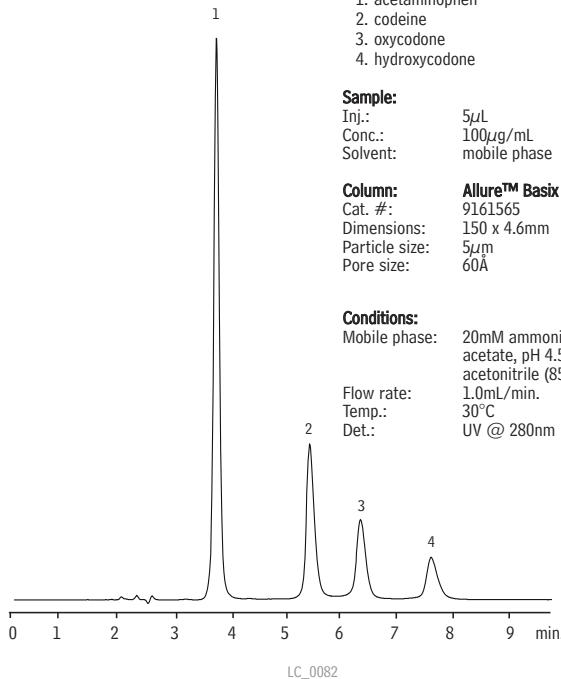
### Sample:

Inj.: 5 $\mu$ L  
Conc.: 100 $\mu$ g/mL  
Solvent: mobile phase

Column: Allure™ Basix  
Cat. #: 9161565  
Dimensions: 150 x 4.6mm  
Particle size: 5 $\mu$ m  
Pore size: 60 $\text{\AA}$

### Conditions:

Mobile phase: 20mM ammonium acetate, pH 4.5:  
acetonitrile (85:15, v/v)  
1.0mL/min.  
Temp.: 30°C  
Det.: UV @ 280nm



## Acetaminophen and Narcotic Analgesics Ultra C18

HPLC

Peak List:	Conc. ( $\mu$ g/mL)	Ret. Time (min.)	Tailing	Resolution
U. unknown	unknown	3.1	NA	NA
1. morphine sulfate	204	3.3	1.0	1.8
2. acetaminophen	92	5.0	1.1	14.1
3. codeine phosphate	216	5.5	1.4	2.6
4. oxycodone HCl	206	7.5	1.4	8.5
5. hydrocodone bitartrate	218	8.9	1.4	5.0

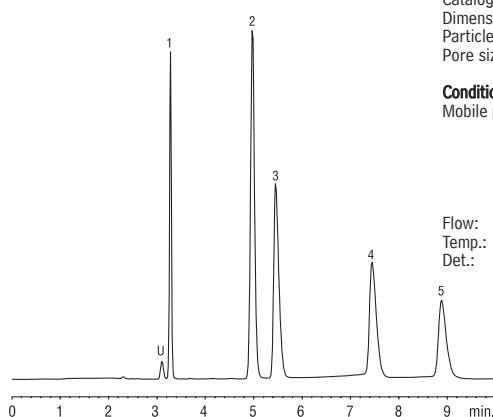
### Sample:

Inj.: 4.0 $\mu$ L  
Sample: raw material mix  
Solvent: mobile phase

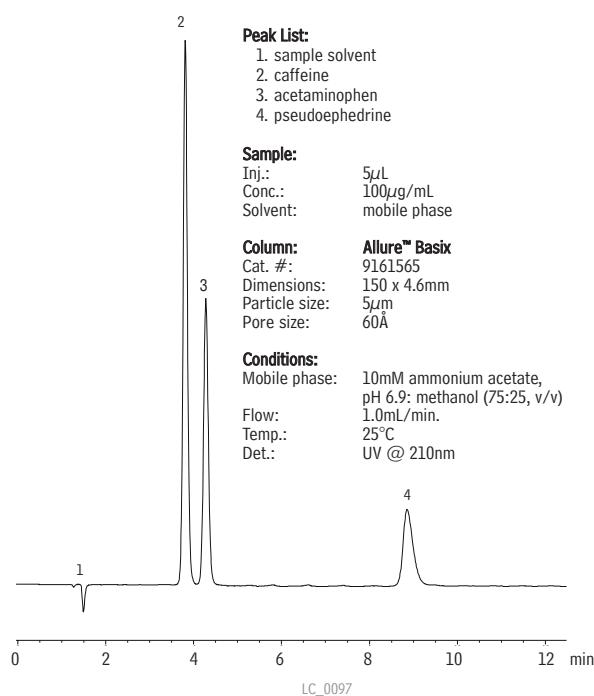
Column: Ultra C18  
Catalog #: 9174575  
Dimensions: 250 x 4.6mm  
Particle size: 5 $\mu$ m  
Pore size: 100 $\text{\AA}$

### Conditions:

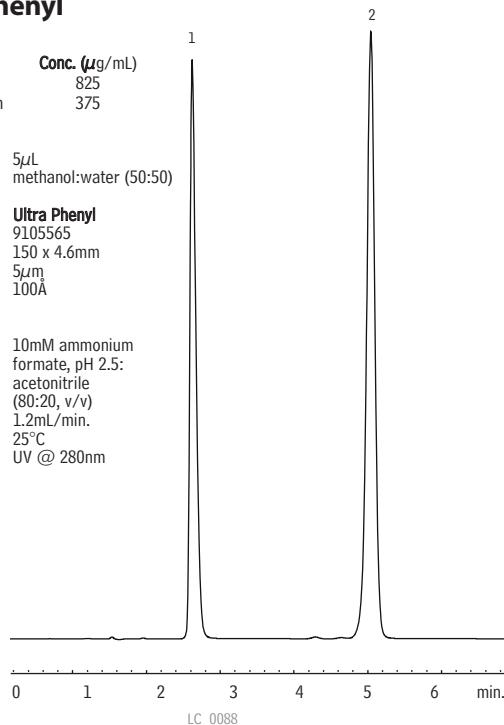
Mobile phase: A: 10mM potassium phosphate, pH 2.8  
B: acetonitrile: methanol (90:10 v/v) (85A:15B, v/v)  
1.0mL/min.  
27°C  
Det.: UV @ 235nm



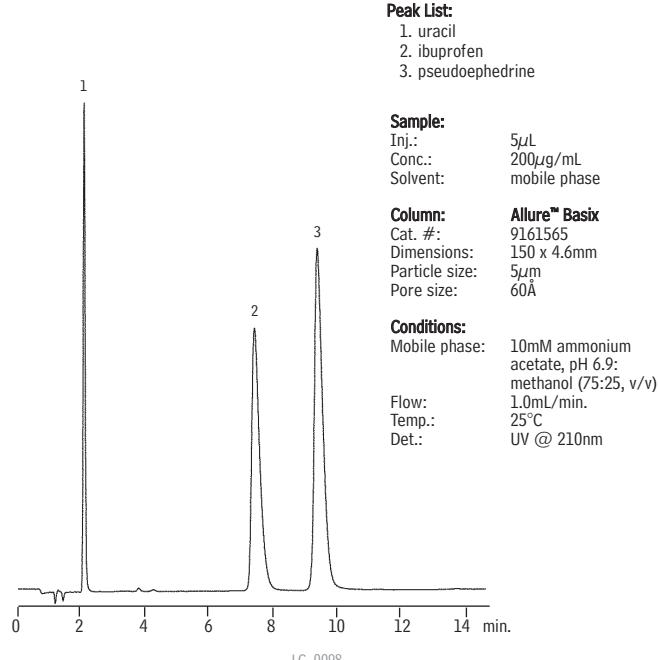
**Acetaminophen (Analgesic), Pseudoephedrine (Decongestant), and Caffeine (Stimulant)**  
Allure™ Basix



**Guaifenesin (Expectorant/Antitussive) and HPLC Codeine (Narcotic Analgesic) Ultra Phenyl**



**Ibuprofen (Analgesic) and Pseudoephedrine (Decongestant)**  
Allure™ Basix



**HPLC**

**free literature**

*HPLC Columns & Accessories (catalog)*

**lit. cat.# 59241B**

*Analysis of Narcotics & Narcotic/Acetaminophen Admixtures:  
What to do When Compendium Methods Don't Work*

**lit. cat.# 59453**

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

# Antidepressants (Tricyclic)

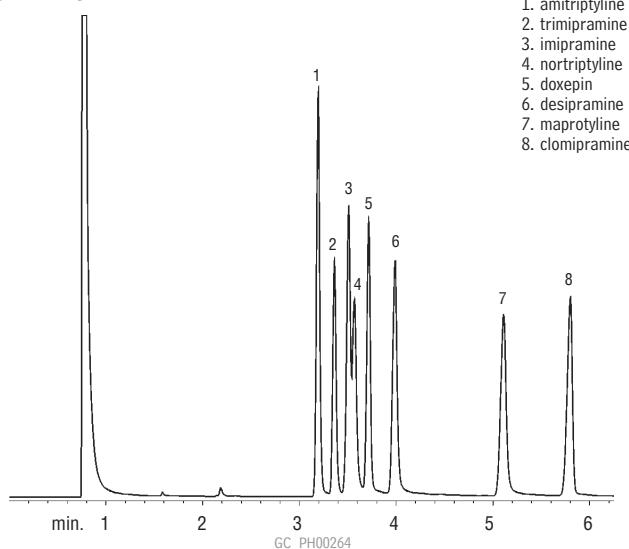
## Tricyclic Antidepressants

Antidepressants are similar to phenothiazines in structure except that the center ring is seven membered instead of six, and does not contain sulfur. Short GC columns operated at elevated temperatures produce the best separations in the shortest time. Rtx®-1701 columns provide a unique selectivity for the antidepressants, performing the separation isothermally in less than six minutes.

Tricyclic antidepressants also are rapidly separated on an HPLC column specially developed for basic compounds: Allure™ Basix.

## Antidepressants (Basic Drugs)

### Rtx®-1701



GC

1. amitriptyline
2. trimipramine
3. imipramine
4. nortriptyline
5. doxepin
6. desipramine
7. maprotiline
8. clomipramine

15m, 0.25mm ID, 0.25µm Rtx®-1701 (cat.# 12020)

1.0µL split injection of antidepressants

Conc.: 25ng/component

Oven temp.: 225°C

Inj. / det. temp.: 250°C / 260°C

Carrier gas: helium

Linear velocity: 30cm/sec. set @ 225°C

FID sensitivity: 2.56 x 10<sup>10</sup> AFS

Split ratio: 40:1

## Antidepressants (Basic Drugs)

### Allure™ Basix

**Peak List:**

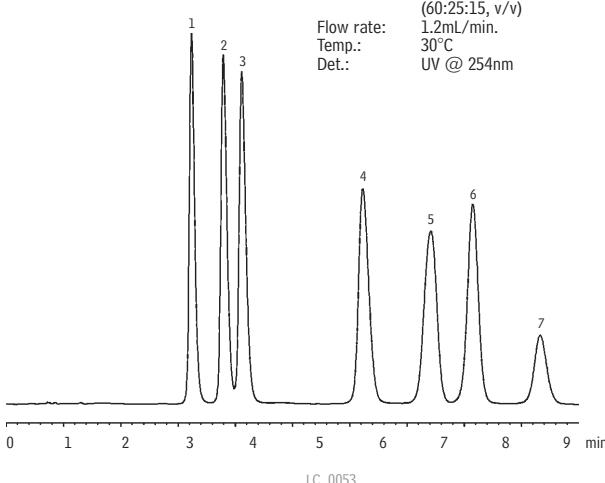
1. doxepin
2. nortriptyline
3. amitriptyline
4. imipramine
5. desipramine
6. nortriptyline
7. protriptyline

**Sample:**

Inj.: 10µL  
Conc.: 100µg/mL each  
Solvent: mobile phase

**Column:** Allure™ Basix  
Cat. #: 9161565  
Dimensions: 150 x 4.6mm  
Particle size: 5µm  
Pore size: 60Å

**Conditions:**  
Mobile phase: acetonitrile:  
50mM KH<sub>2</sub>PO<sub>4</sub>  
pH3:methanol  
(60:25:15, v/v)  
Flow rate: 1.2mL/min.  
Temp.: 30°C  
Det.: UV @ 254nm


**HPLC**

## Antidepressants (Basic Drugs)

### Allure™ Basix (LC/MS)

**Peak List:**

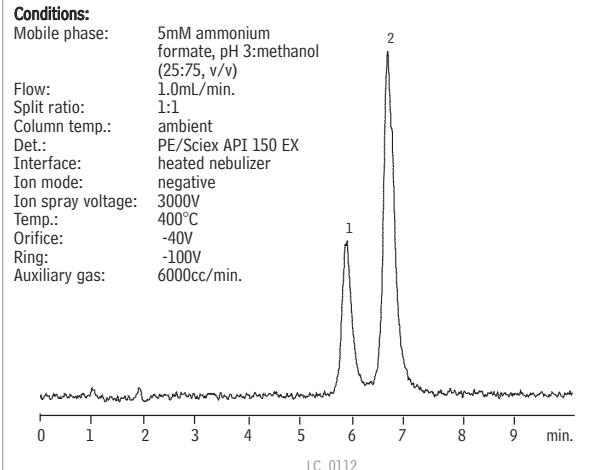
1. desipramine
2. trimipramine

**Sample:**

Inj.: 10µL  
Conc.: 10µg/mL  
Solvent: water:methanol (1:1, v/v)

**Column:** Allure™ Basix  
Cat. #: 9161565  
Dimensions: 150 x 4.6mm  
Particle size: 5µm  
Pore size: 60Å

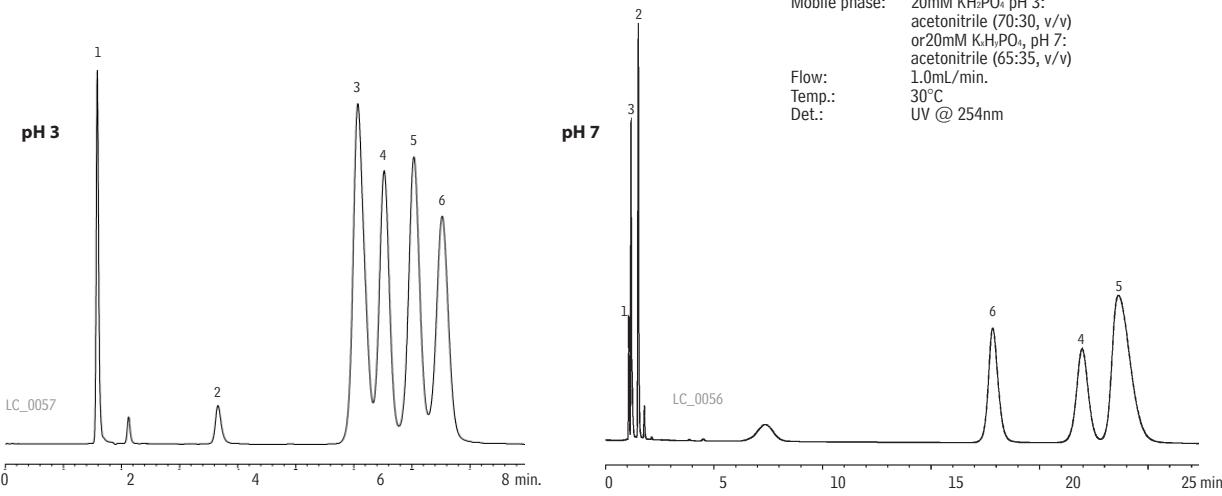
**Conditions:**  
Mobile phase: 5mM ammonium formate, pH 3:methanol (25:75, v/v)  
Flow: 1.0mL/min.  
Split ratio: 1:1  
Column temp.: ambient  
Det.: PE/Sciex API 150 EX  
Interface: heated nebulizer  
Ion mode: negative  
Ion spray voltage: 3000V  
Temp.: 400°C  
Orifice: -40V  
Ring: -100V  
Auxiliary gas: 6000cc/min.


**HPLC**

## Antidepressants Ultra IBD

**HPLC**

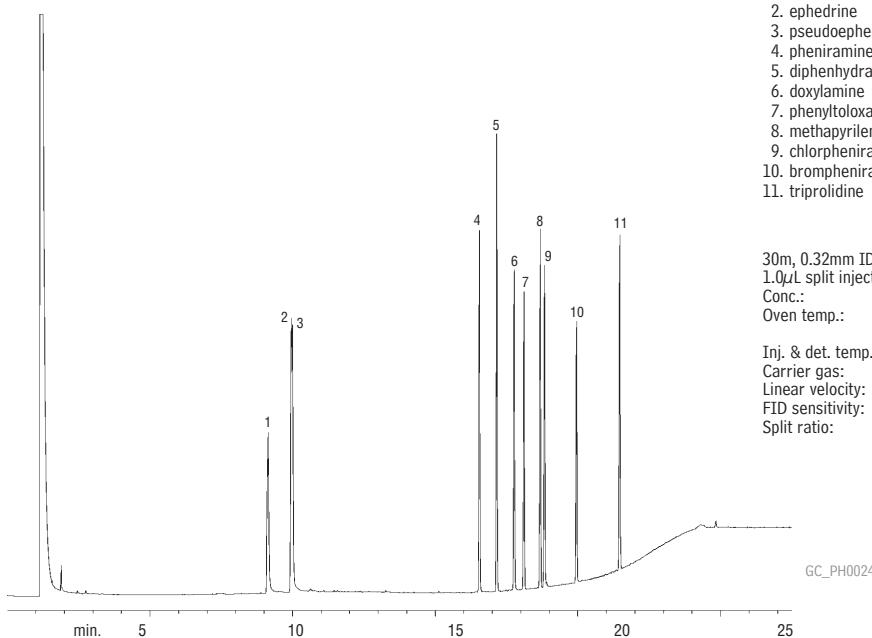
Peak List:	Conc. ( $\mu\text{g/mL}$ )
1. uracil	5
2. maleate	5
3. benzoic acid	50
4. nortriptyline	50
5. amitriptyline	50
6. trimipramine	50



## Anthistamines

Antihistamines and decongestants are common ingredients in over-the-counter cold medications. Many include amine functional groups and are classified as basic compounds. Our Rtx®-5 Amine column is specially designed for basic compounds: antihistamines and other compounds that tail or are adsorbed on poorly deactivated columns exhibit excellent peak shape and better response on an Rtx®-5 Amine column.

## Antihistamines (Underivatized) Rtx®-5 Amine

**GC**


30m, 0.32mm ID, 1.0 $\mu\text{m}$  Rtx®-5 Amine (cat.# 12354)  
1.0 $\mu\text{L}$  split injection of antihistamines.  
Conc.: 1000ng/ $\mu\text{L}$   
Oven temp.: 130°C (hold 5 min.) to 305°C  
(@ 10°C/min. hold 5 min.)  
Inj. & det. temp.: 305°C  
Carrier gas: hydrogen  
Linear velocity: 43cm/sec. set @ 130°C  
FID sensitivity: 6.4 x 10<sup>-11</sup> AFS  
Split ratio: 50:1

# Antiepileptics

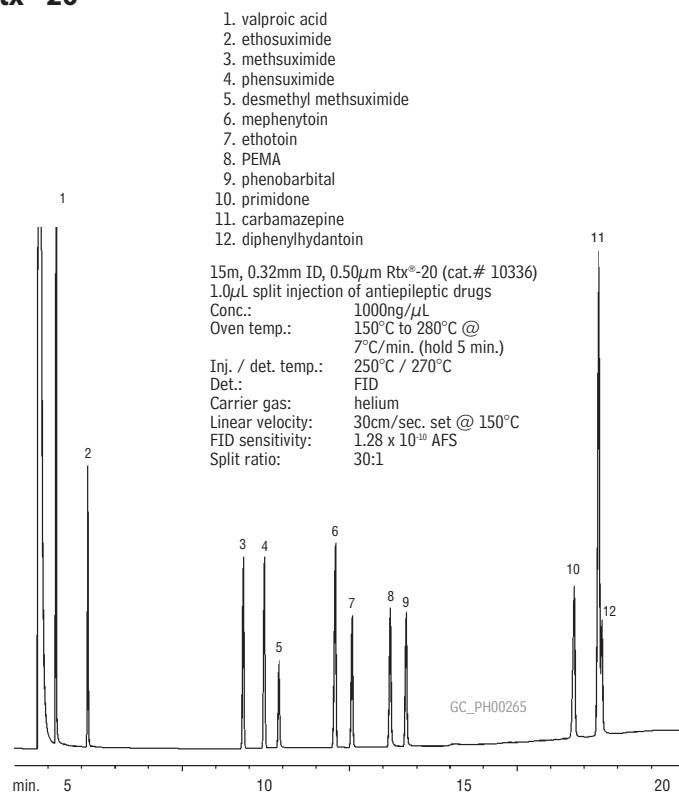
## Antiepileptics

Laboratories that perform therapeutic drug monitoring tests analyze antiepileptic (anti-convulsant) drugs using either GC or HPLC because immunoassays do not exhibit linearity and show cross reactivities in the toxic range. Common antiepileptics are resolved using an Rtx®-20 or Rtx®-1701 GC column.

