



*Leverage the outstanding inertness,
low bleed, and high reproducibility
of Rxi® 3-in-1 technology to gain:*

- *Accurate Data*
- *The Right Results Fast*
- *Maximized Instrument Uptime*

www.restek.com/rxi

RESTEK®

Pure Chromatography



People rely on you for fast, accurate data. Rely on Restek® Rxi® columns to deliver it.

Let's be honest. Before you even put your lab coat on, you have more work waiting for you than you can handle. Your instrument needs to run, and it needs to run now. But it is not enough to simply go fast—you need to get the right results the first time and save money in the process. Samples don't stop coming in; top-quality data and products can't stop going out. In short, it is imperative you have a gas chromatography column that produces the data you need, when you need it.

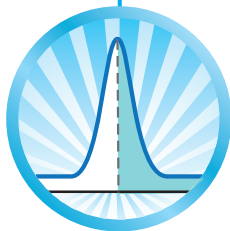
We understand what you're going through. In fact, many of our in-house chromatography experts were once on the front lines like you, and that's ultimately why we do what we do. Restek developed the Rxi® family of fused silica columns to help you solve the challenges you face in your lab on a daily basis. Let us worry about column inertness and lifetime, stability and reproducibility, bleed and peak shape. Take advantage of Restek® Pure Chromatography to get your work done right and get it done quickly.

Rxi® Columns: Built for Your Continued Success

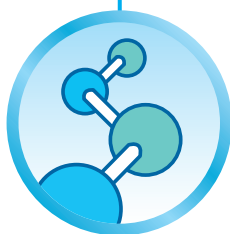
We know that as a customer, it is incredibly important to you that your suppliers are honest when they make a claim. As fellow scientists, it is also very important to us that we are honest in order to maintain our credibility and adhere to our principles. That is why Restek has complete control of our Rxi® column production stream—to ensure that you will receive a top-quality product that performs the way we promised it would, every time. As a result, Rxi® columns come with an unbeatable guarantee: Restek® Pure Satisfaction.



Fused Silica: It is absolutely critical that we ensure adequate supply and utmost quality of our raw materials, and for most Rxi® columns, that starts with the foundation of this exemplary product line: fused silica. We draw our own fused silica tubing to exacting specifications, and during the drawing process, we apply our own polyimide resin. By applying multiple layers of resin, we improve stability at higher temperatures and widen the application range of the fused silica tubing.



Deactivation: Once a batch of fused silica tubing is drawn, it must then be deactivated before it is worthy of becoming an Rxi® column. Our surface deactivation technology and proprietary processes effectively shield silanols to ensure comprehensive inertness for polar compounds as well as acids and bases, providing symmetric peaks for higher sensitivity.



Phase Chemistry: In addition to producing our own raw materials, we also develop our own proprietary stationary phases. Our California-based research facility, "Restek West," is charged with focusing on capillary column phases and deactivations. It is this skilled and dedicated team that creates the optimized polymers with the enhanced selectivities you need for the most challenging separations. Each Rxi® phase is cross-linked to the deactivated fused silica tubing, creating a layer with strong mechanical characteristics and resulting in a long-lasting and rugged final product. This unique bonding technology ensures low bleed for higher sensitivity and reproducible retention times. From the widely used Rxi®-5Si1 MS to the specialty Rxi®-PAH, our Rxi® phases are developed and applied to your finished product in our own facility to better control quality and address your specific needs.



Quality Control: All Rxi® columns are guaranteed to exhibit reliable column-to-column reproducibility and low bleed because we *individually test every column for inertness, selectivity, film thickness, efficiency, and bleed*—measuring the results against strict QC specifications. Rxi® columns are never batch tested. The critical performance values, including bleed, that we obtain with our tests are listed on the chromatographic test report included with your Rxi® column. Every Rxi® column that leaves our facility has been proven to meet or exceed the most stringent requirements.

Why Should You Switch to Rxi® Columns?