## Antiepileptics (Underivatized)

### Rtx®-20

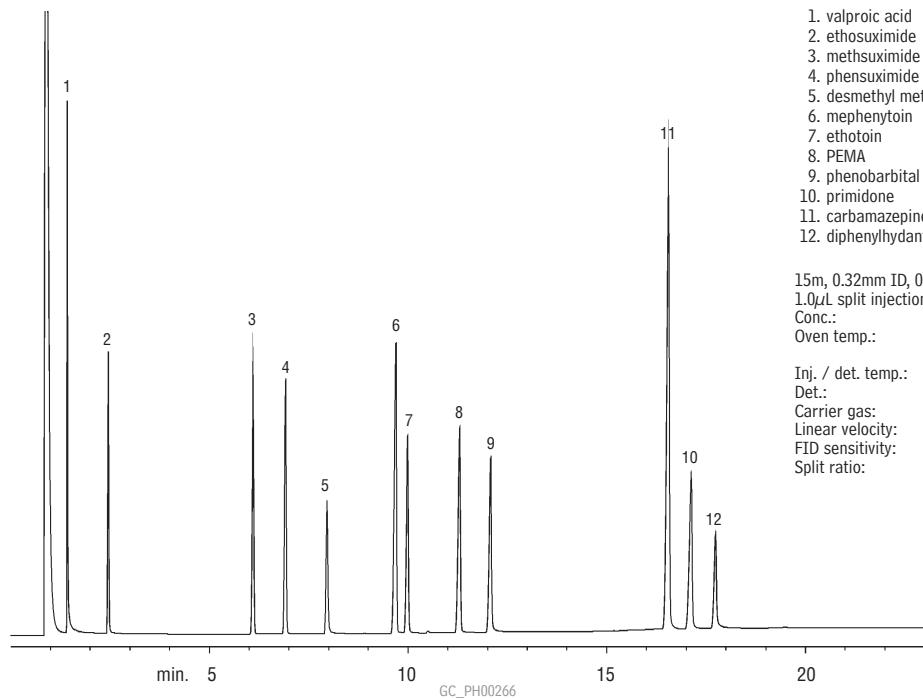
GC



## Antiepileptics (Underivatized)

### Rtx®-1701

GC



### Atenolol (Antiarrhythmic) Allure™ Basix

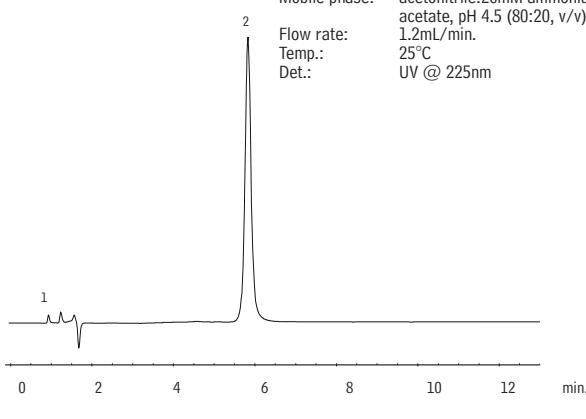
HPLC

**Peak List:**

- uracil (marker)
- atenolol

**Sample:**

Inj.: 1 $\mu$ L  
 Conc.: 1mg/mL  
 Solvent: water:methanol (7:3, v/v)

**Column:**  
 Cat. #: 9161565  
 Dimensions: 150 x 4.6mm  
 Particle size: 5 $\mu$ m  
 Pore size: 60 $\text{\AA}$ 
**Conditions:**  
 Mobile phase: acetonitrile:20mM ammonium acetate, pH 4.5 (80:20, v/v)  
 Flow rate: 1.2mL/min.  
 Temp.: 25°C  
 Det.: UV @ 225nm


### Triamterene and Hydrochlorothiazide (Antiarrhythmics) Allure™ Basix

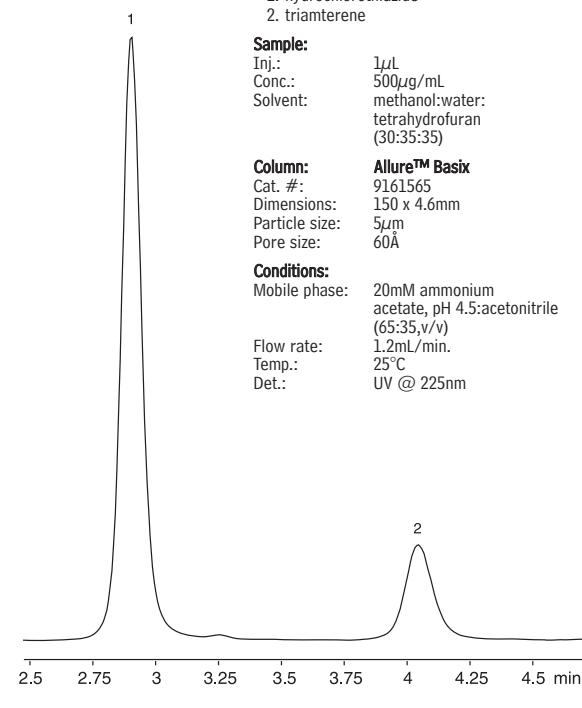
HPLC

**Peak List:**

- hydrochlorothiazide
- triaterene

**Sample:**

Inj.: 1 $\mu$ L  
 Conc.: 500 $\mu$ g/mL  
 Solvent: methanol:water: tetrahydrofuran (30:35:35)

**Column:**  
 Cat. #: 9161565  
 Dimensions: 150 x 4.6mm  
 Particle size: 5 $\mu$ m  
 Pore size: 60 $\text{\AA}$ 
**Conditions:**  
 Mobile phase: 20mM ammonium acetate, pH 4.5:acetonitrile (65:35, v/v)  
 Flow rate: 1.2mL/min.  
 Temp.: 25°C  
 Det.: UV @ 225nm


### Calcium Channel Blockers (Antiarrhythmics) Ultra Cyano

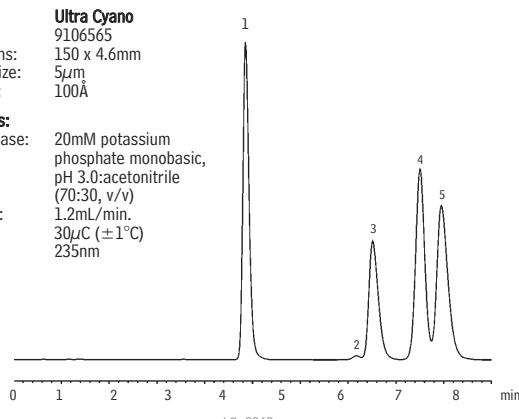
HPLC

**Peak List:**

- diltiazem
- nifedipine impurity
- verapamil
- nifedipine
- nicardipine

**Sample:**

Inj.: 5 $\mu$ L  
 Conc.: 100mg/mL  
 Solvent: acetonitrile:water (1:1)

**Column:**  
 Cat. #: 9106565  
 Dimensions: 150 x 4.6mm  
 Particle size: 5 $\mu$ m  
 Pore size: 100 $\text{\AA}$ 
**Conditions:**  
 Mobile phase: 20mM potassium phosphate monobasic, pH 3.0:acetonitrile (70:30, v/v)  
 Flow rate: 1.2mL/min.  
 Temp.: 30°C ( $\pm 1^\circ$ C)  
 Det.: 235nm


### Digitalis Extracts/Derivatives Ultra PFP Propyl Cartridge Column (Fast LC)

HPLC

**Peak List:** Conc. Ret. Time (min.)

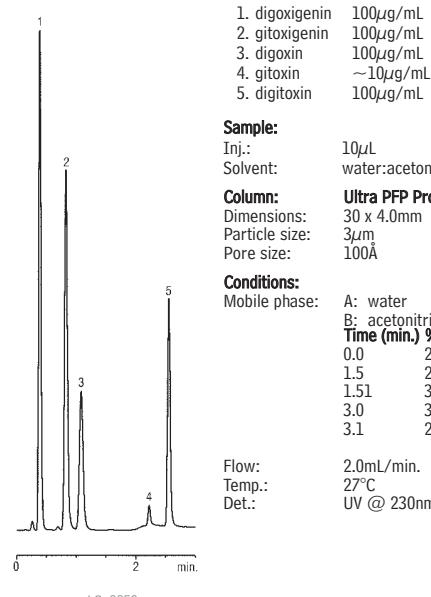
	Conc.	Ret. Time (min.)
1. digoxigenin	100 $\mu$ g/mL	0.40
2. gitoxigenin	100 $\mu$ g/mL	0.80
3. digitoxin	100 $\mu$ g/mL	1.10
4. gitoxin	$\sim$ 10 $\mu$ g/mL	2.20
5. digitoxin	100 $\mu$ g/mL	2.60

**Sample:**

Inj.: 10 $\mu$ L  
 Solvent: water:acetonitrile (80:20 v/v)

**Column:**  
 Dimensions: 30 x 4.0mm  
 Particle size: 3 $\mu$ m  
 Pore size: 100 $\text{\AA}$ 
**Conditions:**  
 Mobile phase: A: water  
 B: acetonitrile  
 Time (min.) %B  

0.0	20
1.5	20
1.51	35
3.0	35
3.1	20



# Cardiac Medications; CNS Depressants (Sedatives)

## Cardiac Medications

Several classes of medications are used to decrease high blood pressure, control arrhythmias (abnormal heart rhythms), and treat congestive heart failure. These medications include beta antagonists, ACE inhibitors, diuretics, and calcium channel blockers. HPLC is the preferred technique for analyzing many of these compounds. Selecting the appropriate analytical column is critical, because many of the basic compounds tail badly on poorly deactivated HPLC phases. Restek's fully end-capped Allure™ Basix, Allure™ PFP Propyl, Ultra PFP, and Ultra Cyano phases can use the basic nature of these compounds to achieve separation without peak tailing.

## free literature

*Analyzing Cardiac Medications by HPLC*

lit. cat.# 59151

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

## Metoprolol (Antiarrhythmic)

### Allure™ Basix

HPLC

#### Peak List:

1. unknown
2. metoprolol

#### Sample:

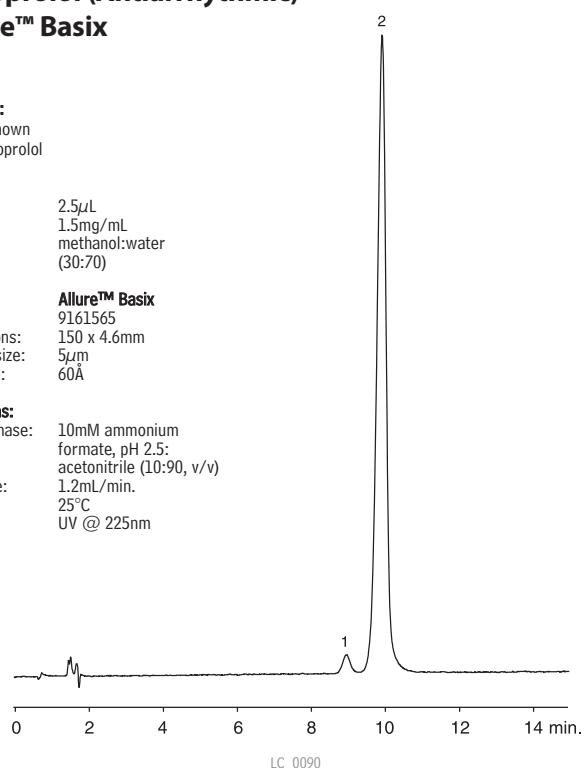
Inj.: 2.5 $\mu$ L  
Conc.: 1.5mg/mL  
Solvent: methanol:water (30:70)

#### Column:

Allure™ Basix  
Cat. #: 9161565  
Dimensions: 150 x 4.6mm  
Particle size: 5 $\mu$ m  
Pore size: 60 $\text{\AA}$

#### Conditions:

Mobile phase: 10mM ammonium formate, pH 2.5;  
acetonitrile (10:90, v/v)  
Flow rate: 1.2mL/min.  
Temp.: 25°C  
Det.: UV @ 225nm



## Sedatives

Sedatives are CNS (central nervous system) depressants. They have been identified as contributors in impaired driving cases, and have been used in greyhound racing and horseracing to decrease an animal's speed. CNS depressants can be analyzed by HPLC on an Allure™ Basix column.

## free literature

*HPLC Analysis of Basic Pharmaceutical Compounds on an Ultra Cyano Phase*

lit. cat.# 59545

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

## Alprazolam and Lorazepam (Sedatives)

### Allure™ Basix

HPLC

#### Peak List:

1. toluene (marker)
2. lorazepam
3. alprazolam

#### Sample:

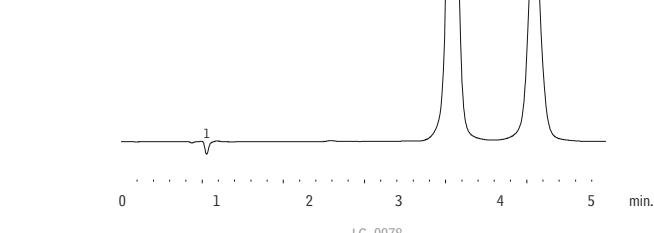
Inj.: 10 $\mu$ L  
Conc.: 500 $\mu$ g/mL  
Solvent: water:acetonitrile (7:3, v/v)

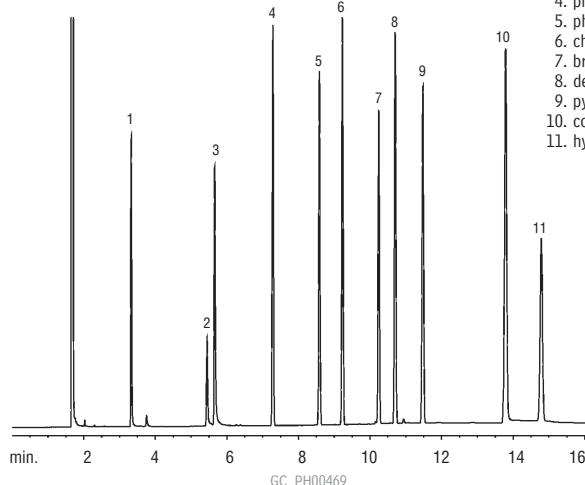
#### Column:

Allure™ Basix  
Cat. #: 9161565  
Dimensions: 150 x 4.6mm  
Particle size: 5 $\mu$ m  
Pore size: 60 $\text{\AA}$

#### Conditions:

Mobile phase: 10mM ammonium formate, pH 3.0:acetonitrile (70:30, v/v)  
Flow rate: 2.0mL/min.  
Temp.: 25°C  
Det.: UV @ 230nm



**Cold Medications (Underivatized)****Rtx®-5 Amine****GC**

1. phenylpropanolamine
2. phenylephrine
3. guaifenesin
4. pheniramine
5. phenyltoloxamine
6. chlorpheniramine
7. brompheniramine
8. dextromethorphan
9. pyrilamine
10. codeine
11. hydrocodone

**Cold & Sinus Medications**

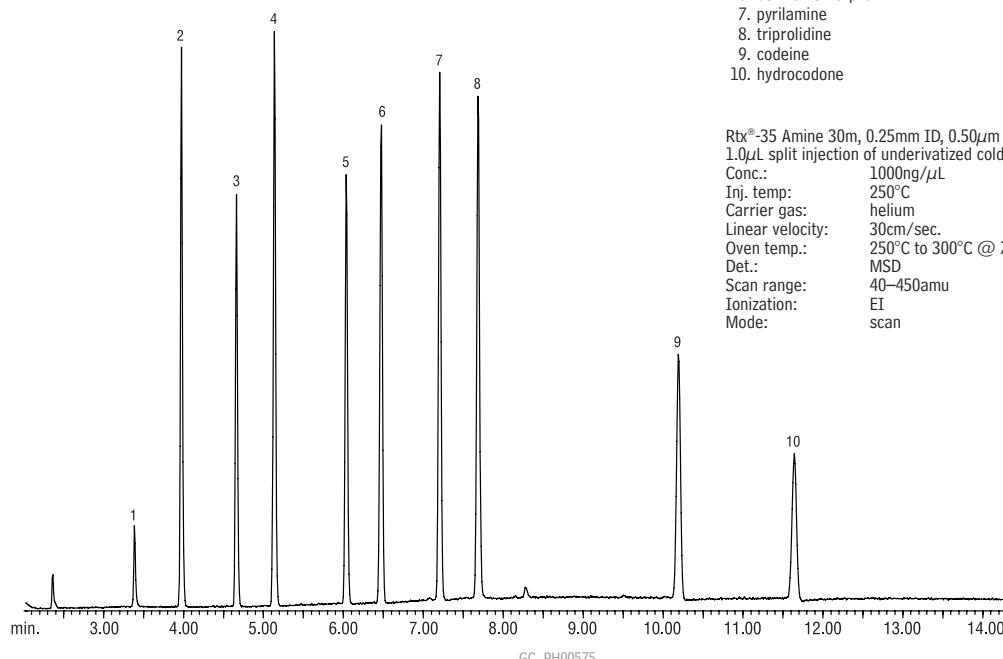
Cold and sinus medications can be analyzed for phenylpropanolamine using a simple extraction procedure followed by GC analysis. An Rtx®-5 Amine or Rtx®-35 Amine column provides excellent resolution of all the compounds commonly found in most cold medications. Phenylpropanolamine is separated easily from the other compounds. All target analytes exhibit good peak shape, even when in the free base form. Additionally, the analysis is complete in less than 15 minutes, which allows quick turn-around of multiple samples.

**free literature**

*GC Analysis of Phenylpropanolamine in Cold Medications, Using an Rtx®-5Amine Column*

lit. cat.# 59339

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

**Cold Medications (Underivatized)****Rtx®-35 Amine****GC**

1. guaifenesin
2. pheniramine
3. phenyltoloxamine
4. chlorpheniramine
5. brompheniramine
6. dextromethorphan
7. pyrilamine
8. triprolidine
9. codeine
10. hydrocodone

Rtx®-35 Amine 30m, 0.25mm ID, 0.50μm (cat.# 11338)  
1.0μL split injection of underivatized cold medicines  
Conc.: 1000ng/μL  
Inj. temp: 250°C  
Carrier gas: helium  
Linear velocity: 30cm/sec.  
Oven temp.: 250°C to 300°C @ 7°C/min. (hold 7 min.)  
Det.: MSD  
Scan range: 40–450amu  
Ionization: EI  
Mode: scan

# Steroids

## Steroids

Anabolic steroids can be analyzed as TMS-derivatized or as underivatized compounds. In either case, this analysis is usually done at high temperature by GC. Analysis time can be reduced through the use of thin film GC columns. Lower polarity GC columns will help to reduce the effective elution temperature. Rtx®-5 columns provide sufficient selectivity to resolve many anabolic steroids, and have the stability necessary to withstand the high temperatures needed.

Allure™ Biphenyl columns are an excellent choice for steroid analyses. Through  $\pi$ - $\pi$  interactions with double bonds in the steroid ring structure, the biphenyl stationary phase greatly improves selectivity, relative to alkyl phases (e.g., C18). For example analyses, request the free Applications Note listed below.

Steroids also can be analyzed by HPLC on an octadecylsilyl (C18) stationary phase. Specially developed for HPLC/MS. Allure™ C18 columns increase the sensitivity of the analysis by allowing higher concentrations of organic content in the mobile phase.

## free literature

*Improved HPLC Analysis of Steroids, Using Restek's Unique Allure™ Biphenyl Column*

lit. cat.# 580020

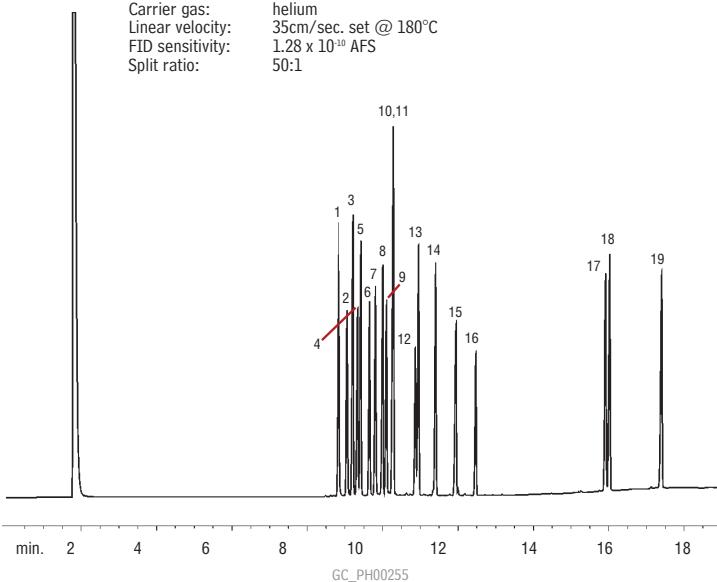
Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

## Steroids, Anabolic (Underivatized)

### Rtx®-5

GC

30m, 0.25mm ID, 0.10 $\mu$ m Rtx®-5 (cat.# 10208)  
0.5 $\mu$ L split injection of anabolic steroids  
Conc.: 1000ng/ $\mu$ L  
Oven temp.: 180°C to 340°C @ 10°C/min. (hold 3 min.)  
Inj. / det. temp.: 280°C / 340°C  
Carrier gas: helium  
Linear velocity: 35cm/sec. set @ 180°C  
FID sensitivity: 1.28 x 10<sup>-10</sup> AFS  
Split ratio: 50:1



- |   |  |
|---|--|
| 1. 5-androstone-3 $\beta$ ,17 $\beta$ -diol                     | 11. bolasterone                        |
| 2. 17 $\alpha$ -methyl-5-androstone-3 $\beta$ ,17 $\beta$ -diol | 12. oxymethalone                       |
| 3. 5 $\alpha$ -androstan-17 $\beta$ -ol-3-one                   | 13. 19-nortestosterone-17-propionate   |
| 4. 19-nortestosterone   | 14. testosterone propionate            |
| 5. 17 $\alpha$ -methylandrostan-17 $\beta$ -ol-3-one            | 15. fluoxymesterone                    |
| 6. mesterolone  | 16. 4-chlorotestosterone-17-acetate    |
| 7. testosterone   | 17. testosterone-17 $\beta$ -cypionate |
| 8. 17 $\alpha$ -methyldihydrotestosterone                       | 18. 1-dehydrotestosterone benzoate     |
| 9. 1-dehydrotestosterone  | 19. 1-dehydrotestosterone undecylenate |
| 10. 1-dehydro-17 $\alpha$ -methyltestosterone                   |  |

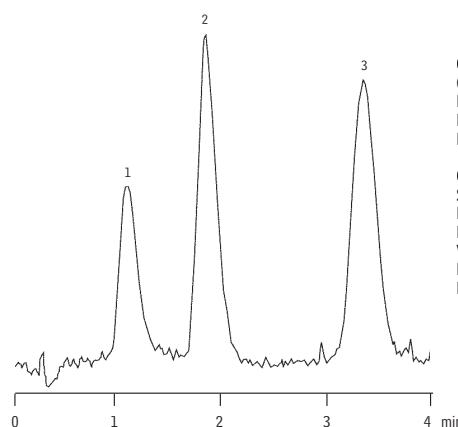
## Corticosteroids

HPLC

### Allure™ C18 vs. Conventional C18 (LC/MS)

#### Conventional C18

water:methanol (40:60, v/v)  
3324.0 cps



#### Allure™ C18

water:methanol (33:67, v/v)  
4191.1 cps

**12% increase in organic =  
26% increase in LC/MS sensitivity**

#### Peak List:

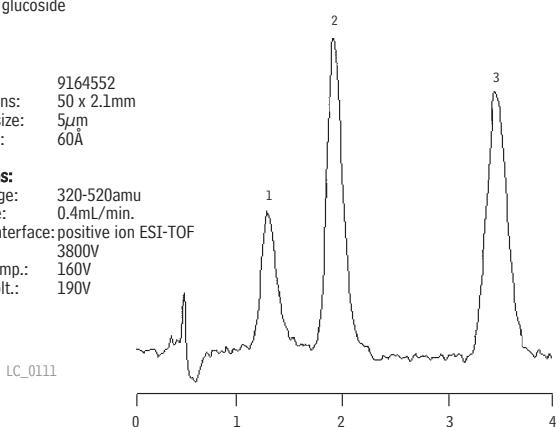
1. deoxycorticosterone (DCC) acetate
2. DCC glucoside
3. DCC

#### Column:

Cat. #: 9164552  
Dimensions: 50 x 2.1mm  
Particle size: 5 $\mu$ m  
Pore size: 60 $\text{\AA}$

#### Conditions:

Scan range: 320-520amu  
Flow rate: 0.4mL/min.  
LC/MS Interface: positive ion ESI-TOF  
Voltage: 3800V  
Nozzle temp.: 160V  
Nozzle volt.: 190V



Data Courtesy of Pfizer Inc

## Corticosteroids Ultra C18

HPLC

**Peak List:**

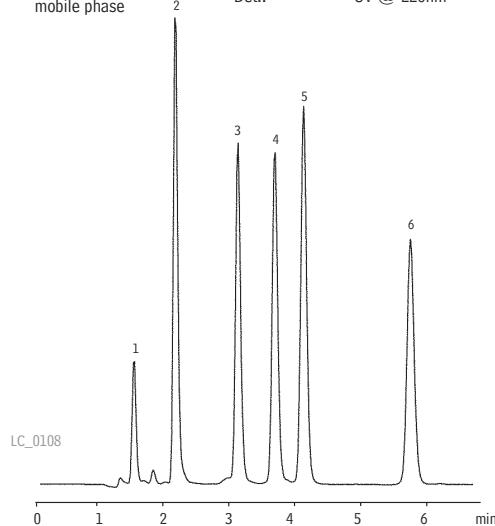
1. uracil
2. triamcinolone
3. hydrocortisone
4. dexamethasone
5. corticosterone
6. desoxycorticosterone

**Sample:**

Inj.: 5 $\mu$ L  
 Conc.: 100 $\mu$ g/mL  
 Solvent: mobile phase

**Column:** Ultra C18  
 Cat. #: 9174565  
 Dimensions: 150 x 4.6mm  
 Particle size: 5 $\mu$ m  
 Pore size: 100Å

**Conditions:**  
 Mobile phase: water:methanol (30:70, v/v)  
 Flow: 1.0mL/min.  
 Temp.: 30°C  
 Det.: UV @ 220nm



## Corticosteroids Pinnacle™ II Phenyl

HPLC

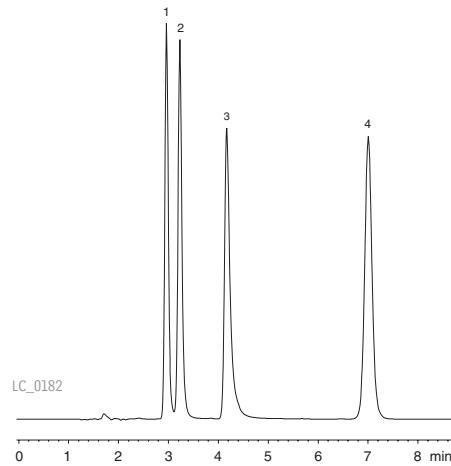
**Peak List:**

1. hydrocortisone
2. cortisone
3. corticosterone
4. cortisone acetate

**Sample:**  
 Inj.: 5 $\mu$ L  
 Conc.: 200 $\mu$ g/mL each  
 Solvent: methanol

**Column:** Pinnacle™ II Phenyl  
 Cat. #: 9215565  
 Dimensions: 150 x 4.6mm  
 Particle size: 5 $\mu$ m  
 Pore size: 110Å

**Conditions:**  
 Mobile phase: water:methanol (60:40 v/v)  
 Flow: 1.0mL/min.  
 Temp.: ambient  
 Det.: UV @ 254nm



## Corticosteroids Allure™ Biphenyl

HPLC

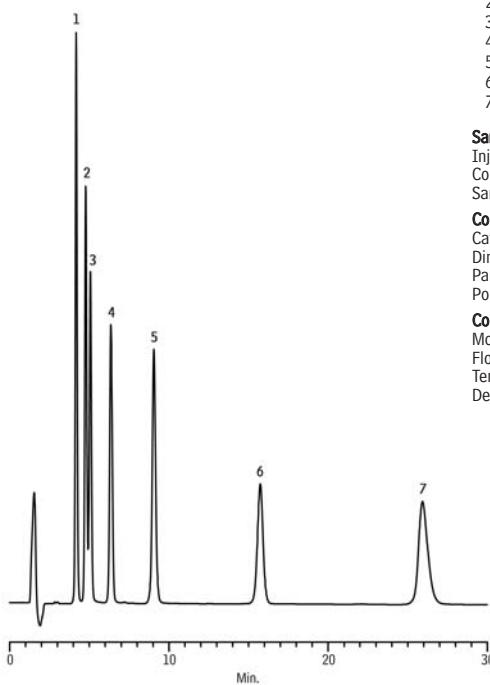
Peak List	Ret. Time (min.)
1. hydrocortisone	4.19
2. prednisone	4.79
3. cortisone	5.08
4. dexamethasone	6.37
5. corticosterone	9.01
6. cortisone acetate	15.75
7. desoxycorticosterone	25.94

**Sample:**

Inj.: 5 $\mu$ L  
 Conc.: 100 $\mu$ g/mL each component  
 Sample diluent: methanol

**Column:** Allure™ Biphenyl  
 Cat. #: 9166565  
 Dimensions: 150 x 4.6 mm  
 Particle size: 5 $\mu$ m  
 Pore size: 60Å

**Conditions:**  
 Mobile phase: water:acetonitrile, 60:40  
 Flow: 1mL/min.  
 Temp.: ambient  
 Det.: UV @ 254 nm



# Chiral Drugs

**Chiral Drugs**  
In many instances stereochemical properties of chiral drugs are the controlling factor concerning activity. One enantiomer might provide a biological function, the other might be inactive or might exhibit another functionality, which could result in side effects. In some cases, one optical isomer might be harmful. Enantiomeric separation of these compounds for accurate interpretation of drug tests, is easily achieved on Rt- $\beta$ DEXcst™ and Rt- $\beta$ DEXsm™ chiral capillary GC columns.

## free literature

*A Guide to the Analysis of Chiral Compounds by GC*

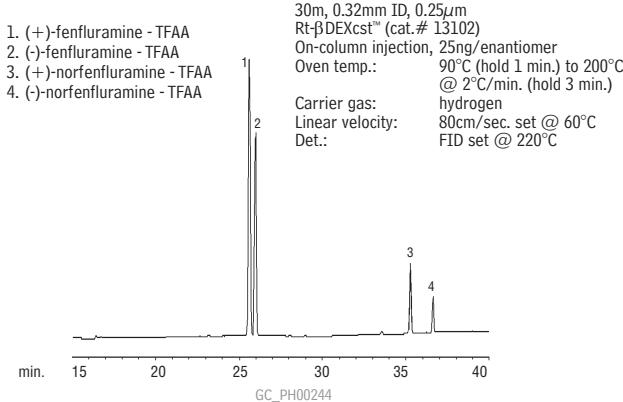
lit. cat.# 59889

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

GC

## Fenafluramine (TFAA Derivative)

### Rt- $\beta$ DEXcst™

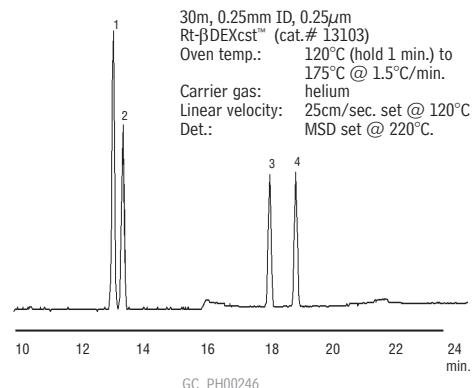


## Amphetamine & Methamphetamine (TFAA Derivatives)

GC

### Rt- $\beta$ DEXcst™

1. (+)-methamphetamine - TFAA
2. (-)-methamphetamine - TFAA
3. (+)-amphetamine - TFAA
4. (-)-amphetamine - TFAA



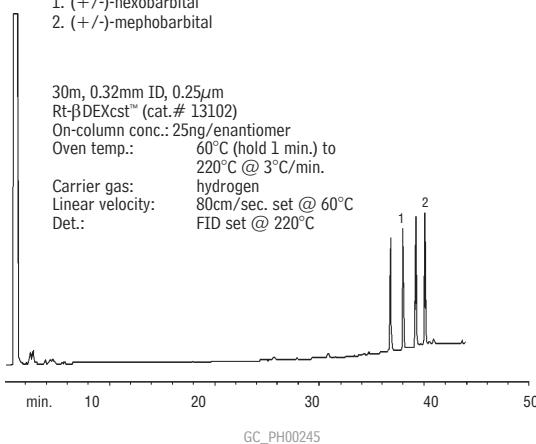
GC

## Barbiturates (Underivatized)

### Rt- $\beta$ DEXcst™

1. (+/-)-hexobarbital
2. (+/-)-mephobarbital

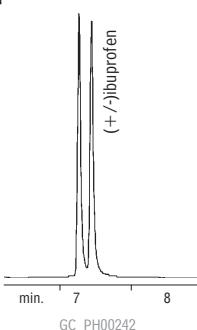
30m, 0.32mm ID, 0.25 $\mu$ m  
Rt- $\beta$ DEXcst™ (cat.# 13102)  
On-column conc.: 25ng/enantiomer  
Oven temp.: 60°C (hold 1 min.) to  
220°C @ 3°C/min.  
Carrier gas: hydrogen  
Linear velocity: 80cm/sec. set @ 60°C  
Det.: FID set @ 220°C



## Ibuprofen (Underivatized)

GC

### Rt- $\beta$ DEXsm™

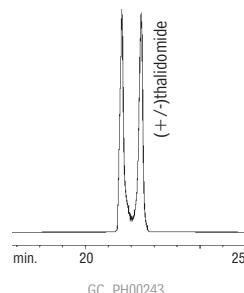


30m, 0.32mm ID, 0.25 $\mu$ m Rt- $\beta$ DEXsm™ (cat.# 13104)  
On-column injection  
Conc.: 125ng each enantiomer  
Oven temp.: 175°C to 200°C @ 2°C/min.  
Inj./det. temp.: 200°C/230°C  
Carrier gas: helium  
Linear velocity: 60cm/sec.  
Det.: GC-FID  
Split ratio: 13:1 using cup splitter liner (cat.# 20709)

## Thalidomide (Underivatized)

GC

### Rt- $\beta$ DEXcst™



30m, 0.32mm ID, 0.25 $\mu$ m Rt- $\beta$ DEXcst™ (cat.# 13102)  
On-column injection  
Conc.: approximately 15ng each enantiomer  
Oven temp.: 200°C to 230°C @ 1°C/min.  
Inj./det. temp.: 200°C/230°C  
Carrier gas: hydrogen  
Linear velocity: 80cm/sec.  
Detector type: GC/FID  
Split ratio: 13:1 using cup splitter liner (cat.# 20709)

# Capillary GC Columns: Guard Columns

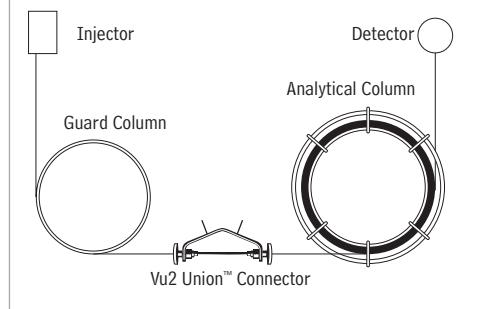
## What is a guard column?

A capillary GC guard column is a short length of deactivated, uncoated fused silica or MXT® stainless steel tubing that is connected to the inlet end of the analytical column (Figure 1). The guard column traps nonvolatile residues and prevents them from collecting at the inlet of the analytical column, with important benefits:

- Increased column lifetime (more injections).
- Prevents peak splitting during splitless analysis.
- Improved analyte focusing.

Contaminants that accumulate within the analytical column can adsorb active compounds, reduce resolution, and cause poor peak symmetry. Packed inlet liners remove only a portion of the non-volatile contaminants in samples. When this contamination begins to affect sample analysis, a section (15–30cm) of the analytical column must be removed to restore performance. Each time a section of the analytical column is removed, retention times change and some resolution is lost, eventually resulting in a need to replace the column. By removing contaminated loops from the guard column instead of the analytical column, the inertness and length of the analytical column remain intact, so retention times and resolution do not change. The amount of time the sample spends in the guard column is minimal because there is no stationary phase.

**Figure 1** A guard column connected to an analytical column



## did you know?

We test our guard columns/transfer lines with the Grob test mix to ensure high inertness.

## please note

For superior inertness, try our Siltek® guard columns!

## for more info

Having trouble making a leak-free connection? Try our "built in" Integra-Guard™ columns!

See page 30 for details.

## What type of guard column should be used?

It is important to match the polarity of the sample solvent and the polarity of the surface deactivation in the guard column. Intermediate Polarity (IP) guard columns allow most common solvents (methylen chloride, hexane, isoctane, toluene) to easily wet and create a uniform film on the tubing surface. A polar-deactivated guard column is necessary to allow more polar solvents such as methanol or water to wet the tubing surface. Polar-deactivated guard columns are not resistant to water vaporization, which occurs when liquid water is injected onto the tubing, and rapidly vaporizes (such as in steam cleaning). Hydroguard™ deactivation is an alternative for direct aqueous injections. However, a Hydroguard™-deactivated guard column will not allow polar solvents to wet the tubing surface, and may cause beading of the solvent if the oven temperature is 20°C below the solvent boiling point. Siltek® deactivation creates a highly inert surface for very active compounds such as chlorinated pesticides. Base-deactivated guard columns reduce adsorption and tailing for amines and other basic compounds.

## How is a guard column connected to the analytical column?

The most common connector is the Press-Tight® connector. In addition, Restek offers Vu-Union®, Vu2-Union™, and Gerstel GRAPHPACK® connectors for attaching guard columns. MXT® unions are available for connecting stainless steel MXT® columns and guard columns. See our general catalog, or website, for information about these connectors.

## Intermediate-Polarity Deactivated Guard Columns/Transfer Lines

- Useful for a wide range of applications.
- Use with most common solvents.
- Maximum temperature: 325°C

## Fused Silica

Nominal ID	Nominal OD	1-Meter	5-Meter	5-Meter/6-pk.
0.18mm	0.37 ± 0.04mm	10102	10046	
0.25mm	0.37 ± 0.04mm		10043	10043-600
0.32mm	0.45 ± 0.04mm		10044	10044-600
0.53mm	0.69 ± 0.05mm		10045	10045-600

# Capillary GC Columns: Guard Columns

## Siltek®-Deactivated Guard Columns/Transfer Lines

- Revolutionary deactivation process for superior inertness.
- Minimize bleed.
- Analyze active samples accurately; ideal for chlorinated pesticide analysis (reduces endrin breakdown to less than 1%).
- Maximum temperature: 380°C.

## Fused Silica

Nominal ID	Nominal OD	5-Meter	10-Meter
0.25mm	0.37 ± 0.04mm	10026	10036
0.32mm	0.45 ± 0.04mm	10027	10037
0.53mm	0.69 ± 0.05mm	10028	10038

## Base-Deactivated Guard Columns

- Excellent inertness for basic compounds.
- Recommended for use with Rtx®-5 Amine, Rtx®-35Amine, and Stabilwax®-DB capillary columns.
- Tested with basic amine test mix.
- Batch test chromatogram included.
- Maximum temperature: 315°C.

Chemists using guard columns in analyses of basic compounds frequently observe peak tailing and low recovery, because conventionally deactivated tubing surfaces can be adsorptive to basic compounds. Restek offers both base-deactivated columns and base-deactivated guard columns for completely inert sample pathways.

## Fused Silica

Nominal ID	Nominal OD	5-Meter	5-Meter/6-pk.
0.25mm	0.37 ± 0.04mm	10000	10000-600
0.32mm	0.45 ± 0.04mm	10001	10001-600
0.53mm	0.69 ± 0.05mm	10002	10002-600

## Innovative Integra-Guard™ Columns

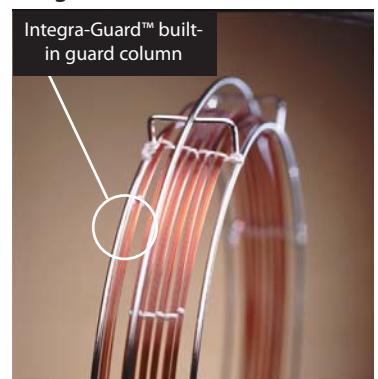
For analysts who find it inconvenient to make a leak-free connection between the guard column and the analytical column, Restek offers Integra-Guard™ columns. These innovative columns incorporate both guard column and analytical column in a continuous length of tubing, eliminating the connection and all connection-associated problems! The guard column section is tied separately from the analytical column, using high-temperature string. The column is suspended in our unique “crush-free” cage, which protects the column from damage.

Restek offers a wide variety of Integra-Guard™ capillary columns, listed in the figure below. The Integra-Guard™ column is so economical that we challenge you to compare our price against that of a conventional connection, even if you assemble it yourself. If you are currently using a guard column, or are considering using one, call today and ask about Integra-Guard™ columns.

Ordering is simple. Just add the appropriate suffix number and price to the analytical column's catalog number and price. For example, a 30m, 0.25mm ID, 0.25µm Rtx®-5 column with a 5-meter Integra-Guard™ column is cat.# 10223-124.

ID	Length	Suffix
0.25mm	5m	-124
	10m	-127
0.32mm	5m	-125
	10m	-128
0.53mm	5m	-126
	10m	-129

### Phases currently available as Integra-Guard™ columns



Rtx®-1  
Rtx®-1MS  
Rtx®-5  
Rtx®-5MS  
Rtx®-5Sil MS  
XTI®-5  
Rtx®-1301  
Rtx®-624  
Rtx®-1701  
Rtx®-Volatiles  
Rtx®-20  
Rtx®-35  
Rtx®-35MS  
Rtx®-BAC 1 & 2  
Stabilwax®

Available for all phases listed, for columns with 0.25 to 0.53mm ID and lengths to 75 meters.

**restek**  
**innovation!**

Integra-Guard™ Columns:  
guard columns WITHOUT  
connections—protecting your  
analytical column has never  
been this easy!

**Rxi™-1ms** (nonpolar phase, Crossbond® 100% dimethyl polysiloxane)

- General purpose columns for drugs of abuse, essential oils, hydrocarbons, pesticides, PCB congeners or (e.g.) Aroclor® mixes, sulfur compounds, amines, solvent impurities, simulated distillation, oxygenates, gasoline range organics (GRO), refinery gases.
- Temperature range: -60°C to 330/350°C (bleed tested temperature/maximum operating temperature).
- Low bleed - improved signal to noise ratio, for better sensitivity and mass spectral integrity.
- Equivalent to USP G2 phase.

**Rxi™-1ms** (fused silica)

(Crossbond® 100% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.25	-60 to 330/350°C	13320	13323	13326
	0.50	-60 to 330/350°C	13335	13338	13341
	1.00	-60 to 330/350°C	13350	13353	13356
0.32mm	0.25	-60 to 330/350°C	13321	13324	13327
	0.50	-60 to 330/350°C	13336	13339	13342
	1.00	-60 to 330/350°C	13351	13354	13357
0.53mm	0.50	-60 to 330/350°C	13337	13340	
	1.00	-60 to 330/350°C	13352	13355	
	1.50	-60 to 330/350°C	13367	13370	
ID	df ( $\mu\text{m}$ )	temp. limits	12-Meter	20-Meter	25-Meter
0.18mm	0.18	-60 to 330/350°C		13302	
0.20mm	0.33	-60 to 330/350°C	13397		13398
					13399

new column technology!

## did you know?

Our Technical Service Department is staffed with more than 35 experienced chemists on rotating shifts from various departments. Whether your chromatography problem is simple or complex, call Restek's Technical Service Team at 1-800-356-1688 (ext. 4), or contact your Restek representative, and we will do everything we can to help you find a solution.

**Rtx®-1MS** (fused silica)

(Crossbond® 100% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	15-Meter	30-Meter
0.25mm	0.10	-60 to 330/350°C	11605	11608
	0.25	-60 to 330/350°C	11620	11623
	0.50	-60 to 330/350°C	11635	11638
0.32mm	0.10	-60 to 330/350°C	11606	11609
	0.25	-60 to 330/350°C	11621	11624
	0.50	-60 to 330/350°C	11636	11639
0.53mm	1.00	-60 to 320/340°C	11652	11655
	1.50	-60 to 310/330°C	11667	11670

## Similar Phases

DB-1, DB-1ms, HP-1, HP-1ms, Ultra-1, SPB-1, Equity-1

## Similar Phases

DB-1, DB-1MS, HP-1, HP-1MS, Ultra-1, SPB-1, Equity-1, MDN-1

**Rtx®-20** (low/mid-polarity phase; Crossbond® 80% dimethyl / 20% diphenyl polysiloxane)

- General purpose columns for volatile compounds, flavor compounds, alcoholic beverages.
- Temperature range: -20°C to 320°C.
- Equivalent to USP G28, G32 phases.

**Rtx®-20** (fused silica)

(Crossbond® 80% dimethyl/20% diphenyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.25	-20 to 300/320°C	10320	10323	10326	10329
	0.50	-20 to 290/310°C	10335	10338	10341	10344
	1.00	-20 to 280/300°C	10350	10353	10356	10359
0.32mm	0.25	-20 to 300/320°C	10321	10324	10327	10330
	0.50	-20 to 290/310°C	10336	10339	10342	10345
	1.00	-20 to 280/300°C	10351	10354	10357	10360
0.53mm	0.50	-20 to 260/280°C	10337	10340	10343	
	1.00	-20 to 260/280°C	10352	10355	10358	

\*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

## Similar Phases

SPB-20

# Capillary GC Columns

## Similar Phases

DB-5, HP-5, HP-5Ms, Ultra-2,  
SPB-5, Equity-5

## also available

Custom lengths and film thicknesses are available.  
Call technical service at  
**800-356-1688 (ext. 4)**,  
or contact your Restek representative.

## Similar Phases

DB-5, HP-5, HP-5MS, Ultra-2,  
SPB-5, Equity-5, MDN-5  
DB-5MS is equivalent to  
Rtx®-5Si MS

### Rxi™-5ms (low-polarity phase, Crossbond® 5% diphenyl / 95% dimethyl polysiloxane)

- General purpose columns for semivolatiles, phenols, amines, residual solvents, drugs of abuse, pesticides, PCB congeners or (e.g.) Aroclor® mixes, solvent impurities.
- Temperature range: -60°C to 330/350°C (bleed tested temperature/maximum operating temperature).
- Low bleed - improved signal to noise ratio, for better sensitivity and mass spectral integrity.
- Equivalent to USP G27 phase.

new column technology!

### Rxi™-5ms (fused silica)

(Crossbond® 5% diphenyl / 95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.25	-60 to 330/350°C	13420	13423	13426
	0.50	-60 to 330/350°C	13435	13438	
	1.00	-60 to 330/350°C	13450	13453	13456
0.32mm	0.25	-60 to 330/350°C	13421	13424	
	0.50	-60 to 330/350°C	13436	13439	
	1.00	-60 to 330/350°C	13451	13454	13457
0.53mm	0.25	-60 to 330/350°C	13422	13425	
	0.50	-60 to 330/350°C	13437	13440	
	1.00	-60 to 330/350°C	13452	13455	
1.50mm	1.50	-60 to 330/350°C	13467	13470	
ID	df (µm)	temp. limits	12-Meter	20-Meter	25-Meter
0.18mm	-60 to 330/350°C		13402		
0.36	-60 to 330/350°C		13411		
0.20mm	0.33	-60 to 330/350°C	13497	13498	
					13499

### Rtx®-5MS (fused silica)

(Crossbond® 5% diphenyl / 95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	-60 to 330/350°C	12605	12608	12611
	0.25	-60 to 330/350°C	12620	12623	12626
	0.50	-60 to 330/350°C	12635	12638	12641
0.32mm	0.25	-60 to 330/350°C	12621	12624	12627
	0.50	-60 to 330/350°C	12636	12639	12642
	0.53mm	0.50	-60 to 320/340°C	12637	12640
0.53mm	1.00	-60 to 320/340°C	12652	12655	

### Rtx®-5 Amine (low-polarity phase; Crossbond® 5% diphenyl / 95% dimethyl polysiloxane)

- Application-specific columns for amines and other basic compounds, including alkylamines, diamines, triamines, ethanolamines, and nitrogen-containing heterocyclics.
- Stable to 315°C.