Simply put, Rxi® columns are built to be the best. But what does "best" mean? For the overworked analyst with an ever-shrinking budget, the best GC column is the one that lasts the longest while also providing accurate data, the right results fast, and maximized instrument uptime.

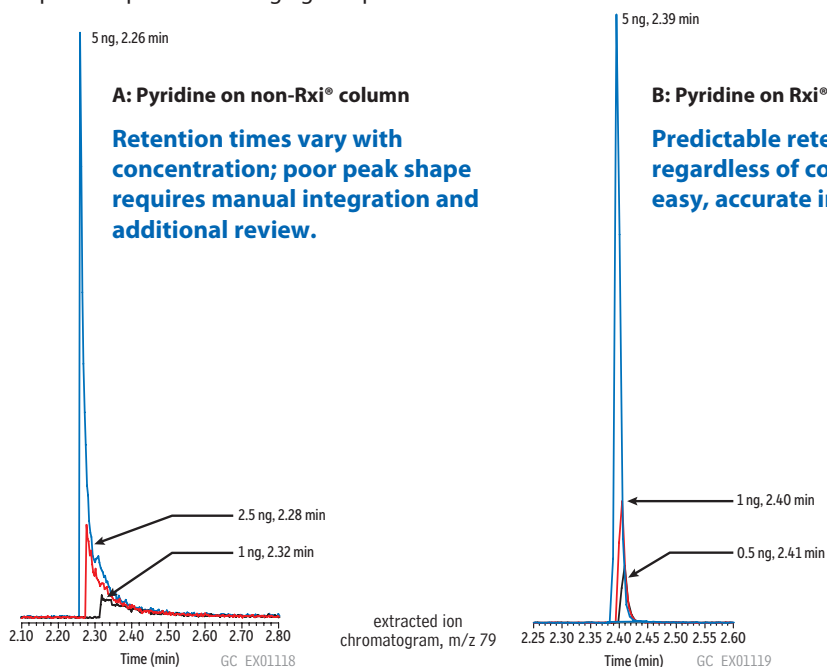
ACCURATE DATA

Without accurate data, nothing else matters. Groundbreaking Rxi® 3-in-1 technology unifies outstanding inertness, low bleed, and high reproducibility into a single high-performance column line that gives you the foundational low-level accuracy you need.

Outstanding Inertness

Our 3-in-1 technology produces such inert columns that we named them **Restek® eXtreme Inertness (Rxi®)**. This extreme inertness improves signal-to-noise ratios and, therefore, your ability to consistently identify and quantify compounds in real-world samples. Inertness is especially important for the ever-lower detection limits required by testing regulations because many acidic, basic, and polar compounds tail significantly if your column has active sites (Figure 1). The remarkable inertness of Rxi® technology solves this problem and allows a wide range of compounds to be analyzed with high sensitivity, often on a single column!

Figure 1: Compared to conventional GC columns, Rxi® columns show excellent inertness and produce good peak shapes for challenging compounds.