Active basic compounds that previously required derivatization or another analytical technique can be analyzed on the Rtx®-5 Amine column. The tubing surface is chemically altered to reduce tailing of basic compounds, eliminating the need for column priming. Breakthrough technology also allows the analysis of neutral compounds, adsorptive compounds with oxygen groups susceptible to hydrogen bonding, and even mildly acidic compounds such as phenols.

Thorough testing of each Rtx®-5 Amine column ensures that every column exceeds the requirements for analyzing ppm levels of amines, without priming. The temperature program/bleed profile for each column is measured to ensure low bleed at maximum operating temperature. Rtx®-5 Amine columns are bonded and can be rejuvenated by solvent rinsing.

### Rtx®-5 Amine (fused silica)

(Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.25mm	0.50	-60 to 300/315°C	12335	12338
	1.00	-60 to 300/315°C	12350	12353
0.32mm	1.00	-60 to 300/315°C	12351	12354
	1.50	-60 to 290/305°C	12366	12369
0.53mm	1.00	-60 to 290/305°C	12352	12355
	3.00	-60 to 280/295°C	12382	12385

## Similar Phases

PTA-5

**Rtx®-1701** (mid-polarity phase; Crossbond® 14% cyanopropylphenyl / 86% dimethyl polysiloxane)

- General purpose columns for alcohols, oxygenates, PCB congeners or (e.g.) Aroclor® mixes, pesticides.
- Temperature range: -20°C to 280°C.
- Equivalent to USP G46 phase.

**Rtx®-1701** (fused silica)

(Crossbond® 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.25	-20 to 280°C	12020	12023	12026	12029
	0.50	-20 to 270/280°C	12035	12038	12041	12044
0.32mm	0.25	-20 to 280°C	12021	12024	12027	12030
	0.50	-20 to 270/280°C	12036	12039	12042	12045
0.53mm	0.50	-20 to 260/270°C	12037	12040	12043	
	1.00	-20 to 250/270°C	12052	12055	12058	

## Similar Phases

DB-1701, HP-1701, SPB-1701

**Rtx®-35/Rtx®-35MS** (mid-polarity phase; Crossbond® 35% diphenyl / 65% dimethyl polysiloxane)

- General purpose columns for organochlorine pesticides, PCB congeners or (e.g.) Aroclor® mixes, herbicides, pharmaceuticals, sterols, rosin acids, phthalate esters.
- Temperature range: 0°C to 320°C.
- Equivalent to USP G42 phase.

**Rtx®-35** (fused silica)

(Crossbond® 35% diphenyl/65% dimethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.25	0 to 320°C	10420	10423	10426	10429
	0.50	0 to 310°C	10435	10438	10441	10444
0.32mm	0.25	0 to 320°C	10421	10424	10427	10430
	0.50	0 to 310°C	10436	10439	10442	10445
0.53mm	0.50	0 to 300°C	10437	10440	10443	
	1.00	0 to 290°C	10452	10455	10458	

## Similar Phases

DB-35, HP-35, SPB-35,  
SPB-608**Rtx®-35MS** (fused silica)

(Crossbond® 35% diphenyl / 65% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.10	-20 to 320°C	14605	14608
	0.25	-20 to 320/340°C	14620	14623
0.32mm	0.10	-20 to 320/340°C	14606	14609
	0.25	-20 to 320/340°C	14621	14624
0.53mm	0.50	-20 to 300/320°C	14637	14640
	1.00	-20 to 290°C	14652	14655

**Rtx®-35 Amine** (mid-polarity phase; Crossbond® 35% diphenyl / 65% dimethyl polysiloxane)

- Application-specific columns for amines and other basic compounds, including alkylamines, diamines, triamines, ethanolamines, and nitrogen-containing heterocyclics.
- Stable to 310°C.

Active basic compounds that otherwise require derivatization can be analyzed on an Rtx®-35 Amine column. The tubing surface is chemically altered to reduce tailing of basic compounds, eliminating the need for column priming. An Rtx-35® Amine column is ideal for a wide variety of basic compounds, but also is suitable for neutral compounds, adsorptive compounds with oxygen groups susceptible to hydrogen bonding, or even weakly acidic compounds such as phenols. Every Rtx®-5 Amine column is tested to ensure that it exceeds the requirements for analyzing ppm levels of amines, without priming, and to ensure low bleed at maximum operating temperature.

**Rtx®-35 Amine** (fused silica)

(Crossbond® 35% diphenyl/65% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.50	0 to 290/310°C	11335	11338
	1.00	0 to 280/300°C	11350	11353
0.32mm	1.00	0 to 280/300°C	11351	11354
	1.50	0 to 270/290°C	11366	11369
0.53mm	1.00	0 to 260/280°C	11352	11355
	3.00	0 to 240/260°C	11382	11385

\*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

## Capillary GC Columns

### Rtx®-200/Rtx®-200MS (mid-polarity phase; Crossbond® trifluoropropylmethyl polysiloxane)

- General purpose columns for solvents, Freon® fluorocarbons, alcohols, ketones, silanes, glycols.
- Excellent confirmation column, with an Rtx®-5 column, for phenols, nitrosamines, organochlorine pesticides, chlorinated hydrocarbons, chlorophenoxy herbicides.
- Temperature range: -20°C to 340°C.
- Equivalent to USP G6 phase.

### Rtx®-200 (fused silica)

(Crossbond® trifluoropropylmethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.25	-20 to 320/340°C	15020	15023	15026	15029
	0.50	-20 to 310/330°C	15035	15038	15041	15044
0.32mm	0.25	-20 to 320/340°C	15021	15024	15027	15030
	0.50	-20 to 310/330°C	15036	15039	15042	15045
0.53mm	0.50	-20 to 300/320°C	15037	15040	15043	
	1.00	-20 to 290/310°C	15052	15055	15058	

### Similar Phases

DB-200, DB-210

### also available

Custom lengths and film thicknesses are available. Call technical service at **800-356-1688 (ext. 4)**, or contact your Restek representative.

### Rtx®-200MS (fused silica)

(Crossbond® trifluoropropylmethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.10	-20 to 320/340°C	15605	15608
	0.25	-20 to 320/340°C	15620	15623
0.32mm	0.10	-20 to 320/340°C	15606	15609
	0.25	-20 to 320/340°C	15621	15624
0.53mm	0.50	-20 to 300/320°C	15637	15640

\*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

### Stabilwax® (polar phase; Crossbond® Carbowax® polyethylene glycol)

- General purpose columns for FAMEs, flavor compounds, essential oils, amines, solvents, xylene isomers, US EPA Method 603 (acrolein/acrylonitrile).
- Resistant to oxidative damage.
- Temperature range: 40°C to 250°C.
- Equivalent to USP G14, G15, G16, G20, G39 phases.

### Stabilwax® (fused silica)

(Crossbond® Carbowax® polyethylene glycol—provides oxidation resistance)

ID	df (μm)	temp. limits	15-Meter	30-Meter	30-Meter 6/pk.	60-Meter
0.25mm	0.25	40 to 250°C	10620	10623		10626
	0.50	40 to 250°C	10635	10638		10641
0.32mm	0.25	40 to 250°C	10621	10624		10627
	0.50	40 to 250°C	10636	10639		10642
0.53mm	0.50	40 to 250°C	10637	10640		10643
	1.00	40 to 240/250°C	10652	10655	10655-600	10658

### Similar Phases

DB-WAX, DB-WAXetr, HP-Wax, HP-Innowax, Supelcowax 10

**Rtx®-Wax** (polar phase; Crossbond® Carbowax® polyethylene glycol)

- General purpose columns for FAMEs, solvents, BTEX aromatics, flavor compounds.
- Temperature range: 20°C to 250°C.
- Equivalent to USP G14, G15, G16, G20, G39 phases.

**Rtx®-Wax** (fused silica)

(Crossbond® Carbowax® polyethylene glycol)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.25	20 to 250°C	12420	12423	12426
	0.50	20 to 250°C	12435	12438	12441
0.32mm	0.25	20 to 250°C	12421	12424	12427
	0.50	20 to 250°C	12436	12439	12442
0.53mm	1.00	20 to 240/250°C	12451	12454	12457
	0.50	20 to 250°C	12437	12440	12443
	1.00	20 to 240/250°C	12452	12455	12458

\*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

## Similar Phases

DB-WAX, HP-Wax

**Rtx®-G27 & Rtx®-G43**

- Application-specific columns, designed for analysis of residual solvents in pharmaceutical products.
- Meet all requirements of USP 467.
- Integra-Guard™ guard+analytical column eliminates connecting problems and leaks.
- Rtx®-G27 thermally stable to 290°C; Rtx®-G43 thermally stable to 240°C.

Some USP 467 methods require the use of a guard column. Our Integra-Guard™ integrated guard column system makes this an easy task.

**Rtx®-G27** (fused silica with 5-meter Integra-Guard™)

(Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	30-Meter with 5-Meter, 0.53mm ID Integra-Guard™ Column
0.53mm	5.00	-60 to 270/290°C	10279-126

**Rtx®-G43** (fused silica with 5-meter Integra-Guard™)

(Crossbond® 6% cyanopropylphenyl/94% dimethyl polysiloxane)

ID	df (μm)	temp. limits	30-Meter with 5-Meter, 0.53mm ID Integra-Guard™ Column
0.53mm	3.00	-20 to 240°C	16085-126

**Rtx®-BAC1/Rtx®-BAC2** (proprietary Crossbond® phase)

- Application-specific columns for blood alcohol analysis, achieving baseline resolution in less than 3 minutes. Also excellent for abused inhalant anesthetics, γ-hydroxybutyrate (GHB) / γ-butyrolactone (GBL), glycols, and common industrial solvents.
- Rtx®-BAC2 confirmation column provides four elution order changes under the same conditions.
- Rtx®-BAC1 stable to 260°C, Rtx®-BAC2 stable to 240°C.

These columns achieve baseline separation of all blood alcohol compounds in blood, breath, or urine in less than 3 minutes, under isothermal conditions. Isothermal analysis increases productivity by eliminating the need for oven cycling. Confirmation is easily achieved with this tandem set because there are four elution order changes between the two columns.

**Rtx®-BAC1** (fused silica)

ID	df (μm)	temp. limits	30-Meter
0.32mm	1.80	-20 to 240/260°C	18003
0.53mm	3.00	-20 to 240/260°C	18001

**Rtx®-BAC2** (fused silica)

ID	df (μm)	temp. limits	30-Meter
0.32mm	1.20	-20 to 240/260°C	18002
0.53mm	2.00	-20 to 240/260°C	18000

# Capillary GC Columns

## Cyclodextrin Columns for Analyzing Many Chiral Compounds

By adding  $\beta$  or  $\gamma$  cyclodextrin to our bonded Rtx<sup>®</sup>-1701 stationary phase, we greatly enhance overall utility and column lifetime for our chiral columns, compared to columns that have pure cyclodextrin stationary phases. Separations of more than one hundred chiral compounds have been achieved using our unique DEX columns, and our columns continue to demonstrate stability after hundreds of temperature program cycles. Refer to the applications section of this catalog for example applications, or call our Technical Service chemists or your Restek representative for assistance in matching a column to your chiral analysis.

### Rt- $\beta$ DEXm™ (fused silica)

(permethylated beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13100
0.32mm	0.25	40 to 230°C	13101

Uses: General purpose chiral phase with many published applications.

### Rt- $\beta$ DEXsm™ (fused silica)

(2,3-di-O-methyl-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13105
0.32mm	0.25	40 to 230°C	13104

Uses: Excellent column for most chiral compounds found in essential oils.

### Rt- $\beta$ DEXse™ (fused silica)

(2,3-di-O-ethyl-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13107
0.32mm	0.25	40 to 230°C	13106

Uses: Similar in performance to Rt- $\beta$ DEXsm™ but provides better resolution for limonene, linalool, linalyl acetate, ethyl-2-methylbutyrate, 2,3-butane diol, and styrene oxides.

### Rt- $\beta$ DEXsp™ (fused silica)

(2,3-di-O-propyl-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13111
0.32mm	0.25	40 to 230°C	13110

Uses: Often useful in dual-column configurations, with the Rt- $\beta$ DEXsm™ column, for complex enantiomeric separations.

### Rt- $\beta$ DEXsa™ (fused silica)

(2,3-di-acetoxy-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13109
0.32mm	0.25	40 to 230°C	13108

Uses: Unique selectivity for esters and lactones, and other fruit flavor components.

### Rt- $\beta$ DEXcst™ (fused silica)

(Proprietary cyclodextrin material doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13103
0.32mm	0.25	40 to 230°C	13102

Uses: Proprietary stationary phase, developed specifically for the fragrance industry. Also used for pharmaceutical applications.

### Rt- $\gamma$ DEXsa™ (fused silica)

(2,3-di-acetoxy-6-O-*tert*-butyl dimethylsilyl gamma cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df ( $\mu\text{m}$ )	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13113
0.32mm	0.25	40 to 230°C	13112

Uses: Larger organic molecules. Also useful for flavor compounds in fruit juices.

**CarboBlack™ Solid Supports**

Graphitized carbon black offers unique selectivity for alcohols, with very little adsorption. Two types of CarboBlack™ supports are available, CarboBlack™ B and CarboBlack™ C. CarboBlack™ B support, with its higher surface area, can hold up to a 10% loading of a non-silicone liquid phase. CarboBlack™ C support can hold up to a 1% loading of a non-silicone liquid phase. Many Carbowax® 20M-loaded CarboBlack™ packings are available. CarboBlack™ packings are treated with KOH or picric acid for basic or acidic compounds, and special alcoholic beverage loadings are available. CarboBlack™ supports provide resolution and retention similar to Carbopack™ and Carbograph™ supports.

for more info

Blood alcohol analysis on a CarboBlack™ B packed column is shown on page 11.

On CarboBlack™ B	Mesh	Stainless Steel Tubing			SilcoSmooth™ Tubing**				
		L (ft.)	OD (in.)	ID (mm)	cat.#*	L (m)	OD (in.)	ID (mm)	cat.#*
5% Carbowax® 20M	80/120	—	—	—	—	2	1/8	2	80105-
5% Carbowax® 20M	60/80	6	1/8	2.1	88012-	1.8	1/8	2	80106-
6.6% Carbowax® 20M	80/120	6	1/8	2.1	80451-	2	1/8	2	80107-
4% Carbowax® 20M/ 0.8% KOH	60/80	—	—	—	—	2	1/8	2	80116-
1% Rt-1000	60/80	8	1/8	2.1	88013-	2.4	1/8	2	80206-
1% Rt-1000	60/80	6	1/8	2.1	80452-	2	1/8	2	80207-
3% Rt-1500	80/120	10	1/8	2.1	80453-	3.05	1/8	2	80211-
1% Rt-1510	60/80	10	1/8	2.1	80454-	3.05	1/8	2	80216-
1.5% XE-60/1% H <sub>3</sub> PO <sub>4</sub>	60/80	6	1/8	2.1	80455-	1.8	1/8	2	80305-

**Nickel 200 Tubing**

On CarboBlack™ B	Mesh	Nickel 200 Tubing			
		L (m)	OD (in.)	ID (mm)	cat.#*
5% Krytox (Ni 200 tubing)	60/80	3.05	1/8	2.1	80127-

On CarboBlack™ C	Mesh	Stainless Steel Tubing			SilcoSmooth™ Tubing**				
		L (ft.)	OD (in.)	ID (mm)	cat.#*	L (m)	OD (in.)	ID (mm)	cat.#*
0.2% Carbowax® 1500	60/80	6	1/8	2.1	80456-	2	1/8	2	80121-
0.2% Carbowax® 1500	80/100	6	1/8	2.1	80457-	2	1/8	2	80122-
0.1% Rt-1000	80/100	6	1/8	2.1	80458-	1.8	1/8	2	80205-
0.19% picric acid	80/100	6	1/8	2.1	80459-	2	1/8	2	80311-
0.3% Carbowax® 20M/0.1% H <sub>3</sub> PO <sub>4</sub>	60/80	2.5	3/16	3.2	80460-	0.75	3/16	3.2	80111-

\*Please add configuration suffix number to cat.# when ordering.

\*\*Silcosteel®-deactivated stainless steel.

**Column Configurations**

**Note:** Initial 2" of column will be empty, to accommodate a needle. For a completely filled column add suffix -901.

See our general catalog for custom configurations

Searching for free technical literature?

**www.restek.com**

## Packed GC Columns

### **Chromosorb® Diatomaceous Earth Supports**

Restek offers the full line of Chromosorb® solid supports that are specially sieved to remove fines and ensure tight particle distribution. Choosing the appropriate support will depend on your application. Need assistance? Call Technical Service at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative for more information.

### **Chromosorb® P (used to prepare Silcoport™ P)**

Chromosorb® P support is manufactured from hard firebrick, making it a rugged material. This support is available acid washed (AW), non-acid washed (NAW), and traditional dimethyldichlorosilane (DMDCS) treated. Chromosorb® P support can hold up to 30 weight% of liquid stationary phase, making it the highest loading support available.

### **Chromosorb® W (used to prepare Silcoport™ W and Silcoport™ BW)**

Chromosorb® W support is a flux-calcinated diatomite. This solid support is very fragile but offers the highest inertness of all diatomaceous earth supports. It can be prepared with up to 25 weight% of liquid stationary phase. Chromosorb® W support is available in AW, NAW, and DMDCS, or treated with Restek's proprietary (Silcoport™) deactivation. Chromosorb® W-HP is an acid washed, silanized version of Chromosorb® W.

### **Chromosorb® G**

Chromosorb® G support is the hardest support available and has the lowest surface area of all the diatomaceous earth supports. Chromosorb® G support is available as AW, NAW, and DMDCS-treated. It can hold up to 10 weight% of liquid stationary phase.

### **Chromosorb® T**

Chromosorb® T support is made from PTFE and is an extremely inert solid support.

Call Restek at 800-356-1688 or 814-353-1300, ext. 3, or contact your Restek representative for quotes on any Chromosorb® material. Some of the popular Chromosorb®-based stock columns and packings available are:

### **Chromosorb®-Based Packed Columns**

	Stainless Steel Tubing				SilcoSmooth™ Tubing**				
	L (ft.)	OD (in.)	ID (mm)	cat.#*	L (m)	OD (in.)	ID (mm)	cat.#**	
<b>On 100/120 Silcoport™ W***</b>									
3% Rt-101	6	1/8	2.1	80461-	2	1/8	2	80400-	
3% Rt-2100	6	1/8	2.1	80462-	2	1/8	2	80420-	
5% Rt-1200/1.75% Bentone 34	6	1/8	2.1	80463-	2	1/8	2	80125-	
5% Rt-1200/5% Bentone 34	6	1/8	2.1	80464-	2	1/8	2	80129-	
 <b>On Chromosorb® PAW</b>									
	L (ft.)	OD (in.)	ID (mm)	cat.#*	L (m)	OD (in.)	ID (mm)	cat.#**	
10% TCEP	8	1/8	2.1	80465-	2.5	1/8	2	80126-	
23% Rt-1700	80/100	30	1/8	2.1	80466-	9.2	1/8	2	80128-

\*Please add configuration suffix number to cat.# when ordering. See page 37.

\*\*Silcosteel®-deactivated stainless steel.

\*\*\*Modified version of Chromosorb® W; highest inertness, most consistent performance.

Searching for a product?

**www.restek.com**

SPLITLESS LINERS FOR AGILENT/FINNIGAN GCs	Benefits/Uses	ID*/OD & Length (mm)	Similar to Agilent part #	ea.	Cat.#	5-pk.	25-pk.
4mm Splitless	trace samples >2µL	4.0 ID 6.5 OD x 78.5	210-3003 (ea.) 210-3003-5 (5-pk.)	20772	20773	20774	
Siltek® 4mm Splitless	trace samples >2µL	4.0 ID 6.5 OD x 78.5	—	20772-214.1	20773-214.5	20774-214.25	
4mm Splitless w/ Wool	trace samples >2µL	4.0 ID 6.5 OD x 78.5	19251-60540 (ea.) 5183-4691 (5-pk.) 5183-4692 (25-pk.)	22400	22401	22402	
Gooseneck Splitless (4mm)†	trace samples >2µL	4.0 ID 6.5 OD x 78.5	5181-3316 (ea.) 5183-4695 (5-pk.) 5183-4696 (25-pk.)	20798	20799	20800	
Siltek® Gooseneck Splitless (4mm)†	trace samples >2µL	4.0 ID 6.5 OD x 78.5	—	20798-214.1	20799-214.5	20800-214.25	
Gooseneck Splitless (4mm) w/ Wool†	trace samples >2µL	4.0 ID 6.5 OD x 78.5	5062-3587 (ea.) 5183-4693 (5-pk.) 5183-4694 (25-pk.)	22405	22406	22407	
Siltek® Gooseneck Splitless (4mm) w/ Wool†	trace samples >2µL	4.0 ID 6.5 OD x 78.5	—	22405-213.1	22406-213.5	22407-213.25	
SPLITLESS LINERS FOR SHIMADZU GCs	Benefits/Uses:	ID*/OD & Length (mm)	Similar to Shimadzu part #	ea.	Cat.#	5-pk.	25-pk.
17A & 2010 Double Gooseneck	reduces backflash and catalytic decomposition	3.5 ID 5.0 OD x 95	—	20958	20959	20960	
17A & 2010 Single Gooseneck	reduces backflash, also operates in DI mode	3.5 ID 5.0 OD x 95	221-41599-00	20961	20962	20963	
SPLIT/SPLITLESS LINERS FOR SHIMADZU GCs	Benefits/Uses:	ID*/OD & Length (mm)	Similar to Shimadzu part #	ea.	Cat.#	5-pk.	25-pk.
17A & 2010 Split/Splitless w/ Wool	universal, for most common analyses	3.5 ID 5.0 OD x 95	221-41444-00	20955	20956	20957	
Siltek® 17A & 2010 Split/Splitless w/ Wool	universal, for most common analyses	3.5 ID 5.0 OD x 95	—	20955-213.1	20956-213.5	20957-213.25	
LINERS FOR VARIAN 1177 GCs	Benefits/Uses:	ID*/OD & Length (mm)	Similar to Varian part #	ea.	Cat.#	5-pk.	25-pk.
Gooseneck Splitless (4mm)	trace samples <2µL	4.0 ID 6.5 OD x 78.5	39-26119-27	21896	21897	—	
Siltek® Gooseneck Splitless (4mm)	trace samples <2µL	4.0 ID 6.5 OD x 78.5	—	21896-214.1	21897-214.5	—	
Gooseneck Splitless (4mm) w/ Wool	trace samples <2µL	4.0 ID 6.5 OD x 78.5	39-26119-36	21896-200.1	21897-200.5	—	
Siltek® Gooseneck Splitless (4mm) w/ Wool	trace samples <2µL	4.0 ID 6.5 OD x 78.5	—	21896-213.1	21897-213.5	—	
SPLITLESS LINERS FOR PERKINELMER GCs	Benefits/Uses:	ID*/OD & Length (mm)	Similar to PE part #	ea.	Cat.#	5-pk.	25-pk.
Auto SYS™ Splitless w/ Wool (2mm ID)	trace samples	2.0 ID 6.2 OD x 92.1	N6101372	20829	20830	20831	
Siltek® Auto SYS™ Splitless w/ Wool (2mm ID)	trace samples	2.0 ID 6.2 OD x 92.1	—	20829-213.1	20830-213.5	20831-213.25	
Auto SYS™ Double Gooseneck	trace, active samples up to 4µL	4.0 ID 6.2 OD x 92.1	—	20853	20854	—	
SPLITLESS LINERS FOR THERMO FINNIGAN 8000 & TRACE™ SERIES GCs	Benefits/Uses:	ID*/OD & Length (mm)	Similar to TF part #	ea.	Cat.#	5-pk.	25-pk.
Splitless (3mm ID)	trace samples	3.0 ID 8.0 OD x 105	453 20032	20942	20943	20944	
Siltek® Splitless (3mm ID)	trace samples	3.0 ID 8.0 OD x 105	—	20942-214.1	20943-214.5	20944-214.25	
Splitless (5mm ID)	trace samples	5.0 ID 8.0 OD x 105	453 20033	20945	20946	20947	

\*Nominal ID at syringe needle expulsion point.

†Use this liner for increased sensitivity.

All liners are  
**100%**  
deactivatedAll liners are shipped intermediate  
polarity (IP) deactivated unless  
otherwise requested.

# GC Accessories

## septum sizes

Reference Chart

Instrument	Septum Size (mm)
Agilent (HP)	
5880A, 5890, 6890, 6850, PTV	11
5700, 5880	9.5/10
On-Column Injection	5
CE Instruments (TMQ)	
TRACE™ GC	17
Finnigan (TMQ)	
GC 9001	9.5
GCQ 9.5	
GCQ w/TRACE™, PTV	17
QCQ™ 9.5	
TRACE™ 2000	9.5
Fisons/Carlo Erba (TMQ)	
8000 series	17
Gow-Mac	
6890 series	11
All other models	9.5
PerkinElmer	
Sigma series	11
900,990	11
8000 series	11
Auto SYS	11
Auto SYS XL	11
Pye/Unicam	
All models	7
Shimadzu	
All models	Plug
SRI	
All models	Plug
Tracor	
54011.5	
550,560	9.5
220,222	12.5
Varian	
Injector type:	
Packed column	9.5/10
Split/splitless	
1078/1079	10/11
1177 9	
1075/1077	11

## for more info

To see our complete selections of septa, ferrules, and other consumables for GC, please request our current catalog, or visit our website.



## save money!

Buy ferrules in 50-packs!

### Thermolite® Septa

- Usable to 340°C inlet temperature.
- Each batch tested with FIDs, ECDs, and MSDs to ensure lowest bleed.
- Excellent puncturability.
- Preconditioned and ready to use.
- Do not adhere to hot metal surfaces.
- Packaged in non-contaminating glass jars.



### Septum Diameter

### 25-pk.

### 50-pk.

### 100-pk.

5mm (3/16")	20351	20352	20353
6mm (1/4")	20355	20356	20357
7mm	20381	20382	20383
8mm	20370	20371	—
9mm	20354	20358	20362
9.5mm (5/16")	20359	20360	20361
10mm	20378	20379	20380
11mm (7/16")	20363	20364	20365
11.5mm	22385	22386	22387
12.5mm (1/2")	20367	20368	20369
17mm	20384	20385	20386
Shimadzu Plug	20372	20373	20374

### Measure

your old  
septum here  
(size in mm)



### Vespel® Ferrules

- 100% high-temperature polyimide.
- Stable to 350°C.
- Durable, leak-tight.

### Graphite Ferrules

- High-purity, high-density graphite.
- Smoother surface and cleaner edges than conventional graphite ferrules.
- Contain no binders that can off-gas or adsorb analytes.
- Stable to 450°C.

### Vespel®/Graphite Ferrules

- 60%/40% Vespel®/graphite blend, offering the best combination of sealing and ease of workability.
- Seal with minimal torque, reusable, and preferred for vacuum and high-pressure uses.
- Stable to 400°C.
- Recommended for mass spec transfer lines.

### Capillary Ferrules—For 1/16-Inch Compression-Type Fittings

Ferrule ID	Fits Column ID	qty.	Vespel®	Graphite	Vespel®/Graphite
0.3mm	≤ 0.20μm	10-pk.	22213	20233	20275
0.4mm	0.25/0.28mm	10-pk.	22214	20200	20211
0.4mm	0.25/0.28mm	50-pk.	—	20227	20229
0.5mm	0.28/0.32mm	10-pk.	22215	20201	20212
0.5mm	0.28/0.32mm	50-pk.	—	20228	20231
0.6mm	0.28mm**	10-pk.	—	—	20232
0.8mm	0.45/0.53mm	10-pk.	22216	20202	20213
0.8mm	0.45/0.53mm	50-pk.	—	20224	20230
1.0mm	0.75mm*	10-pk.	22217	21058	24912
1.2mm	0.75mm	10-pk.	22218	—	—
1.6mm	1.00mm*	10-pk.	—	21060	—

\*For micropacked columns.

\*\*For 0.28mm MXT® columns.

**Viton® O-Rings for Agilent GCs**

- Fit split (6.3mm OD) or splitless (6.5mm OD) liners.

Description	Max. temp.	Similar to Agilent part #	qty.	cat.#
Viton® O-Rings for Agilent GCs	250°C	5180-4182	25-pk.	20377

**Graphite O-Rings for Agilent and Varian 1177 GCs**

- Excellent thermal stability at injection port temperatures up to 450°C!

Description	Max. temp.	Similar to Agilent part #	Restek cat.#
		10-pk.	50-pk.
Graphite O-rings for split liners (6.35mm ID)	450°C	5180-4168	20296
Graphite O-rings for splitless liners (6.5mm ID)	450°C	5180-4173	20298

**Liner Seals for Varian 1078/1079**

Description	Max. temp.	Similar to Varian part #	qty.	cat.#
5mm Graphite Liner Seals for Varian 1078/1079 GCs	450°C	392611919 392534201	10-pk.	22683

**Viton® O-Rings for PerkinElmer Auto SYS™ GCs**

Description	Max. temp.	Similar to PE part #	qty.	cat.#
Viton® O-Rings for PerkinElmer Auto SYS™ GCs	250°C	N6101374	10-pk.	20262

**Graphite O-Rings for PerkinElmer Auto SYS™ XL PSS**

Description	Max. temp.	Similar to PE part #	qty.	cat.#
Graphite O-Rings for PerkinElmer Auto SYS™ XL PSS	450°C	N610-1751	10-pk.	21475
Graphite O-Rings for PerkinElmer Auto SYS™ XL PSS	450°C	N610-1751	25-pk.	21476

**Viton® O-Rings for PerkinElmer PSS**

Description	Max. temp.	Similar to PE part #	qty.	cat.#
Viton® O-Rings for PerkinElmer PSS	250°C	N6101747	10-pk.	20366

**Graphite O-Rings for Shimadzu 17A and 2010 GCs**

Description	Max. temp.	Similar to Shimadzu part #	qty.	cat.#
Graphite O-Rings for Split Liners	450°C	221-48393-91	5-pk.	20243
Graphite O-Rings for Splitless Liners	450°C	221-47222-91	5-pk.	20244

**Viton® O-Rings for Shimadzu 17A and 2010 GCs**

Description	Max. temp.	Similar to Shimadzu part #	qty.	cat.#
Viton® O-Rings for Shimadzu 17A and 2010 GCs	250°C	036-11203-84	10-pk.	21477

**Septum Puller**

- Keep several on hand in your laboratory—can be used in many different ways.
- Use hooked end for removing septa and O-rings; pointed end works well for removing stuck ferrules or fragments.

Description	qty.	cat.#
Septum Puller	ea.	20117

**Inlet Liner Removal Tool**

- Easily remove liner from injector—no more burned fingers.
- Made from high-temperature silicone.
- Won't chip or crack the liner.

Description	qty.	cat.#
Inlet Liner Removal Tool	3-pk.	20181

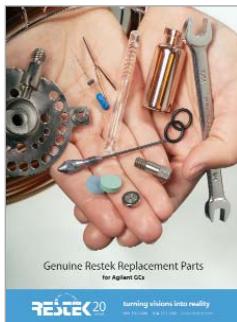


## GC Accessories



### for more info

Restek offers an extensive line of GC and HPLC columns, accessories, and replacement parts. Call to request one of these catalogs for a full listing of products or visit us on the web at [www.restek.com](http://www.restek.com)



GC Replacement Parts  
for Agilent GCs,  
Lit. Cat. #59627E



2006 General Catalog  
Lit. Cat. #580021

### Leak Detector

- Reliable thermal conductivity leak detector—every analyst should have one.
- Compact, portable, ergonomic design—easy to hold and operate.
- Sensitive—detects helium or hydrogen at  $1 \times 10^{-4}$  cc/sec\*.
- Fast results—responds to leaks in less than 2 seconds, zeros with the touch of a button.
- Built-in rechargeable battery—charging adaptor included.

In continuing our efforts to provide chromatographers with the best available columns, tools, and accessories, we have enhanced our popular Restek Electronic Leak Detector. New features include internal battery charge capability, a low-battery indicator, a battery charge indicator light, yellow lights to signal a nitrogen leak, a repositioned on/off switch, to eliminate accidentally powering on the unit, and a new probe tip design that prevents debris from entering the unit. The new leak detector retains the microchip technology that enables high sensitivity in a compact unit, the autozero feature that allows instantaneous zeroing with the touch of a button, and the ergonomic design that puts all controls at your fingertips, for maximum ease of use.

The new Restek Electronic Leak Detector is the affordable solution for detecting helium, hydrogen, or nitrogen leaks in your GC system. Leaks can cause detector noise and baseline instability, waste carrier gas, and shorten column lifetimes. The leak detector responds in less than 2 seconds to leaks of gases with thermal conductivities different from air, indicating leaks with both an audible alarm and an LED readout. The leak detector detects minute gas leaks that can go undetected by liquid leak detectors. And, remember—you should never use liquid leak detectors on a capillary system, because liquids drawn into the system through the leaks will contaminate the system.



### Description

	qty.	cat.#
Leak Detector with 110Volt Battery Charger	ea.	22451
Leak Detector with 220Volt European Battery Charger	ea.	22451-EUR
Leak Detector with 220Volt UK Battery Charger	ea.	22451-UK

Caution: The Restek Electronic Leak Detector is NOT designed for determining leaks of combustible gases. A combustible gas detector should be used for determining combustible gas leaks in possibly hazardous conditions.

\*Sensitivity measured using helium.

### Leak Detector Accessory Kit

The kit includes an adaptor fitting that fits over the probe assembly to detect leaks in hard-to-reach locations, and a mounting bracket that can be affixed to the wall or GC.



Verify pinpoint leaks with the adaptor fitting.



Leak Detector is easily accessed when stored in the mounting bracket.

### Description

	qty.	cat.#
Leak Detector Accessory Kit (adaptor fitting for probe, mounting bracket)	kit	22453

**Press-Tight® Connectors**

- Fit column ODs from 0.33–0.74mm (Restek 0.1mm–0.53mm ID).
- Made from inert fused silica.
- Deactivated Press-Tight® connectors are ideal for better recovery of polar and non-polar compounds.

**Universal Press-Tight® Connectors**

- Connect a guard column to an analytical column.
- Repair a broken column.
- Connect a column outlet to a transfer line.

Description	5-pk.	25-pk.	100-pk.
Universal Press-Tight® Connectors	20400	20401	20402
Deactivated, Universal Press-Tight® Connectors	20429	20430	20431

**Universal Angled Press-Tight® Connectors**

- Angle approximates the curvature of a capillary column, reduces strain on column-end connections.

Description	5-pk.	25-pk.	100-pk.
Universal Angled Press-Tight® Connectors	20446	20447	20448
Deactivated Universal Angled Press-Tight® Connectors	20446-261	20447-261	20448-261

**Universal "Y" Press-Tight® Connectors**

- Split sample flow onto two columns.
- Split a single column flow to two detectors—perform confirmation analysis with a single injection.

Description	ea.	3-pk.
Universal "Y" Press-Tight® Connector	20405	20406
Deactivated Universal "Y" Press-Tight® Connector	20405-261	20406-261

**Universal Angled "Y" Press-Tight® Connectors**

- Angle approximates the curvature of a capillary column, reduces strain on column-end connections.

Description	ea.	3-pk.
Universal Angled "Y" Press-Tight® Connector	20403	20404
Deactivated Universal Angled "Y" Press-Tight® Connector	20403-261	20404-261

**MXT®-Union Connector Kits for Fused Silica Columns**

- Low-dead-volume, leak-tight connection.
- Reusable; use to oven temperatures of 350°C.
- Siltek® treatment ensures maximum inertness.
- Ideal for connecting a guard column or transfer line to an analytical column.

These MXT® connectors can be used with fused silica tubing, as well as with metal tubing, because a Valcon polyimide  $\frac{1}{32}$ -inch one-piece fused silica adaptor allows a capillary column to slide into the adaptor and be locked in place simply by loosening and tightening the fitting.

**MXT®-Union Connector Kits for Fused Silica Columns**

Each kit contains the MXT® union, two  $\frac{1}{32}$ -inch nuts and two one-piece fused silica adaptors.

Description	qty.	cat.#
For 0.25mm ID Fused Silica Columns	kit	21386
For 0.32mm ID Fused Silica Columns	kit	21385
For 0.53mm ID Fused Silica Columns	kit	21384

**MXT® "Y"-Union Connector Kits for Fused Silica Columns**

Each kit contains the MXT® union, three  $\frac{1}{32}$ -inch nuts and three one-piece fused silica adaptors.

Description	qty.	cat.#
For 0.25mm ID Fused Silica Columns	kit	21389
For 0.32mm ID Fused Silica Columns	kit	21388
For 0.53mm ID Fused Silica Columns	kit	21387

 **$\frac{1}{32}$ -Inch Replacement Nut**

Description	qty.	cat.#
$\frac{1}{32}$ " Replacement Nut	5-pk.	20389





**Secure, reliable column-to-column connections!**

### Vu2 Union™ Connectors

- Connect a guard column to an analytical column.
- Connect a column to a transfer line.
- Connect two columns in series.
- Repair a broken column.

Our Vu2 Union™ connector combines the simplicity of a Press-Tight® union with the strength of a metal union. The columns cannot unexpectedly disconnect, even at temperatures as high as 400°C.

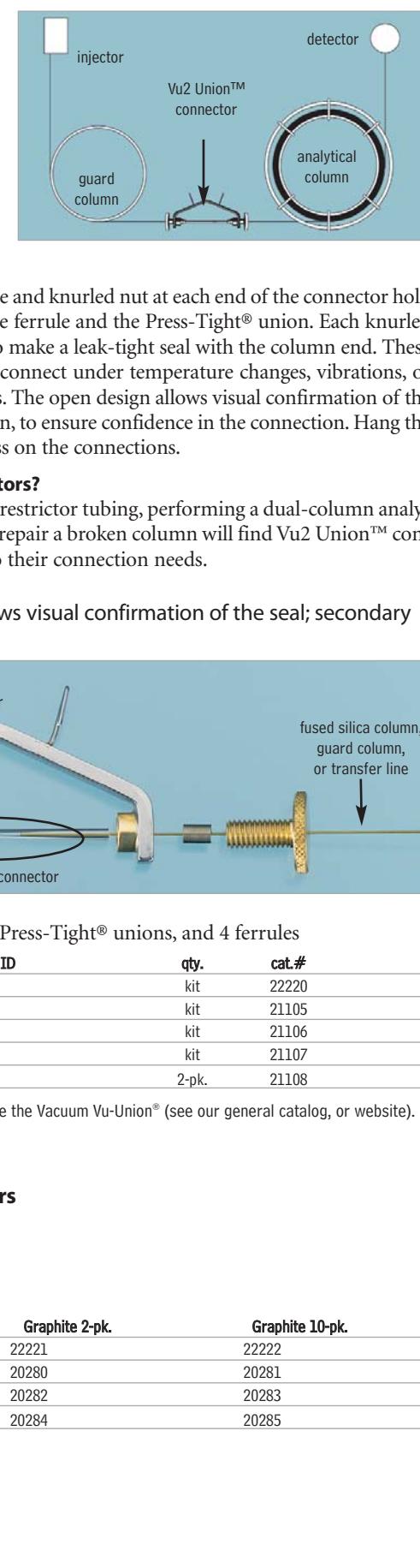
#### How does a Vu2 Union™ connector work?

A Press-Tight® union in the Vu2 Union™ connector joins the fused silica ends together; the ferrule and knurled nut at each end of the connector hold the tubing in place via a secondary seal between the ferrule and the Press-Tight® union. Each knurled nut applies independent pressure to each ferrule, to make a leak-tight seal with the column end. These ultra-strong connections will not unexpectedly disconnect under temperature changes, vibrations, or other stresses normally encountered in GC analyses. The open design allows visual confirmation of the seal between the column and the Press-Tight® union, to ensure confidence in the connection. Hang the connector from the column cage, to minimize stress on the connections.

#### Who will benefit from using Vu2 Union™ connectors?

Any analyst using guard columns, transfer lines, or restrictor tubing, performing a dual-column analysis with columns connected in series, or seeking to repair a broken column will find Vu2 Union™ connectors the simple, reliable, easy-to-use solution to their connection needs.

The Vu2 Union™ connector's open design allows visual confirmation of the seal; secondary seals ensure a leak-tight connection.



#### for more info

See page 43 for Universal Press-Tight® Connectors.

Kits include: Vu2 Union™ body, 2 knurled nuts, 2 Press-Tight® unions, and 4 ferrules

Description	Ferrules Fit Column ID	qty.	cat.#
Vu2 Union™ Connector Kit	0.10/0.15mm	kit	22220
Vu2 Union™ Connector Kit	0.18/0.28mm	kit	21105
Vu2 Union™ Connector Kit	0.32mm	kit	21106
Vu2 Union™ Connector Kit	0.45/0.53mm	kit	21107
Knurled nut		2-pk.	21108

NOTE: Not recommended for GC column-to-MS connections—use the Vacuum Vu-Union® (see our general catalog, or website).

#### Graphite Ferrules for Vu2 Union™ Connectors

- High-purity, high-density graphite.
- Stable to 450°C.
- No binders that can off-gas or adsorb analytes.
- Smooth surface and clean edges.

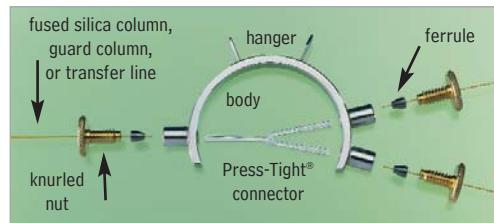


Ferrule ID	Fits Column ID	Graphite 2-pk.	Graphite 10-pk.
0.3mm	0.10/0.15mm	22221	22222
0.4mm	0.18/0.28mm	20280	20281
0.5mm	0.32mm	20282	20283
0.8mm	0.45/0.53mm	20284	20285

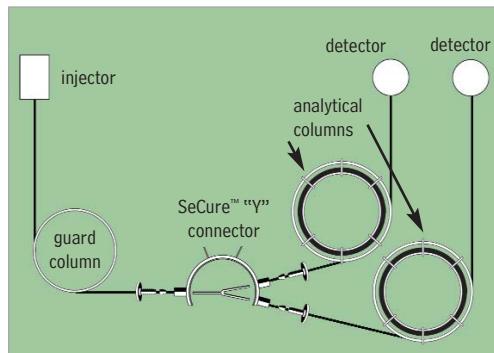
**SeCure™ "Y" Connector Kits**

- Connect two analytical columns to a transfer line or guard column.
- Use standard "Y" Press-Tight® connectors and  $\frac{1}{16}$ " graphite ferrules.
- Reliable seal integrity, will not unexpectedly disconnect during temperature-programmed analyses.
- Open design allows visual confirmation of the seal for added confidence in the connection.

Combine the simplicity of a "Y" Press-Tight® connector with the strength of a metal union. The ferrules and knurled nuts hold the fused silica tubing in place, which prevents the tubing from unexpectedly disconnecting, even at temperatures as high as 400°C.



The SeCure™ "Y" Connector's open design allows visual confirmation of the seal; secondary seals ensure a leak-tight connection.



The SeCure™ "Y" connector allows dual-column confirmational analysis with a single injection—one of the connector's many uses.

Kits include: SeCure™ "Y" connector body, 3 knurled nuts, "Y" Universal Press-Tight® union, 3 ferrules.

Description	Ferrules Fit Column ID	qty.	cat.#
SeCure™ "Y" Connector Kit	0.25/0.28mm	kit	20276
SeCure™ "Y" Connector Kit	0.28/0.32mm	kit	20277
SeCure™ "Y" Connector Kit	0.45/0.53mm	kit	20278
Knurled nut		3-pk.	20279

for **more** info

See page 43 for Universal "Y" Press-Tight® Connectors.

**Graphite Ferrules for SeCure™ "Y" Connectors**

- High-purity, high-density graphite.
- Stable to 450°C.
- No binders that can off-gas or adsorb analytes.
- Smooth surface and clean edges.

Ferrule ID	Fits Column ID	Graphite 10-pk.	Graphite 50-pk.
0.4mm	0.25/0.28mm	20200	20227
0.5mm	0.28/0.32mm	20201	20228
0.8mm	0.45/0.53mm	20202	20224



## GC Accessories



Kit installs easily,  
without special tools  
or plumbing.

### restek innovation!

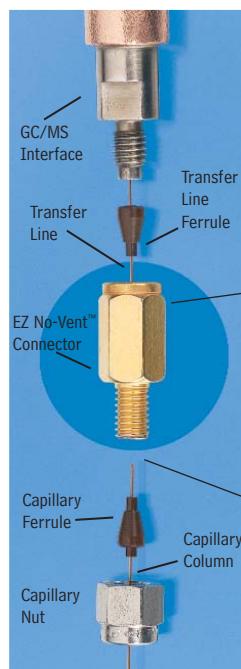
Change columns in minutes—  
without venting!