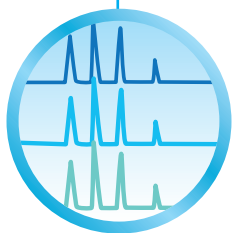
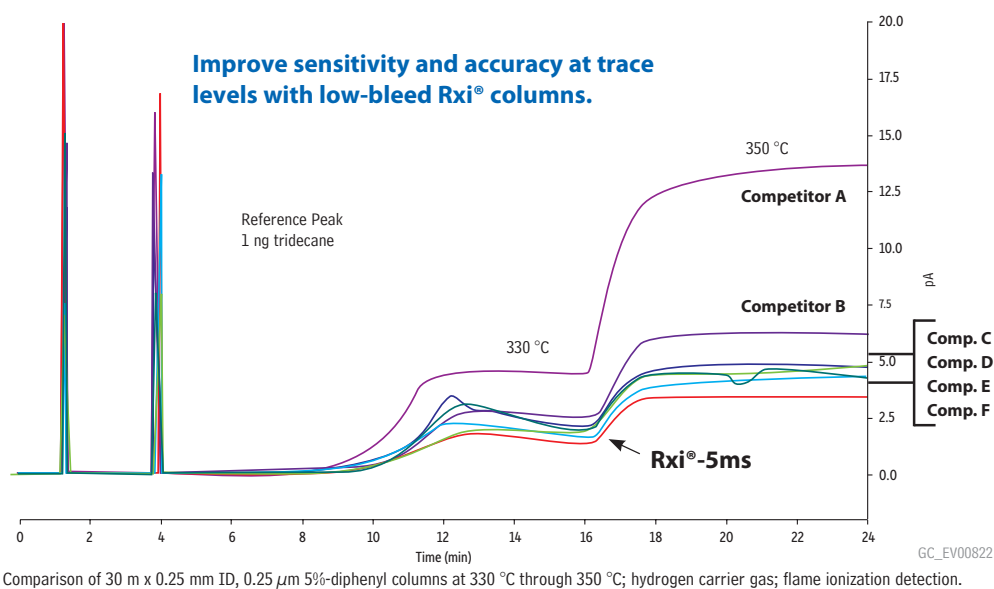




Low Bleed

Rxi® columns are more stable than other manufacturers' columns, so they generate less bleed (Figure 2) and reduce background to further improve signal-to-noise ratios, enhance sensitivity, and lower detection limits. These qualities make low-bleed Rxi® columns the perfect choice for trace-level analyses. In addition, decreased contamination from bleed makes them ideal for sensitive detection systems like mass spectrometry (MS), where you will also benefit from better matches to mass spectral libraries.

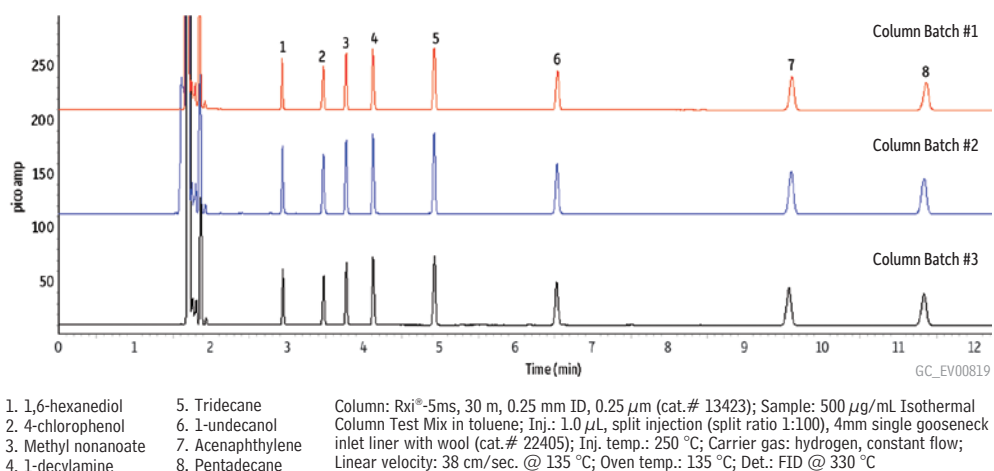
Figure 2: Rxi® columns have the lowest bleed among major brands of columns.



High Reproducibility

Unpredictable retention times and shifting peaks can be frustrating at best and bring your work to a dead stop at worst. Unmatched manufacturing precision and stringent quality control mean that every Rxi® column performs the same way as the column it replaces, every time you run it. We consistently exceed industry standards as measured by efficiency, retention, bleed, and inertness (Figure 3).

Figure 3: Rxi® columns are engineered and QC tested to ensure column-to-column and lot-to-lot reproducibility.