#### EZ No-Vent™ GC Column-Mass Spectrometer Connector

- Change GC/MS columns in minutes without venting—100µm transfer line throttles vacuum and prevents MS venting.
- Easy to install and maintain—no special tools or plumbing required.
- Gold-plated body for inertness.
- Deactivated transfer line keeps analytes focused; high-temperature polyimide ferrules eliminate leaks at the problematic transfer line fitting.
- Lower cost than other “no-vent” fittings.
- Available for Agilent GCs with 5971/5972 or 5973 GC/MS and Varian Saturn 2000 Series Mass Spectrometers.

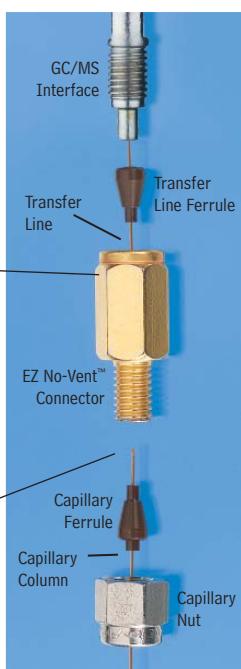
We designed the EZ No-Vent™ GC column-mass spectrometer connector to be simple and easy to use. After studying user feedback concerning our EZ-Vent™ 2000 connector, we re-engineered the connector fitting for even better performance. A critical orifice in the EZ No-Vent™ connector minimizes the amount of oxygen allowed into the MS source, eliminating the need for purge gas and enabling you to skip the lengthy vent and pump-down cycle otherwise required when you make a column change. This can save nearly a day of downtime with each column change. The EZ No-Vent™ connector easily attaches to the MS source without special tools or extra plumbing. Figure 1 shows the internal structure of the connector.

#### For Agilent GCs:



**Figure 1** The EZ No-Vent™ connector incorporates a laser machined orifice for optimal flow through the fitting. Coupled with the 100µm ID transfer line, it minimizes the amount of oxygen entering the MS, which eliminates the need for purge gases.

#### For Varian MSs:



Description	qty.	cat.#
<b>EZ No-Vent™ Connector Kit for Agilent 5971/5972 and 5973 GC/MS</b> Kit includes: EZ No-Vent™ Connector, two 0.4mm ID ferrules for capillary column, two 0.4mm ID ferrules for transfer line, 100µm deactivated transfer line (3 ft.), column plug, column nut.	kit	21323
<b>EZ No-Vent™ Connector Kit for Varian Saturn 2000 Series MSs</b> Kit includes: EZ No-Vent™ Connector, two 0.4mm ID ferrules for capillary column, two 0.4mm ID ferrules for transfer line, 100µm deactivated transfer line (3 ft.), column plug, column nut.	kit	22423
Replacement ferrules for connecting capillary column to EZ No-Vent™: 0.4mm ID 0.5mm ID	2-pk. 2-pk.	21015 21016
Replacement ferrules for connecting transfer line to EZ No-Vent™: 0.4mm ID	2-pk.	21043
Replacement 100µm deactivated transfer line	3 ft.	21018
Replacement EZ No-Vent™ Column Nut	5-pk.	21900
Replacement EZ No-Vent™ Plug	2-pk.	21915
Open-End Wrenches ( $\frac{1}{4}$ " x $\frac{5}{16}$ ")	2-pk.	20110

## Choosing a Stationary Phase

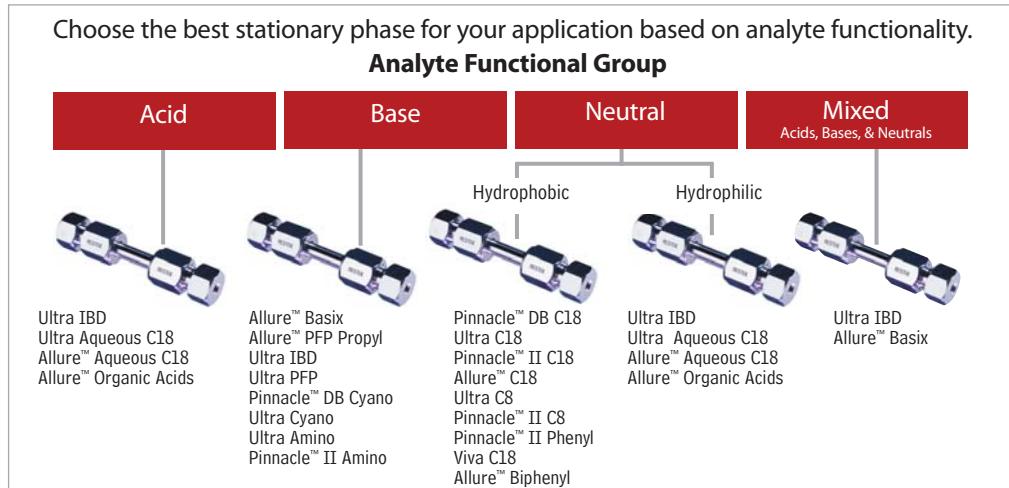
Identifying the appropriate stationary phase for your separation is the most critical step of column selection. The choice of stationary phase should be based on sample solubility and on chemical differences among the sample compounds that can be exploited to separate the analytes of interest (Figure 1).

Sample hydrophobicity also is a major determinant of the separation mode (reversed phase or normal phase). In reversed phase separations, the mobile phase is more polar than the stationary phase, which is traditionally a straight alkyl chain, most often octadecylsilyl, C18 (ODS). The majority of HPLC analyses are performed in reversed phase mode because most analytes of interest can be dissolved in mixtures of water and/or a polar organic solvent such as methanol or acetonitrile.

In normal phase separations, the mobile phase is less polar than the stationary phase (e.g., when bare silica is the stationary phase and hexane with a modifier is the mobile phase). The normal phase mode is used primarily when the reversed phase mode cannot be used, because reversed phase separations generally are more robust, reproducible, and versatile. Note that a stationary phase incorporating both polar and nonpolar functionality can be used in either reversed phase or normal phase mode. Cyano phases (e.g., Ultra, Pinnacle™ DB, or Pinnacle™ II cyano columns) commonly are used in either reversed phase or normal phase mode. Ultra IBD and Allure™ Basix columns also can be used for either reversed phase or normal phase separations. Allure™ PFP Propyl and Ultra PFP columns also display dual functionality.

**Figure 1**  
Choice of stationary phase is dependent upon polarity of the sample.

Non-polar analytes are more attracted to the less polar stationary phase. Polar analytes are more strongly retained by the more polar stationary phase.



## Pinnacle™ II Phenyl (USP L11)

### Physical Characteristics:

particle size: 3 $\mu$ m or 5 $\mu$ m, spherical  
pore size: 110 $\text{\AA}$   
carbon load: 6%

endcap: fully endcapped  
pH range: 2.5 to 10  
temperature limit: 80°C

### Chromatographic Properties:

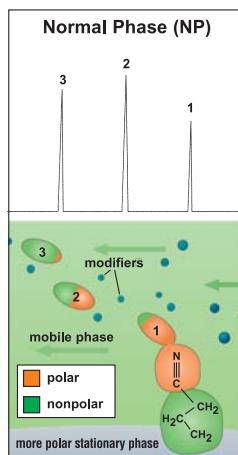
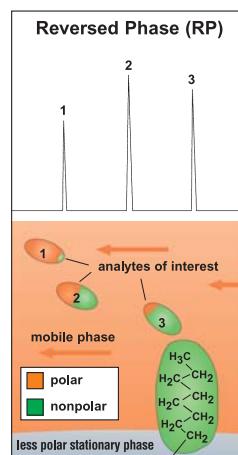
The Pinnacle™ II Phenyl phase offers unique selectivity versus traditional alkyl chain phases, especially for aromatic compounds.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3<math>\mu</math>m Columns</b>				
30mm	9215331	9215332	9215333	9215335
50mm	9215351	9215352	9215353	9215355
100mm	9215311	9215312	9215313	9215315
<b>5<math>\mu</math>m Columns</b>				
30mm	9215531	9215532	9215533	9215535
50mm	9215551	9215552	9215553	9215555
100mm	9215511	9215512	9215513	9215515
150mm	9215561	9215562	9215563	9215565

To order a 2.1mm, 3.2mm, or 4.6mm ID column with a Trident™ Integral Inlet Fitting, add "-700" to the catalog number for the column.

Example: 100mm x 4.6mm ID Ultra C18 column with Trident™ Integral Inlet Fitting: 9174315-700  
Nominal additional charge

For guard cartridges for these columns, see page 52.



## HPLC Columns

### Allure™ C18 (USP L1)

#### Excellent Columns for LC/MS and ELSD

##### Physical Characteristics:

particle size: 3µm or 5µm, spherical  
pore size: 60Å  
carbon load: 27%

endcap: fully endcapped  
pH range: 2.5 to 7.5  
temperature limit: 80°C

##### Chromatographic Properties:

Most retentive phase for hydrophobic and slightly polar analytes due to large surface area of the base silica and high-density bondings. High-purity packings exhibit excellent peak shapes for a wide range of compounds.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9164331	9164332	9164333	9164335
50mm	9164351	9164352	9164353	9164355
100mm	9164311	9164312	9164313	9164315
<b>5µm Columns</b>				
30mm	9164531	9164532	9164533	9164535
50mm	9164551	9164552	9164553	9164555
100mm	9164511	9164512	9164513	9164515
150mm	9164561	9164562	9164563	9164565

### Allure™ Basix (USP L10)

#### Excellent Columns for LC/MS and ELSD

##### Physical Characteristics:

particle size: 3µm or 5µm, spherical  
pore size: 60Å  
carbon load: 12%

endcap: fully endcapped  
pH range: 2.5 to 7.5  
temperature limit: 80°C

##### Chromatographic Properties:

Highly retentive propyl cyano phase. Excellent choice for analytes containing amine group functionality.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9161331	9161332	9161333	9161335
50mm	9161351	9161352	9161353	9161355
100mm	9161311	9161312	9161313	9161315
<b>5µm Columns</b>				
30mm	9161531	9161532	9161533	9161535
50mm	9161551	9161552	9161553	9161555
100mm	9161511	9161512	9161513	9161515
150mm	9161561	9161562	9161563	9161565

### Allure™ Biphenyl

##### Physical Characteristics:

particle size: 3µm or 5µm, spherical  
pore size: 60Å  
carbon load: 23%

endcap: yes  
pH range: 2.5 to 7.5  
temperature limit: 80°C

##### Chromatographic Properties:

Highly retentive and selective phase for aromatic compounds. Increased retention over phenyl phases; uses high-purity, Type B silica.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>5µm Columns</b>				
30mm	9166531	9166532	9166533	9166535
50mm	9166551	9166552	9166553	9166555
100mm	9166511	9166512	9166513	9166515
150mm	9166561	9166562	9166563	9166565
200mm	9166521	9166522	9166523	9166525
250mm	9166571	9166572	9166573	9166575

**Allure™ PFP Propyl****Excellent Columns for LC/MS and ELSD****Physical Characteristics:**

particle size: 3µm or 5µm, spherical  
pore size: 60Å  
carbon load: 17%

endcap: fully endcapped  
pH range: 2.5 to 7.5  
temperature limit: 80°C

**Chromatographic Properties:**

A pentafluorophenyl phase with a propyl spacer. Highly retentive for basic analytes. An excellent phase for separating nucleosides, nucleotides, purines, pyrimidines, halogenated compounds, β-blockers, and tricyclic antidepressants.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9169331	9169332	9169333	9169335
50mm	9169351	9169352	9169353	9169355
100mm	9169311	9169312	9169313	9169315
<b>5µm Columns</b>				
30mm	9169531	9169532	9169533	9169535
50mm	9169551	9169552	9169553	9169555
100mm	9169511	9169512	9169513	9169515
150mm	9169561	9169562	9169563	9169565

**Ultra C18 (USP L1)****Physical Characteristics:**

particle size: 3µm or 5µm, spherical  
pore size: 100Å  
carbon load: 20%

endcap: fully endcapped  
pH range: 2.5 to 7.5  
temperature limit: 80°C

**Chromatographic Properties:**

A retentive, high-purity packing that exhibits excellent peak shape for a wide range of compounds. Excellent general-purpose reversed phase column.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.0mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>					
30mm	9174331	9174332	9174333	—	9174335
50mm	9174351	9174352	9174353	—	9174355
100mm	9174311	9174312	9174313	—	9174315
<b>5µm Columns</b>					
30mm	9174531	9174532	9174533	—	9174535
50mm	9174551	9174552	9174553	—	9174555
100mm	9174511	9174512	9174513	9174514	9174515
150mm	9174561	9174562	9174563	9174564	9174565
250mm	9174571	9174572	9174573	—	9174575

**for more info**

Restek offers an extensive line of GC and HPLC columns, accessories, and replacement parts. Call to request our general catalog, or our HPLC products catalog, for a full listing of products, or visit us on the web at [www.restek.com](http://www.restek.com)

**To order a 2.1mm, 3.2mm, or 4.6mm ID column with a Trident™ Integral Inlet Fitting, add "-700" to the catalog number for the column.**

Example: 100mm x 4.6mm ID Ultra C18 column with Trident™ Integral Inlet Fitting: 9174315-700  
Nominal additional charge

**For guard cartridges for these columns, see page 52.**

# HPLC Columns

## free literature

*HPLC Analysis of Vitamins*

lit. cat.# 59181

Analyze Polar Compounds by Reversed Phase HPLC Using Ultra Aqueous C18 Columns

lit. cat.# 59177

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

### Ultra Aqueous C18 (USP L1)

#### Physical Characteristics:

particle size: 3µm or 5µm, spherical  
pore size: 100Å

endcap: no  
pH range: 2.5 to 7.5  
temperature limit: 80°C

#### Chromatographic Properties:

Highly retentive and selective for reversed phase separations of polar analytes. Highly base deactivated. Compatible with highly aqueous (up to 100%) mobile phases.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9178331	9178332	9178333	9178335
50mm	9178351	9178352	9178353	9178355
100mm	9178311	9178312	9178313	9178315
<b>5µm Columns</b>				
30mm	9178531	9178532	9178533	9178535
50mm	9178551	9178552	9178553	9178555
100mm	9178511	9178512	9178513	9178515
150mm	9178561	9178562	9178563	9178565
250mm	9178571	9178572	9178573	9178575

## Ultra IBD

### Specialized Columns for Mixed Polar and Nonpolar Compounds

#### Physical Characteristics:

particle size: 3µm or 5µm, spherical  
pore size: 100Å  
carbon load: 12%

endcap: no  
pH range: 2.5 to 7.5  
temperature limit: 80°C

#### Chromatographic Properties:

An intrinsically base-deactivated (IBD) phase, containing a polar group within, or intrinsic to, the hydrocarbon bonded phase. Unique selectivity and a high level of base deactivation, while reducing or eliminating the need for mobile phase additives.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9175331	9175332	9175333	9175335
50mm	9175351	9175352	9175353	9175355
100mm	9175311	9175312	9175313	9175315
<b>5µm Columns</b>				
30mm	9175531	9175532	9175533	9175535
50mm	9175551	9175552	9175553	9175555
100mm	9175511	9175512	9175513	9175515
150mm	9175561	9175562	9175563	9175565

#### To order a 2.1mm, 3.2mm, or 4.6mm ID column with a Trident™ Integral Inlet Fitting, add "-700" to the catalog number for the column.

Example: 100mm x 4.6mm ID Ultra C18 column with Trident™ Integral Inlet Fitting: 9174315-700  
Nominal additional charge

Also order the appropriate XG-XF fitting - see page 52.

**For guard cartridges for these columns, see page 52.**

## free literature

*Excellent LC/MS Separation of Penicillins and Cephalosporins Using Ultra IBD Columns*

lit. cat.# 59133

Analyze Nucleotides, Nucleosides, Purines, and Pyrimidines Simultaneously with the Ultra IBD Column

lit. cat.# 59141

The Ultra IBD Column Allows HPLC Separation of Polar and Non-Polar Analytes from the Same Sample

lit. cat.# 59512

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

**Ultra Cyano (USP L10)****Physical Characteristics:**

particle size: 3µm or 5µm, spherical  
 pore size: 100Å  
 carbon load: 8%

endcap: fully endcapped  
 pH range: 2.5 to 7.5  
 temperature limit: 80°C

**Chromatographic Properties:**

High-purity cyano phase with few silanol sites. Often a better choice than C18 phases for basic pharmaceuticals, especially regarding peak shape and selectivity. Cyano phases are more rugged than bare silica for normal phase analyses because they are less sensitive to small amounts of water present in the mobile phase.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9106331	9106332	9106333	9106335
50mm	9106351	9106352	9106353	9106355
100mm	9106311	9106312	9106313	9106315
<b>5µm Columns</b>				
30mm	9106531	9106532	9106533	9106535
50mm	9106551	9106552	9106553	9106555
100mm	9106511	9106512	9106513	9106515
150mm	9106561	9106562	9106563	9106565

**Ultra Phenyl (USP L11)****Physical Characteristics:**

particle size: 3µm or 5µm, spherical  
 pore size: 100Å  
 carbon load: 10%

endcap: fully endcapped  
 pH range: 2.5 to 7.5  
 temperature limit: 80°C

**Chromatographic Properties:**

High-purity, highly retentive, base-deactivated phase with alternative selectivity to straight chain hydrocarbon phases, especially for aromatic analytes.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
<b>3µm Columns</b>				
30mm	9105331	9105332	9105333	9105335
50mm	9105351	9105352	9105353	9105355
100mm	9105311	9105312	9105313	9105315
<b>5µm Columns</b>				
30mm	9105531	9105532	9105533	9105535
50mm	9105551	9105552	9105553	9105555
100mm	9105511	9105512	9105513	9105515
150mm	9105561	9105562	9105563	9105565
200mm	9105521	9105522	9105523	9105525
250mm	9105571	9105572	9105573	9105575



# HPLC Columns

**Trident™ Direct provides three levels of protection**



**Trident™ Direct high-pressure filter**  
Protection against particulate matter.



**Trident™ Direct 10mm guard cartridge holder with filter**  
Protection against particulate matter and moderate protection against irreversibly adsorbed compounds.



**Trident™ Direct 20mm guard cartridge holder with filter**  
Protection against particulate matter and maximum protection against irreversibly adsorbed compounds.

## Trident™ Direct Guard Column System

### Easy to Use, Low Dead Volume—The Ultimate Combination of Convenience and Column Protection

The system offers three levels of protection and guard cartridges in four dimensions, with a variety of bonded phases to match your analytical column. The economical, leak-free cartridge design provides an unprecedented combination of convenience, economy, and reliability. The foundation of the Trident™ Direct system is a reusable direct connect holder that easily attaches to any HPLC column using CPI- or Waters®-style end fittings.\* The system is available in configurations to match different protection level needs: in-line filter, in-line filter with holder for 10mm guard cartridge, and in-line filter with holder for 20mm guard cartridge. The guard cartridges are available in 2.1 and 4.0mm ID and are interchangeable within the appropriate length holder.

Description	qty.	cat.#
High-pressure filter	ea.	25082
10mm guard cartridge holder without filter	ea.	25083
10mm guard cartridge holder with filter	ea.	25084
20mm guard cartridge holder without filter	ea.	25085
20mm guard cartridge holder with filter	ea.	25086
Connection tip for Waters®-style end fittings	ea.	25088
PEEK® tip standard fittings	ea.	25087
Replacement cap frits: 4mm, 2.0µm	5-pk.	25022
Replacement cap frits: 4mm, 0.5µm	5-pk.	25023
Replacement cap frits: 2mm, 2.0µm	5-pk.	25057

\*The standard PEEK® tip in Trident™ Direct systems is compatible with Parker®, Upchurch®, Valco®, and other CPI-style fittings. To use Trident™ Direct systems with Waters®-style end fittings, replace the tip with cat.# 25088.

## Restek's Exclusive Trident™ Integral System

The system's foundation consists of the analytical column configured with our exclusive Trident™ end fitting and XF fitting. This configuration contains the standard internal frit as well as a replaceable cap frit, which easily can be changed without disturbing the packed bed. Changing the external frit can reverse the effects of accumulated particles, such as high backpressure or peak distortion. To obtain this basic configuration, simply order any Restek HPLC column, and add the suffix -700 to the catalog number for the column. (Nominal additional charge. )

Compound	qty.	cat.#
XG-XF Fitting for 10mm Guard Cartridge	ea.	25026
XG-XF Fitting for 20mm Guard Cartridge	ea.	25062
Replacement XF Filter Fitting	ea.	25024
Replacement Cap Frits	5-pk.	25022
Replacement Cap Frits	5-pk.	25023
Replacement cap frits	5-pk.	25057

## Trident™ HPLC Guard Cartridges

Guard Cartridges	3-pk. (10 x 2.1mm)	3-pk. (10 x 4.0mm)	2-pk. (20 x 2.1mm)	2-pk. (20 x 4.0mm)
Allure™ Basix	916150212	916150210	916150222	916150220
Allure™ C18	916450212	916450210	916450222	916450220
Allure™ PFP Propyl	916950212	916950210	916950222	916950220
Pinnacle™ II Phenyl	921550212	921550210	921550222	921550220
Ultra Aqueous C18	917850212	917850210	917850222	917850220
Ultra C18	917450212	917450210	917450222	917450220
Ultra Cyano	910650212	910650210	910650222	910650220
Ultra IBD	917550212	917550210	917550222	917550220
Ultra Phenyl	910550212	910550210	910550222	910550220



10 & 20mm Guard Cartridges

## Genuine Restek Replacement Parts for Agilent HPLC Systems

Description	Model #	Similar to Agilent part #	qty.	cat.#
Preventive Maintenance Kit (Includes: rotor seal, needle seat, needle assembly, seat cap)	1050	01078-68721	kit	25259
Autosampler Preventive Maintenance Kit (Includes: rotor seal, needle assembly, needle seat)	1100	G1313-68709	kit	25271
Pump Maintenance Kit (Includes: PTFE frit, outlet cap, active inlet cartridge, gold disk seal, 2 piston seals, glass solvent filter)	1050 & 1100	G1311-68710	kit	25270
Outlet Ball Valve, Binary Pump	1100	G1312-60012	ea.	25267
Outlet Ball Valve	1050 & 1100	G1311-60012	ea.	25276
Sieves for Outlet Valve	1050 & 1100	5063-6505	10-pk.	25266
Check Valve Cartridge Assembly	1090	79835-67101	ea.	25344
Piston Seals, PTFE w/Graphite	1050 & 1100	5063-6589	2-pk.	22482
Piston Seals, PTFE w/Graphite	1050 & 1100	5063-6589	10-pk.	22483
Piston Seals (Black)	1090	5062-2494	4-pk.	25347
Seal Wash Kit, Binary Pump (4 seals, 4 gaskets)	1100	—	kit	25268
Seal Wash Kit (2 seals, 2 gaskets)	1100	—	kit	25269
Wash Seal	1050 & 1100	0905-1175	ea.	25277
Sapphire Piston	1050 & 1100	5063-6586	ea.	25273
Sapphire Piston	1090	6980-0672	ea.	25345
Needle Seat	1050	79846-67101	ea.	25258
Needle Seat	1090	79846-67101	ea.	25348
Needle Seat Assembly	1100	G1313-87101	ea.	25265
Needle Assembly	1100	G1313-87201	ea.	25278
Rotor Seal (not for use with 7125 injection valve)	1050	0101-0626	ea.	25272
Rotor Seal	1100	0100-1853	ea.	25275
Rotor Seal (Rheodyne®-style)	1090	0101-0623	ea.	25349
Frits, PTFE	1050 & 1100	01018-22707	5-pk.	25466
Seal, Gold Disk (outlet)	1050 & 1100	5001-3707	ea.	25467
Detector Lamp, 1090 DA, 1050 VW/DA/MWD	1090, 1050	79883-60002	ea.	25260
Lamp, DAD G1315A, G1365A	1100	2140-0590	ea.	25261
Lamp, VWD G1314A	1100	G1314-60100	ea.	25262
8453 Deuterium Lamp	—	2140-0605	ea.	25263
G1321 Fluorescence Detector Flash Lamp	—	2140-0600	ea.	25264
Lamp, DAD Long Life Deuterium (2000 hours)	1100	5181-1530	ea.	25399



## for more info

Genuine Restek Replacement Parts for HPLC Systems

lit. cat.# 59012A

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

## Genuine Restek Replacement Parts for Thermo Separation HPLC Systems

Description	Model #	Similar to TSP/SP part #	qty.	cat.#
Inlet Check Valve Assembly	SP8800 & P-Series Pumps	A3495-010	ea.	25474
Outlet Check Valve Assembly	SP8800 Series Pumps	A3490-010	ea.	25475
Piston	SP8800 & P-Series Pumps	A3102-010	ea.	25476
Back-up Seal	SP8800 & P-Series Pumps	A2963-010	ea.	25477
Plunger Seal, Gold Superseal	SP8800 & P-Series Pumps	A2962-010	ea.	25478
Check Valve and Transducer Assembly	P-Series Pumps	A3990-010	ea.	25479
Kel-F® Washer	P-Series Pumps	A2973-010	ea.	25480
Rotor Seal Assembly, Rheodyne® 7010	TSP AS100, 300, 1000, 3000, 3500, 8875, and 8880 Autosamplers	7010-039	ea.	25481
Syringe Assembly, 250µL	TSP AS100, 300, 1000, 3000, 3500, 8875, and 8880 Autosamplers	A3588-020	ea.	25482
Syringe, 500µL	TSP AS100, 300, 1000, 3000, 3500, 8875, and 8880 Autosamplers	A3588-010	ea.	25483
Lamp, UV	Linear UV-200, 203, 204, 205, 206, and UV 100, 150, 1000, and 2000 Detectors	9551-0023	ea.	25484
Description	Model #	Similar to TSP part #	qty.	cat.#
Check Valve Cartridge	LDC Constametric Pumps	900946	ea.	25485
Sapphire Plunger	LDC Constametric Pumps	801306	ea.	25486
Plunger Seal Kit, Gold	LDC Constametric Pumps	31-36-00754	ea.	25487
Plunger Seal, Black	LDC Constametric Pumps	206129001	ea.	25488
Plunger Seal, Gold	LDC Constametric Pumps	206156001	ea.	25489
Lamp, Deuterium	LDC SM-I, II, III, 3000, 3100, 3100X, and 4000 Detectors	108035	ea.	25490
Lamp, Deuterium Pre-aligned	LDC 3200 and 4100 Detectors	900918001	ea.	25491

## did you know?

We also offer Genuine Restek Replacement Parts for Beckman, Hitachi, PerkinElmer, and Shimadzu systems. Please refer to our current catalog - or visit our website.