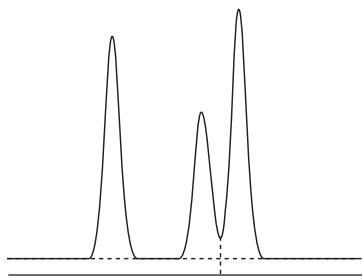


THE RIGHT RESULTS FAST

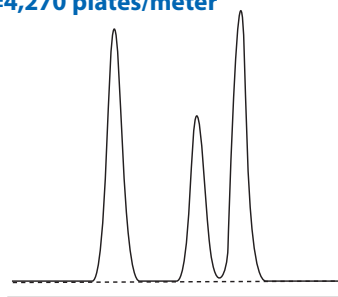
Rxi® columns don't just give you the right results; they give you the right results fast. Outstanding inertness generates consistent peak shapes and retention times, allowing you to accurately quantitate target analytes—even at low concentrations. High reproducibility helps you generate method-compliant data, so your clients get the same fast, accurate results you do. Thermal stability with low column bleed lets you run your instrument at higher oven temperatures, reducing analysis times and increasing sample throughput. And, the efficiency of an Rxi® column generates sharp, narrow peaks, so target analytes are still separated at high temperatures. With these combined features, you can reduce analysis times without sacrificing data quality. Use Rxi® columns to increase sample throughput and laboratory productivity with fast, accurate analyses.

Figure 4: Higher efficiency (i.e., more plates per meter) means better separations on an Rxi® column.

Non-Restek
N=3,900 plates/meter



Restek® Rxi® Technology
N=4,270 plates/meter



MAXIMIZED INSTRUMENT UPTIME

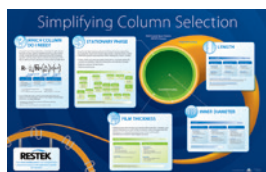
We developed Rxi® columns with robustness in mind. Restek's rugged polymers are cross-bonded and anchored to an extremely inert deactivation surface, resulting in a column that can take whatever abuse you throw at it. This rugged, inert design increases column lifetime and helps to reduce column maintenance, column replacement, instrument recalibration, and the potential need for method revalidation compared to other columns. Rxi® columns are manufactured for low column bleed—even at high GC oven temperatures—to shorten post-installation conditioning time and get your instrument up and running faster. All of these characteristics help minimize the need for maintenance, reduce your downtime, and raise the productivity of your instrument.

When your column lasts as long as an Rxi® column, you will save on costs by purchasing fewer of them. And the column efficiency and inertness allow for faster analyses with lower detection limits. Produce better-quality data, spend less, and run more samples with Rxi® columns.

The Best Column for Your Next Method is an Rxi® Column

Choosing the right stationary phase can make all the difference for the success of your analysis.

We have developed a wide selection of stationary phases that span the polarity range, so you can easily select a perfectly matched Rxi® column that helps you run faster and produce unbeatable results.



Need help choosing the right Rxi® phase?

Go to www.restek.com/posters and download our column selection poster and guide. You can also visit www.restek.com/ezgc to enter your compound list into the industry's only chromatogram modeler—the EZGC® app—to get a custom recommendation for thousands of compounds across hundreds of applications!

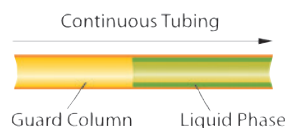
Protect your analytical columns with Rxi® guards.

Restek offers a line of highly inert Rxi® guard/retention gap columns that employ the same groundbreaking 3-in-1 technology, so they are an ideal supplement to Rxi® analytical columns.

Going a step further, Integra-Guard® columns incorporate a guard column and analytical column in one to eliminate the problems associated with this connection altogether. Integra-Guard® columns are available for Rxi®-5Sil MS columns as well as a variety of Rtx® columns. Protecting your analytical column has never been easier.