# HPLC Accessories

## Genuine Restek Replacement Parts for Waters HPLC Systems



Description	Model #	Similar to Waters part #	qty.	cat.#
Preventative Maintenance Kit Includes: sparge diffuser, filter insert, compression screws, SS ferrule, battery for 2690/717, 250 $\mu$ L WISP™ syringe, seal wash plunger seal kits (2), wash tube seal kits (4), 2690 seal pack rebuild kit (steel bodies not included), 2690 head plunger seal kits (2), solvent reservoir 20 $\mu$ m filters (4), Alliance® check valve cartridges (2), Alliance® plunger assemblies (2), 2690 face seals (4)	Alliance® 2690, 2695	WAT270944	kit	25143
Preventative Maintenance Kit Includes:				
PerformancePLUS™ cartridges (2), sparge diffusers (4), Super Seals™ (2), solvent reservoir 20 $\mu$ m filters (2), sapphire plungers (2), reference valve rebuild kit, inlet manifold kit	600 Pump	WAT052675	kit	25144
Preventative Maintenance Kit Includes: 717 seal pack with needle, filter insert, 250 $\mu$ L WISP™ syringe	717 Autosampler	WAT052669	kit	25145
Preventative Maintenance Kit Includes: 616/326/625 plunger assemblies (2), pump seal kit, sparge diffusers (4), solvent reservoir 20 $\mu$ m filters (4), 616 cartridge assemblies (4)	616 Pump	WAT052672	kit	25146
Inlet Check Valve Assembly	M6KA, 501, 510, 515, 590, 600E	33679, 25214	ea.	25360
Inlet Check Valve Housing	M6KA, 501, 510, 515, 590, 600E	25203	ea.	25361
Inlet Check Valve Rebuild Kit	M6KA, 501, 510, 515, 590, 600E	60495	2-pk.	25362
Outlet Check Valve Assembly (Actuator Style)	M6KA, 501, 510, 515, 590, 600E	25030	ea.	25363
Outlet Check Valve Housing (Actuator Style)	M6KA, 501, 510, 515, 590, 600E	25212	ea.	25364
Outlet Check Valve Rebuild Kit (Actuator Style)	M6KA, 501, 510, 515, 590, 600E	26016	2-pk.	25365
Outlet Check Valve Assembly (Ball & Seat Style)	M6KA, 501, 510, 515, 590, 600E	25216	ea.	25366
Outlet Check Valve Housing (Ball & Seat Style)	M6KA, 501, 510, 515, 590, 600E	25207	ea.	25367
Outlet Check Valve Rebuild Kit (Ball & Seat Style)	M6KA, 501, 510, 515, 590, 600E	26014	2-pk.	25368
Inlet Check Valve Assembly, 225 $\mu$ L (Extended Flow)	M6KA, 501, 510, 515, 590, 600E	60307	ea.	25369
PerformancePLUS™ Check Valve Cartridge	M6KA, 501, 510, 515, 590, 600E	700000254	2-pk.	25370
Check Valve Rebuild Kit (Extended Flow)	M6KA, 501, 510, 515, 590, 600E	88223	2-pk.	25371
PerformancePLUS™ Check Valve Housing	M6KA, 501, 510, 515, 590, 600E	—	ea.	25372
Check Valve Cartridges	Alliance®	WAT270941	2-pk.	25373
Super Seal™ for Analytical Heads	M6KA, 501, 510, 515, 590, 600E	22946, 22934	ea.	25374
Plunger Seal, Gold for Analytical Heads*	M6KA, 501, 510, 515, 590, 600E	22934	ea.	25375
Plunger Seal, Black for graphite-filled Teflon®	M6KA, 501, 510, 515, 590, 600E	26613	ea.	25378
Plunger Seal, Black for EF Heads	510, 590, 600E	26644	ea.	25379
Plunger Seal, Gold for EF Heads	510, 590, 600E	26644	ea.	25380
Seal Wash Plunger Seal	Alliance®	WAT271018	2-pk.	25386
Head Plunger Seal Kit	Alliance®	WAT270938	2-pk.	25387
Head Plunger Seal Kit (Black)	Alliance®	WAT271066	2-pk.	25388
Insert Seal Parts Kit	M6KA, 501, 510, 515, 590, 600E	60012	kit	25389
Sapphire Plunger	M6KA, 510, 590, 600	25656	ea.	25381
Sapphire Plunger (Extended Flow)	510, 590, 600E	60304	ea.	25382
Sapphire Plunger	M45, M501	26524	ea.	25383
Sapphire Plunger	M515	WAT207069	ea.	25384
Sapphire Plunger	616, 625, 626	31788	ea.	25420
Sapphire Plunger	Alliance®	WAT270959	ea.	25385
Single Solvent Inlet Manifold	600E	60034, 60042	ea.	25390
Pressure Transducer	M6KA, 501, 510, 515, 590, 600E	60328	ea.	25391
Draw-Off Tube Assembly	M6KA, 501, 510, 515, 590, 600E	25470	ea.	25392
1/16" Stainless Steel TEE	M6KA, 501, 510, 515, 590, 600E	75215	ea.	25411
Inlet Manifold Kit	M45, 501, 510, 590, 600E	60448	kit	25412
Ferrule, Stainless Steel	515	22330	ea.	25417
Gradient Proportioning Valve, 9Volt	600E	34423	ea.	25418
Gradient Proportioning Valve, 12Volt	600E	62037	ea.	25419
Wash Face Seal	Alliance® 2690	WAT271017	ea.	25428
Wash Tube Seal Kit	Alliance® 2690	WAT270940	4-pk.	25429
Proportioning Valve	Alliance® 2690	WAT270927	ea.	25430

\*Ultra-high molecular weight polyethylene (UHMWPE).

### Mobile Phase Degasser

Dissolved oxygen can cause flow rate instability and increased baseline noise. Also, it has a quenching effect on fluorescence detection and increases the background of UV detectors. Dissolved gases can out-gas in the HPLC system, forming bubbles in check valves, at connections, or in detector flow cells.



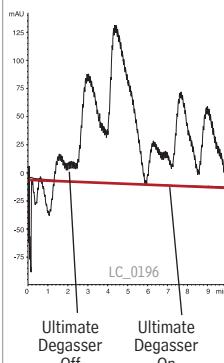
In-line vacuum degassing is more effective at removing dissolved gas from mobile phases than sonication or helium sparging. Most in-line degassers withdraw gas across a gas-permeable PTFE tubing membrane, but the Degasys Ultimate Degasser uses tubing composed of an amorphous fluoropolymer that is 200 to 300 times more gas permeable than PTFE. This translates into the ability to use shorter tubing for removing dissolved gas. This new material also has better tubular burst strength than PTFE. To prevent cross contamination, each channel on this Degasys unit is individually encased within its own vacuum chamber.

#### Specifications:

Residual Oxygen <sup>1</sup>	Pressure Loss <sup>1</sup>	Internal Volume	Wetted Parts	Max Flow Rate
0.9ppm	0.24psi	500µL	PTFE	7mL/min./channel
			PTFE	
			ETFE	
			PPS	

<sup>1</sup> At a flow rate of 1mL/min.

**Degasys Ultimate Degasser provides highly stable baselines**



Mobile Phase: water:methanol 50:50  
Flow: 1.0 mL/min.  
Det.: UV @ 210nm

Not recommended for use with fluorinated mobile phases, including mobile phases containing TFA.

### Solvent Debubbler

Bubbles in an HPLC system can cause check valve malfunctions and pump cavitation, seriously affecting pump performance. The debubbler removes bubbles from the fluid stream before it enters the pump. The gas/liquid interface is easily visible through the translucent wall of the device. Loosening the airtight cap releases the trapped gas. The debubbler is fitted with a bracket and universal connecting tips.



#### Description

	qty.	cat.#
Solvent Debubbler with Bracket	ea.	25014

### Sidewinder™ Column Heater

- Easy to set up!
- Operation range: 5°C above ambient to 85°C, ±1°C.
- Lightweight, compact design fits in small spaces.
- Column holder can be placed in any orientation.

This unique design completely encloses any HPLC analytical column up to 25cm in length. Two lengths of heater jackets are available: the short column holder accommodates columns up to 10cm in length, while the long column holder holds columns up to 25cm in length. The control module provides optimum heating performance, accuracy to within 1°C, and stability to within 0.1°C. The new Sidewinder™ controller has fast 10Hz sampling for improved responsiveness. Power requirements: 24V control unit for maximum stability; RS232 control allows external programming.

Description	qty.	cat.#
Temperature Control Module and Long Column Holder, 25cm Holder	ea.	26516
Temperature Control Module and Short Column Holder, 10cm Holder	ea.	26517

### Sidewinder™ Heater/Cooler Temperature Control Module

- Operation range: 5 - 55°C, ±0.2°C.
- Ability to program multiple temperature points.
- Accommodates columns up to 30cm in length and 7.8mm ID.
- Compact design.

The Sidewinder™ heater/cooler unit has a doubly insulated cover to maintain the programmed temperature to within 0.2°C. The 24V control unit provides maximum stability and rapid equilibration times; RS232 control allows external programming.

Description	qty.	cat.#
Sidewinder™ Heater/Cooler Temperature Control Module	ea.	26518

All Sidewinder™ temperature control products carry the value recognized CE mark. Each unit meets the demanding electromagnetic emission standards of the new European Union Directives, United States standards, and Canadian standards.

## HPLC Accessories



### High-Pressure Frit-Type In-Line Filters

Restek's high-pressure in-line filter is a stand-alone version of the Trident™ column protection system. The filter is specifically designed for ease of use, low dead-volume, and flexibility. The filter has a replaceable, PEEK® encapsulated 316 stainless steel frit with a surface area of 12mm<sup>2</sup>. The standard frit shipped with the filter has a 2.0µm porosity; however, it may be replaced with an optional 0.5µm porosity frit. Use of this filter can greatly extend column life, thereby reducing costs and saving maintenance time. Tubing OD 1/16"; Connectors-CPI

Description	Porosity	qty.	cat.#
Frit-Type In-Line Filter	2.0µm	ea.	25041
Replacement cap frits: 4mm	0.5µm	5-pk.	25023
Replacement cap frits: 4mm	2.0µm	5-pk.	25022



### High-Pressure Cup-Type In-Line Filters

High-pressure cup-type filters can be used in fluid streams operating to 15,000psi. The cup-shaped filter elements have a large (2.5 cm<sup>2</sup>) surface area to give long operating lifetime. Mounted in screw-type adapters, they are easily removed for cleaning. Normally, backflushing and cleaning in an ultrasonic bath with an appropriate solvent will restore them. If they become permanently clogged, replacement elements are available.

Housings and all wetted parts are type 316 stainless steel. Filters are packaged with appropriate gland nuts and ferrules. A bulkhead type is available for thru-panel mounting. Tubing OD 1/16"; Connectors-CPI

Description	Porosity	qty.	cat.#
Cup-Type In-Line Filter	0.5µm	ea.	25000
Cup-Type In-Line Filter	2.0µm	ea.	25001
Replacement Filter Elements & Seals	0.5µm	2-pk.	25002
Replacement Filter Elements & Seals	2.0µm	2-pk.	25003



### Low-Pressure Slip-On Inlet Filter for Mobile Phase Reservoir

A type 316 stainless steel tip with a Tefzel® collar seals to a corrosion-resistant type 316 stainless steel filter element. The slip-on filter easily attaches to the pump inlet line, without the use of wrenches. The universal tip accommodates standard PTFE tubing inner diameters. The cylindrical filter is standard 10µm porosity. 1/8" OD (fits Altex, ISCO, LDC, Varian, Waters, PerkinElmer, and other pumps)

Description	qty.	cat.#
Slip-on Inlet Filter	ea.	25008



### Low-Pressure CPI Inlet Filter for Mobile Phase Reservoir

A type 316 stainless steel knurled cap and Tefzel® CPI ferrule seals to 1/8" OD PTFE tubing when finger-tightened onto the precision-machined filter holder. The filter element is replaceable. Standard 10µm porosity protects delicate pump components from particles but introduces very little pressure drop. 1/8" OD. May be used as a helium sparging diffuser.

Description	qty.	cat.#
CPI Inlet Filter	ea.	25009
Replacement Elements: 10µm filter	2-pk.	25010



### Mobile Phase Spargers and Filters

These helium spargers offer an inexpensive way to prepare and maintain mobile phases free of dissolved gas. They are made from 316 stainless steel and PEEK® and are compatible with most solvents.

Description	qty.	cat.#
Sparge Filter: 2µm	ea.	25311
Inlet Filter: 10µm	ea.	25312
Inlet Filter: 20µm	ea.	25313

### pinnacle™ II hplc columns

Developed using Restek silica. We strictly control the quality of raw material, phase bonding, and column packing. You'll be impressed with our column-to-column reproducibility!

For more information and applications,  
request the Pinnacle™ II Column flyer. (lit. cat. #59281)

**PEEK® Fitting Extractor**

Drill into the broken fitting, then screw the extractor into the fitting and remove it easily.



Description	qty.	cat.#
PEEK® Fitting Extractor	ea.	25325

**PEEK® Union Connector**

Allows you to quickly and reliably connect two pieces of  $\frac{1}{16}$ -inch tubing. 0.3mm union bore. End fittings included.

Description	qty.	cat.#
PEEK® Union Connector $\frac{1}{16}$ "	2-pk.	25323

**Zero-Dead-Volume Internal Union**

Restek is pleased to offer a selected line of Valco® fittings for connecting fused silica or  $\frac{1}{16}$ - or  $\frac{1}{8}$ -inch metal tubing. For over 30 years, Valco® Instrument Co. has been the leading designer and manufacturer of valves and fittings for precision analytical instrumentation. Valco® fittings have been designed for the specific demands of instrumentation and manufactured with the tight tolerances and premium quality that analysts require. If you don't see the Valco® fitting you need, please request special ordering information.



Ends of tubing seat squarely at bottoms of fitting details. 300 series stainless steel. For  $\frac{1}{16}$ -inch OD tubing. Stainless steel ferrules included.

Description	Union Bore	Valco® #	qty.	cat.#
Internal Union	0.15mm	ZU1XC	ea.	20147
Internal Union	0.25mm	ZU1C	ea.	20148
Internal Union	0.75mm	ZU1	ea.	20149
Internal Union	$\frac{1}{16}$ "	ZU1T	ea.	20150

**Universal 10-32 PEEK® Column Connectors and Plugs**

Universal PEEK® Connectors allow easy installation of all  $\frac{1}{16}$ -inch tubing, including stainless steel.

Description	qty.	cat.#
PEEK® Column Connector (beige, round body)	10-pk.	25015
PEEK® Column Plug (black)	10-pk.	25016
PEEK® Fingertight Fittings (blue, flat-sided)	10-pk.	25324

**Rheodyne® Style Nut and Ferrule**

Replacement long nut for connecting stainless steel tubing to a Rheodyne® 6-port valve or other Rheodyne® part.

Description	qty.	cat.#
$\frac{1}{16}$ " Rheodyne® Style Nut	10-pk.	25095
$\frac{1}{16}$ " Rheodyne® Style Ferrule	10-pk.	25096



**Vials****Crimp-Top Vials, Snap Seal™ Style (12 x 32mm, 11mm Crimp)**

Description	100-pk.	1000-pk.
2.0mL Clear Glass Vial w/White Graduated Marking Spot*	24383	24384
2.0mL Amber Glass Vial w/White Graduated Marking Spot*	24385	24386
2.0mL Clear Glass Vial without Graduated Marking Spot	21152	21153

**11mm Aluminum Crimp Seals with Septa**

Description	100-pk.	500-pk.	1000-pk.
Silver Seal, PTFE/Natural Rubber Septum	21174	—	21175
Blue Seal, PTFE/Natural Rubber Septum	24351	—	24352
Green Seal, PTFE/Natural Rubber Septum	24353	—	24354
Red Seal, PTFE/Natural Rubber Septum	24355	—	24356
Yellow Seal, PTFE/Natural Rubber Septum	24357	—	24358
Mixed Colors, PTFE/Natural Rubber Septum	—	21724	—
Silver Seal, PTFE/Silicone Septum	24359	—	24360
Blue Seal, PTFE/Silicone Septum	24361	—	24362
Green Seal, PTFE/Silicone Septum	24363	—	24364
Red Seal, PTFE/Silicone Septum	24365	—	24366
Yellow Seal, PTFE/Silicone Septum	24367	—	24368
Mixed Colors, PTFE/Silicone Septum	—	21725	—
Silver Seal, PTFE/Silicone/PTFE Septum**	24369	—	24370

**Convenience Kits: Vials, Caps, & Septa**

Vials packaged in a clear-lid tray. Caps with septa packaged in a plastic bag.

Description	100-pk.	1000-pk.
2.0mL Clear Vial, <b>deactivated</b> , PTFE/Natural Rubber Seal†	24671	24672
2.0mL Amber Vial, <b>deactivated</b> , PTFE/Natural Rubber Seal†	24673	24674
2.0mL Clear Vial, untreated, PTFE/Natural Rubber Seal	21196	21197
2.0mL Amber Vial, untreated, PTFE/Natural Rubber Seal	21198	21199
2.0mL Clear Vial, untreated, PTFE/Silicone Seal	24646	24647
2.0mL Amber Vial, untreated, PTFE/Silicone Seal	24648	24649



Glass, Flat Bottom Insert w/ID Ring      Glass, Limited Volume Insert with Bottom Spring

**Limited Volume Inserts for 2mL Crimp-Top & Short-Cap, Screw-Thread Vials**

Description	100-pk.	1000-pk.
50µL Glass, Polypropylene, Bottom Spring	24513	21782
250µL Glass, Big Mouth Insert w/ Bottom Spring	21776	21777
250µL Glass, Big Mouth Insert w/ Glass Flange (Step™ design)‡‡	24516	21779
350µL Glass, Flat Bottom Insert	21780	24517
350µL Glass, Flat Bottom Insert w/ ID Ring	24692	24693
250µL Polypropylene, Bottom Spring	24518	—
250µL Polypropylene, Top Flange	24519	—
250µL Polypropylene, No Spring	24520	—



6.0mL Headspace Vial with PTFE/Silicone Seal

**Headspace Autosampler Vials\***

Description	100-pk.	1000-pk.
a) 6mL Clear Vial	21166	21167
b) 10mL Clear Vial, Flat Bottom	24683	24684
c) 10mL Clear Vial, Rounded Bottom	21164	21165
d) 20mL Clear Vial, Flat Bottom	24685	24686
e) 20mL Clear Vial, Rounded Bottom	21162	21163
f) 27mL Clear Vial	21160	21161

**20mm Aluminum Seals w/Septa, Assembled**

Description	100-pk.	1000-pk.
Silver Seal w/ PTFE/Gray Butyl Rubber	21761	21762
Silver Seal w/ PTFE/Silicone	21763	21764
Pressure Release Silver Seal w/ PTFE/Gray Butyl Rubber Septum <125°C	21765	21766
Pressure Release Silver Seal w/ PTFE/Silicone Septum >125°C	21767	21768

\*Colored marking spots available on request in blue, green, rust, or yellow (1000 packs only).

\*\*Individual colored seals available on request.

†Silcote™ CL7 deactivation.

‡Not to be used with 9mm screw-thread vials.

# Syringes

## Standard Micro-Liter Syringes for Agilent 7673, 7683, and 6850 Autosamplers

- Hamilton and SGE syringes are designed and tested to meet critical autosampler performance.
- SGE manufactures autosampler syringes for every major GC instrument company.
- Needle point styles are designed to withstand multiple, fast injections through a septum.