Integra-Guard® Built-In Guard Column



NON-POLAR	Rxi®-1ms
	Rxi®-1HT
	Rxi®-5ms
	Rxi®-5Sil MS
	Rxi®-5HT
POLARITY	Rxi®-XLB
	Rxi®-1301Sil MS
	Rxi®-624Sil MS
	Rxi®-35Sil MS
	Rxi®-PAH
POLAR	Rxi®-17
	Rxi®-17Sil MS

What are Rxi® "Sil" columns?

By combining arylene chemistry with Rxi® technology, Restek has developed a subgroup of phases containing silarylene copolymers that offer even more exceptional thermal stability. These "Sil" columns—Rxi®-5Sil MS, Rxi®-1301Sil MS, Rxi®-624Sil MS, Rxi®-35Sil MS, and Rxi®-17Sil MS—have similar polarity as their conventional counterparts, but differ in selectivity. Higher thermal stability results in lower bleed, making Rxi® "Sil" columns perfect for MS or highly sensitive applications.

Put Rxi® Columns to Work in Your Lab Today

Your work helps ensure the safety of our food and environment, the quality of our fuel and medicine, the justice of our legal system... With so much riding on what you do, you owe it to yourself to put the best GC column into your instrument. For more details about why Restek® Pure Chromatography and Rxi® columns are the right choice for improving the speed and accuracy of your results, visit www.restek.com and order yours today!

Great Results Don't Stop at the Column

Rxi® columns are a great choice for getting unbeatable results from your analyses, but Restek does not stop there—and neither should you. We offer a total solution to help you run faster with more accuracy and maximized uptime!

Products

From collection to detection, if you need it for your analysis, you'll find it in Restek's comprehensive product line.

GC Columns | www.restek.com/GC

GC Accessories | www.restek.com/GCacc

Certified Reference Materials (CRMs) | www.restek.com/crm

Air Sampling | www.restek.com/air

Sample Preparation | www.restek.com/sample-handling

LC Columns | www.restek.com/LC

LC Accessories | www.restek.com/LCacc



Technical Resources

EZGC® Method Development Tools | www.restek.com/ezgc

These free, web-based apps help you create model chromatograms, get column recommendations, translate methods, and calculate flows!

ChromaBLOGraphy | blog.restek.com

Restek's blog is where we share our thoughts on current trends, best practices, and troubleshooting tips. Best of all, you can weigh in yourself.

Literature Library | www.restek.com/library

Read product brochures, guest editorials, application notes from Restek chemists, and much more.

Chromatogram Database | www.restek.com/chromatograms

Over 1,000 chromatograms are at your fingertips—search and filter to find the exact application you are running.

Web Search Tools | www.restek.com

From any page on our website, you can easily find documentation, resources, products, and chromatograms.

Technical Service

Restek's Technical Service team is staffed by individuals with extensive experience in chemistry, chromatography, engineering, and related fields covering the environmental, food safety, petro, chemical, forensic, and bioanalytical industries. This highly diverse group collectively represents hundreds of years of hands-on chromatography experience and specializes in providing information about Restek® products, applications, instrument troubleshooting, method development, and more. For fast, personalized, and thorough answers to your most challenging technical questions, just send us an e-mail!

Customers Inside the U.S. | support@restek.com

Customers Outside the U.S. | Contact your local Restek® representative or e-mail intltechsupp@restek.com

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RESTEK®
Pure Chromatography

Questions about this or any other Restek® product?

Contact us or your local Restek® representative (www.restek.com/contact-us).