### Hamilton Syringes

Volume	Needle Term.	Needle Gauge	Needle Length	Point Style	Hamilton		Restek cat.#
					Model	cat.#	
5µL	ASN	23s	1.71"	Agilent	75	87990	6-pk. 20170
5µL	ASN	26s	1.71"	Agilent	75	87989	6-pk. 21230
5µL	ASN	23s-26s	1.71"	Agilent	75	87994	6-pk. 24594
10µL	ASN	23s	1.71"	Agilent	701	80390*	6-pk. 20169
10µL	ASN	26s	1.71"	Agilent	701	80389	6-pk. 24599
10µL	ASN	23s-26s	1.71"	Agilent	701	80391	6-pk. 24600

### SGE Syringes

Volume	Needle Term.	Needle Gauge	Needle Length	Point Style	SGE		Restek cat.#
					Model	cat.#	
5µL	F	23	42mm	Cone	SK-5F-HP-0.63	001814	6-pk. 24783
5µL	F	26	42mm	Cone	SK-5F-HP-0.47	001804	6-pk. 24782
5µL	F	23-26s	42mm	Cone	SK-5F-HP-0.63/0.47	001822	6-pk. 21214
10µL	F	23	42mm	Cone	SK-10F-HP-0.63	002814	6-pk. 24787
10µL	F	26	42mm	Cone	SK-10F-HP-0.47	002804	6-pk. 24786
10µL	F	23-26s	42mm	Cone	SK-10F-HP-0.63/0.47	002822	6-pk. 21215

\*Designated by Agilent as #80397.

### 23s—Single Gauge Needle

- Most popular gauge for Agilent 7673.
- Best for Merlin Microseal® septum and standard septum-equipped GCs.
- For packed column injection ports.
- For split/splitless injection ports.

### 26s—Single Gauge Needle

- For on-column injection ports.
- For split/splitless injection ports.

### 23s-26s—Dual Gauge (tapered)

- Durability of a 23s gauge needle.
- Ability of a 26s gauge needle to perform split/splitless and on-column injections.

## Syringes for Agilent 1090 & 1100 LC Autosamplers



25µL, 1/4-32 UNEF Thread

### SGE Syringes

Volume	SGE			Restek cat.#
	Model	cat.#	qty.	
25µL	25D-HP1090-GT	003670	ea.	22290
250µL	250D-HP1090-GT	006670	ea.	22291

### Guide to Needle Termination Codes

**Hamilton:**  
(ASN) Autosampler  
Cemented Needle

**SGE:**  
(F) Fixed Needle

## ordering note

Hamilton and SGE syringes are in stock and available for same-day shipment.

## Syringes for Waters WISP® LC Autosamplers



250µL, 1/4-28 UNF Thread

### SGE Syringes

Volume	SGE			Restek cat.#
	Model	cat.#	qty.	
25µL	25D-WISP	003990	ea.	22293
250µL	250D-WISP	006690	ea.	22294

# Sample Preparation



All cartridges are polypropylene and have polyethylene frits unless otherwise noted.

Strong Anion Exchange (SAX)  
Strong Cation Exchange (SCX)  
Weak Anion Exchange (WAX)  
Weak Cation Exchange (WCX)

## Resprep™ SPE Cartridges: Normal Phase

Hydrophilic (polar) adsorbents used to extract hydrophilic analytes from nonpolar matrices, such as organic solvents (e.g., polar contaminants from sample extracts).

	3mL/200mg (50-pk.)	3mL/500mg (50-pk.)	6mL/500mg (30-pk.)	6mL/1000mg (30-pk.)
<b>Florisil®</b> <b>(EPA SW 846 methods and CLP protocols)</b>	—	24031 24032*	— 26086**	24034 26085**
<b>Silica (EPA SW 846 methods)</b>	—	24035 24036*	—	24038
<b>Cyanopropyl (endcapped)</b>	26048	26049	—	—

\* PTFE frits

\*\*Glass tubes with Teflon® frits

## Resprep™ SPE Cartridges: Ion Exchange Phases

Ionized adsorbents used to extract positively- or negatively-charged analytes from aqueous matrices (e.g., tricyclic antidepressants from plasma).

	1mL/100mg (100-pk.)	3mL/200mg (50-pk.)	3mL/500mg (50-pk.)	6mL/500mg (30-pk.)	6mL/1000mg (30-pk.)
<b>SAX, quaternary amine</b>	26054	—	26055	—	—
<b>SCX, propyl</b>	26056	—	26057	—	—
<b>SCX, benzene</b>	—	26058	—	26059	26060
<b>WAX, amino, primary amine</b>	26050	26051	26052	26053	—
<b>WCX, carboxylic acid</b>	26061	—	26062	—	—

## Syringe Filters

- Nylon - PTFE - PVDF membranes.
- 13mm or 25mm diameter.
- 0.22µm or 0.45µm porosity.
- Color coded for easy identification.
- 100 filters, reusable storage container.

	Size	Porosity	qty.	cat.#
<b>Nylon</b>	13mm	0.22µm	100-pk.	26146
	13mm	0.45µm	100-pk.	26147
	25mm	0.22µm	100-pk.	26148
	25mm	0.45µm	100-pk.	26149
<b>PTFE (polytetrafluoroethylene)</b>	13mm	0.22µm	100-pk.	26142
	13mm	0.45µm	100-pk.	26143
	25mm	0.22µm	100-pk.	26144
	25mm	0.45µm	100-pk.	26145
<b>PVDF (polyvinylidifluoride)</b>	13mm	0.22µm	100-pk.	26150
	13mm	0.45µm	100-pk.	26151
	25mm	0.22µm	100-pk.	26152
	25mm	0.45µm	100-pk.	26153

**Excellent syringe filters—great prices!**

## Resprep™ SPE Cartridges: Bonded Reversed Phases

Hydrophobic (nonpolar) adsorbents, used to extract hydrophobic analytes from polar matrices (e.g., pesticides from water).

	1mL 100mg (100-pk)	3mL 200mg (50-pk.)	3mL 500mg (50-pk.)	6mL 500mg (30-pk.)	6mL 1000mg (30-pk.)	20mL 5g (20-pk.)	60mL 10g (16-pk.)
<b>C18 (high load, endcapped)</b>	26030	26031	24050	24052	24051	26034	26035
<b>C8 (high load, endcapped)</b>	26036	26037	26038	26039	26040	—	—
<b>C2 (endcapped)</b>	26041	26042	—	—	—	—	—
<b>Cyclohexyl (endcapped)</b>	—	—	—	—	26043	—	—

## Specialty SPE Cartridges

These cartridges have been specifically designed to provide consistent and reproducible results for the method stated.

Description	Applications	Tube Volume, Bed Weight	qty.	cat.#
<b>Drug Prep I</b>	Acidic, basic, and/or neutral drugs. Mixed-mode hydrophobic and ion exchange sites provide selective, reproducible extraction of biological samples containing therapeutic or illegal drugs.	3mL, 200mg 10mL, 200mg	50-pk. 50-pk.	26044 26045
<b>Drug Prep II</b>	Extraction of THCA from biological samples. Copolymeric anion exchange sites provide selective, reproducible extraction of THCA from urine.	3mL, 200mg 10mL, 200mg	50-pk. 50-pk.	26046 26047

# Analytical Reference Materials

## Exempted Drug of Abuse Reference Materials

1,000 $\mu$ g/mL in P&T methanol (\*except where noted),  
1mL/ampul

Compound	Individual cat.#
<b>Benzodiazepines</b>	
alprazolam	34042
bromazepam	34043
chlor diazepoxide	34044
clobazam	34045
clonazepam	34046
diazepam	34047
flunitrazepam	34049
flurazepam	34050
lorazepam	34051
nitrazepam	34053
oxazepam	34054
prazepam	34055
temazepam	34056
triazolam	34057
<b>Cocaine &amp; Metabolites</b>	
cocaine	34015
benzoylecgone	34016
ecgonine	34017
ecgonine methyl ester	34018
<b>Methadone &amp; Metabolites</b>	
methadone	34005
<b>Ampphetamines &amp; Metabolites</b>	
d-amphetamine	34020
(+)-methamphetamine	34021
<b>Opiates &amp; Metabolites</b>	
codeine	34000
hydrocodone	34002
hydromorphone	34063
morphine	34006
oxycodone	34007
oxymorphone	34065
<b>Cannabinoid &amp; Metabolites</b>	
cannabidiol	34011
cannabinol	34010
<b>Barbiturates</b>	
amobarbital	34028
aprobarbital	34029
barbital	34030
butabarbital	34031
butalbital	34032
DL-glutethimide	34058
hexobarbital	34033
mephobarbital	34034
methohexitol	34035
pentobarbital	34036
phenobarbital	34037
secobarbital	34038
talbutal	34039
thiameylal	34040
thiopental	34041
<b>Other</b>	
benzphetamine	34022
cocaethylene*	34066
fenfluramine	34023
levorphanol	34003
meperidine	34004
meprobamate	34059
methaqualone	34064
methylprylon	34060
pentazocine	34062
phencyclidine	34027
phenidmetrazine	34025
phenmetrazine	34026
phentermine	34024
dextro-propoxyphene	34008
thebaine	34009

\*1,000 $\mu$ g/mL in acetonitrile.

No datapacks available.

## Single-Component Explosives Solutions

These materials support nitroaromatic, nitramine, and nitroester analyses by GC-ECD (Method 8095<sup>1,2</sup>). Compounds listed are explosives, manufacturing intermediates or degradation products. Method 8095 includes Method 8330 target compounds, plus 3,5-dinitroaniline, nitroglycerin, and pentaerythritol tetranitrate (PETN). Method 8095 mixtures contain the additional components at concentration ratios appropriate for ECD.

Compound Packaged 1mL/ampul	CAS#	Solvent Code	Concentration	Individual cat.#
2-amino-4,6-dinitrotoluene	35572-78-2	ACN	1,000	31670
4-amino-2,6-dinitrotoluene	19406-51-0	ACN	1,000	31671
3,5-dinitroaniline	618-87-1	ACN	1,000	31661
1,3-dinitrobenzene	99-65-0	ACN	1,000	31662
2,4-dinitrotoluene	121-14-2	ACN	1,000	31663
2,6-dinitrotoluene	606-20-2	ACN	1,000	31664
EGDN	628-96-6	M	1,000	31601
HMX	2691-41-0	ACN	1,000	31665
nitrobenzene	99-95-3	ACN	1,000	31657
nitroglycerin	55-63-0	M	1,000	31498
nitroguanidine	556-88-7	M	1,000	31602
2-nitrotoluene	88-72-2	ACN	1,000	31659
3-nitrotoluene	99-08-1	ACN	1,000	31660
4-nitrotoluene	99-99-0	ACN	1,000	31658
PETN	78-11-5	M	1,000	31600
picric acid	88-89-1	M	1,000	31499
propylene glycol dinitrate (PGDN)	6423-43-4	M	1,000	31821
RDX	121-84-4	ACN	1,000	31666
tetryl	479-45-8	ACN	1,000	31667
1,3,5-trinitrobenzene	99-35-4	ACN	1,000	31668
2,4,6-trinitrotoluene	118-96-7	ACN	1,000	31669

ACN=acetonitrile

M = methanol

## References (Not available from Restek.)

<sup>1</sup>US Environmental Protection Agency. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. SW-846, Proposed Draft Update IVB, Office of Solid Waste, Washington, DC, 1999.

<sup>2</sup>M. E. Walsh, T. Ranney, J. Chromatogr. Sci., Vol. 36, pp. 406-416, August 1998.



# Analytical Reference Materials

## free data packs

Restek offers free downloadable data packs for analytical reference material products. Just visit our website at [www.restek.com/datapacks](http://www.restek.com/datapacks). Enter the catalog number and lot number for the product you ordered and obtain a printable pdf file.

## please note

We can custom prepare weathered accelerants for fire debris analysis.

Please complete the custom reference material request form on page 64, or online.

We'll be glad to work with you!

## Single Source Weathered Petrochemical Standards

These solutions are prepared from a single source (one refinery) product. The weathered materials indicate the percent weight loss from the original material. Samples of regular and premium grade unleaded gasoline were collected, then blended in equal volumes.

There are four general types of mineral spirits, classified according to boiling point range (BPR):

- Type I (Stoddard solvent) BPR 149–182°C
- Type II (high flash point) BPR 177–196°C
- Type III (odorless) BPR 149–196°C
- Type IV (low dry point) BPR 149–174°C

The mineral spirit solutions listed below were prepared from an equal volume blend of Type I, II, and III mineral spirits.

Compound	cat.# (ea.)
5,000 $\mu$ g/mL in P&T methanol, 1mL/ampul unleaded gasoline: unweathered	30096
unleaded gasoline: 25% weathered	30097
unleaded gasoline: 50% weathered	30098
unleaded gasoline: 75% weathered	30099
unleaded gasoline: 99% weathered	30436
5,000 $\mu$ g/mL in methylene chloride, 1mL/ampul kerosene: unweathered	31229
kerosene: 25% weathered	31230
kerosene: 50% weathered	31231
kerosene: 75% weathered	31232
5,000 $\mu$ g/mL in methylene chloride, 1mL/ampul diesel fuel #2: unweathered	31233
diesel fuel #2: 25% weathered	31234
diesel fuel #2: 50% weathered	31235
diesel fuel #2: 75% weathered	31236
5,000 $\mu$ g/mL in methylene chloride, 1mL/ampul mineral spirits: unweathered	31225
mineral spirits: 25% weathered	31226
mineral spirits: 50% weathered	31227
mineral spirits: 75% weathered	31228
50,000 $\mu$ g/mL in methylene chloride, 1mL/ampul mineral spirits: unweathered	31260
mineral spirits: unweathered (5mL/ampul)	31261

## Stoddard Solvent Standard

10,000 $\mu$ g/mL in P&T methanol, 1mL/ampul  
cat. # 30487 (ea.)

## Weathered Gasoline Kit

30096: Unleaded Gasoline Standard  
30097: Unleaded Gas Standard: 25% Weathered  
30098: Unleaded Gas Standard: 50% Weathered  
30099: Unleaded Gas Standard: 75% Weathered

Contains 1mL each of these mixtures.  
cat. # 30100 (kit)

## Weathered Kerosene Kit

31229: Kerosene Standard  
31230: Kerosene Standard: 25% Weathered  
31231: Kerosene Standard: 50% Weathered  
31232: Kerosene Standard: 75% Weathered

Contains 1mL each of these mixtures.  
cat. # 31238 (kit)

kit

## Weathered Diesel Fuel #2 Kit

31233: Diesel Fuel #2 Standard  
31234: Diesel Fuel #2 Standard: 25% Weathered  
31235: Diesel Fuel #2 Standard: 50% Weathered  
31236: Diesel Fuel #2 Standard: 75% Weathered

Contains 1mL each of these mixtures.  
cat. # 31239 (kit)

kit

## Weathered Mineral Spirits Kit

31225: Mineral Spirits Standard  
31226: Mineral Spirits Standard: 25% Weathered  
31227: Mineral Spirits Standard: 50% Weathered  
31228: Mineral Spirits Standard: 75% Weathered

Contains 1mL each of these mixtures.  
cat. # 31237 (kit)

kit

## ASTM E1387-95 and E1618-97 Fire Debris Analysis

These materials also can be used for underground storage tank monitoring.

## E1387-95 Column Resolution Check Mix

(13 components)

n-hexane (C6)	n-eicosane (C20)
n-octane (C8)	2-ethyltoluene
n-decane (C10)	3-ethyltoluene
n-dodecane (C12)	toluene
n-tetradecane (C14)	1,2,4-trimethylbenzene
n-hexadecane (C16)	p-xylene
n-octadecane (C18)	
2,000 $\mu$ g/mL each in methylene chloride, 1mL/ampul	
cat. # 31224 (ea.)	

## E1618-97 Test Mix

(13 components)  
Components in this mix (0.5 $\mu$ L/mL or 0.05% volume/volume each) are at 10X the concentration of the final test solution specified in ASTM 1618 and ASTM 1387.

n-hexane (C6)	n-eicosane (C20)
n-octane (C8)	2-ethyltoluene
n-decane (C10)	3-ethyltoluene
n-dodecane (C12)	toluene
n-tetradecane (C14)	1,2,4-trimethylbenzene
n-hexadecane (C16)	p-xylene
n-octadecane (C18)	

0.05% volume/volume each in methylene chloride, 1mL/ampul  
cat. # 31613 (ea.)

kit

## Glycols Standard

ethylene glycol  
propylene glycol  
50,000 $\mu$ g/mL each in DI water, 1mL/ampul  
cat. # 30471 (ea.)

## Blood Alcohol Standards

We have developed eleven calibration mixtures for performing multi-point instrument calibrations so that laboratories can construct calibration curves. The data pack includes a Certificate of Analysis, raw material testing results, statistical QA results, analytical balance printout, and gravimetric weight of each analyte. Ethanol in these mixes is National Institute of Standards and Technology (NIST)-traceable.

Compound	qty.	cat.#
<b>0.015g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36232
1mL/ampul	10-pk.	36332
5mL/ampul	ea.	36240
20mL/ampul	ea.	36248
<b>0.02g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36233
1mL/ampul	10-pk.	36333
5mL/ampul	ea.	36241
20mL/ampul	ea.	36249
<b>0.025g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36234
1mL/ampul	10-pk.	36334
5mL/ampul	ea.	36242
20mL/ampul	ea.	36250
<b>0.04g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36235
1mL/ampul	10-pk.	36335
5mL/ampul	ea.	36243
20mL/ampul	ea.	36251
<b>0.05g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36257
1mL/ampul	10-pk.	36259
5mL/ampul	ea.	36258
20mL/ampul	ea.	36260
<b>0.08g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36262
1mL/ampul	10-pk.	36264
5mL/ampul	ea.	36263
20mL/ampul	ea.	36265
<b>0.1g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36236
1mL/ampul	10-pk.	36336
5mL/ampul	ea.	36244
20mL/ampul	ea.	36252
<b>0.15g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36237
1mL/ampul	10-pk.	36337
5mL/ampul	ea.	36245
20mL/ampul	ea.	36253
<b>0.2g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36238
1mL/ampul	10-pk.	36338
5mL/ampul	ea.	36246
20mL/ampul	ea.	36254
<b>0.3g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36239
1mL/ampul	10-pk.	36339
5mL/ampul	ea.	36247
20mL/ampul	ea.	36255
<b>0.4g/dL forensic ethanol solution</b>		
1mL/ampul	5-pk.	36266
1mL/ampul	10-pk.	36268
5mL/ampul	ea.	36267
20mL/ampul	ea.	36269

## Blood Alcohol Mix Resolution Control Standard

(8 components)

Use our Resolution Control Standard to verify the retention time for each compound normally included in a blood alcohol test, and to verify that the compounds are resolved from and do not interfere with one another. Concentration of ethanol is NIST-traceable.

acetaldehyde	ethyl acetate
acetone	isopropanol
acetonitrile	methanol
ethanol (NIST certified value)	methyl ethyl ketone

0.100g/dL each in water, 1mL/ampul  
cat. # 36256 (ea.)

## Bank Dye Standard (MAAQ)

Restek offers this qualitative standard to help investigators in municipal police stations and criminal laboratories fight crime.

1-N-(methylamino)anthraquinone (MAAQ)

100µg/mL in methylene chloride, 1mL/ampul  
cat. # 31823 (ea.)

No data pack available.

## Column Test Mixes

Routine analysis using these products can assist in determining the need to perform column and/or system maintenance.

### Grob Test Mix (Capillary GC)

nC10-FAME	0.42mg/mL
nC11-FAME	0.42
nC12-FAME	0.41
2,3-butanediol	0.53
dicyclohexylamine	0.31
2,6-dimethylaniline	0.32
2,6-dimethylphenol	0.32
2-ethylhexanoic acid	0.38
nonanal	0.40
1-octanol	0.36
undecane	0.29
decane	0.28

In methylene chloride, 1mL/ampul  
cat. # 35000 (ea.)

No data pack available.

### HPLC Reversed Phase Test Mix #1

benzene	0.50
3.00mg/mL	biphenyl
uracil 0.02	0.06
naphthalene	

In methanol:water (75:25), 1mL/ampul  
cat. # 35005 (ea.)

No data pack available.

### HPLC Normal Phase Test Mix #1

benzene	benzyl alcohol
1.00mg/mL	3.00
benzaldehyde	4-methoxybenzyl alcohol
0.04	2.00

In hexane, 1mL/ampul  
cat. # 35004 (ea.)

No data pack available.

## did you know?

Our Rtx®-BAC1 and Rtx®-BAC2 columns can resolve a blood alcohol sample in less than 3 minutes. We continually improve analysis methods and develop innovative products for clinical/forensic applications. If you have any questions about methods or products, please contact our Technical Service Team at: [support@restek.com](mailto:support@restek.com) or contact your Restek representative.

# Custom Reference Materials Request Form

## Take these **eight** steps to create the right solution:

- 1.** Mixture Description: \_\_\_\_\_
- 2.** Solvent: \_\_\_\_\_
- 3.** Number of Components: \_\_\_\_\_
- 4.** Volume per ampul (select): 1mL, 2mL, 5mL, 10mL or other \_\_\_\_\_ mL
- 5.** Quantity of ampuls: \_\_\_\_\_
- 6.** Testing and documentation that best meets your requirements:
  - Gravimetric Documentation: Lot Sheet with balance printout attached.
  - Qualitative Documentation: Certificate of Composition, Chromatogram, and Gravimetric Documentation.
  - Quantitative Documentation: Certificate of Analysis and Data Pack.

## 7. Compound(s): (list or attach sheet; include CAS number)

Compound 01: _____	Concentration: _____
Compound 02: _____	Concentration: _____
Compound 03: _____	Concentration: _____
Compound 04: _____	Concentration: _____
Compound 05: _____	Concentration: _____
Compound 06: _____	Concentration: _____
Compound 07: _____	Concentration: _____
Compound 08: _____	Concentration: _____
Compound 09: _____	Concentration: _____
Compound 10: _____	Concentration: _____
Compound 11: _____	Concentration: _____
Compound 12: _____	Concentration: _____
Compound 13: _____	Concentration: _____
Compound 14: _____	Concentration: _____
Compound 15: _____	Concentration: _____
Compound 16: _____	Concentration: _____
Compound 17: _____	Concentration: _____
Compound 18: _____	Concentration: _____
Compound 19: _____	Concentration: _____
Compound 20: _____	Concentration: _____

## 8. Concentration Units

mg/mL       µg/mL       ng/mL       vol./wt. %       wt./wt. %       other \_\_\_\_\_

## Contact Information:

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company/Location: \_\_\_\_\_

Phone #: \_\_\_\_\_ FAX #: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

### U.S. Customers

FAX#: (814) 355-2895  
 email: [standards@restekcorp.com](mailto:standards@restekcorp.com)  
 online form: [www.restek.com](http://www.restek.com)

### International Customers

Contact Your  
 Restek Representative.

ALL mixtures are produced in accordance with our ISO 9001:2000 registration.  
 Analytical balances are calibrated daily at seven mass levels using NIST traceable weights.  
 ALL raw materials used are a minimum of 97% pure unless otherwise specified.



[www.restek.com](http://www.restek.com)



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