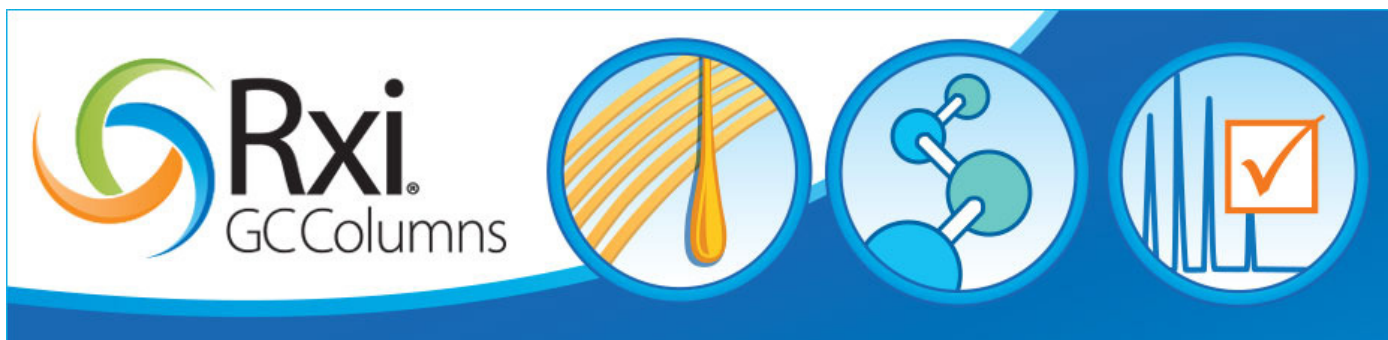
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WELCOME | **OVERVIEW** | PRODUCTS | RESOURCES | CHROMATOGRAMS

People Rely on You for Fast, Accurate Data. Rely on Restek® Rxi® GC Columns to Deliver It.

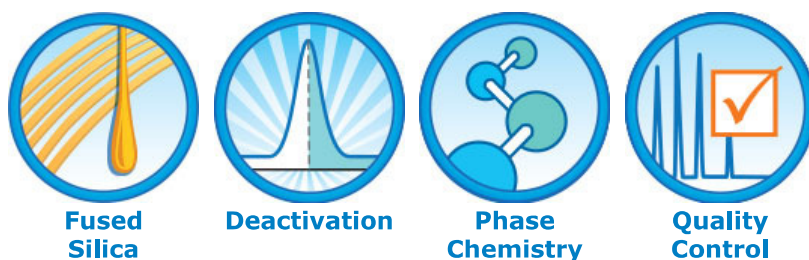
We get it. Your instrument needs to run. It needs to run now. And it is not enough to simply go fast—you need to get the right results the first time and save money in the process. In short, your GC column must produce the data you need, when you need it.

Restek developed the Rxi® family of fused silica columns to help you solve the challenges you face in your lab on a daily basis. Take advantage of Restek® Pure Chromatography to get your work done right and get it done quickly.

Rxi® GC Columns: Built for Your Continued Success

Restek has complete control of our Rxi® column production stream to allow us to offer an unbeatable Pure Satisfaction guarantee. You will receive a top-quality product that performs the way we promised it would, every time.

LEARN MORE



Why Should You Switch to Rxi® GC Columns?

Rxi® columns are built to be the best. But what does "best" mean? For the overworked analyst with an ever-shrinking budget, the best GC column is the one that lasts the longest while also providing:

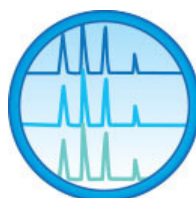
- ACCURATE DATA



**Outstanding
Inertness**



Low Bleed



**High
Reproducibility**

- THE RIGHT RESULTS FAST
- MAXIMIZED INSTRUMENT UPTIME

LEARN MORE

Put Rxi® GC Columns to Work in Your Lab Today

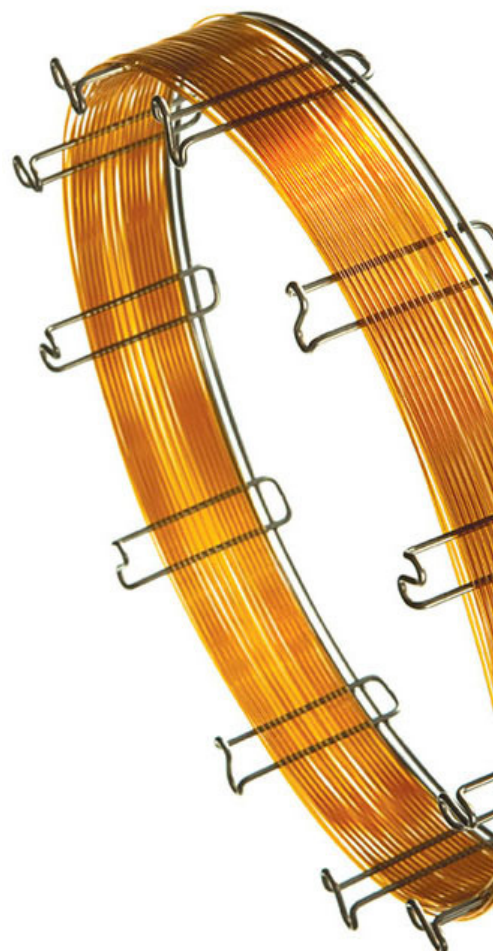
You owe it to yourself, your data, and your customers to put the best GC column into your instrument. [Read on](#) about why Restek® Pure Chromatography and Rxi® columns are the right choice for improving the speed and accuracy of your results, and order yours today.



**Get the Restek®
literature you want,
the way you want it.**

SIGN UP

UPDATE YOUR SETTINGS



POLAR +	Rxi®-17Sil MS
	Rxi®-17
	Rxi®-PAH
	Rxi®-35Sil MS
	Rxi®-624Sil MS
	Rxi®-1301Sil MS
	Rxi®-XLB
	Rxi®-5HT
	Rxi®-5Sil MS
	Rxi®-5ms
NON-POLAR	Rxi®-1HT
	Rxi®-1ms

**The Best GC Column for Your
Next Method is an Rxi®**

Choosing the right stationary phase can make all the difference for the success of your analysis. We have developed a wide selection of stationary phases that span the polarity range, so you can easily select a perfectly matched Rxi® column that helps you run faster and produce unbeatable results.



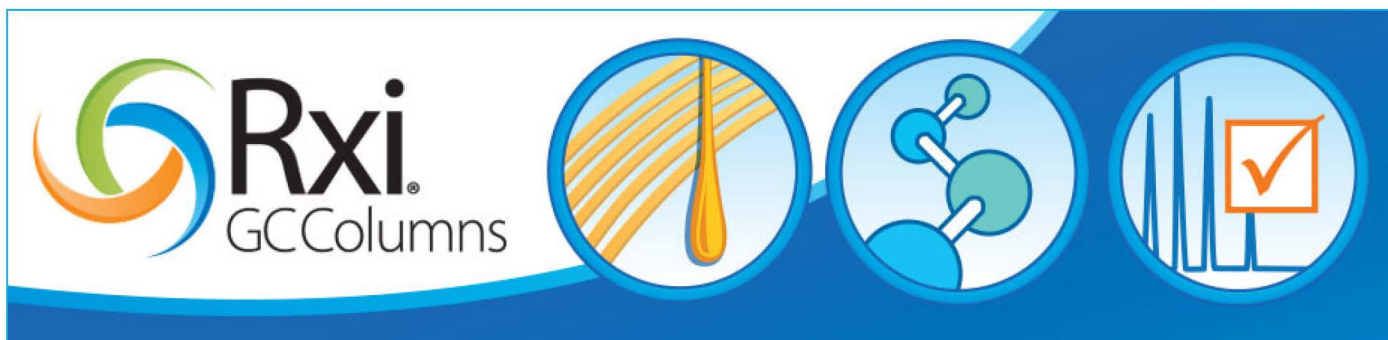
RESTEK Pure Chromatography

Restek Corporation, U.S., 110 Benner Circle, Bellefonte, PA 16823
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A Company of Owens





WELCOME | OVERVIEW | **PRODUCTS** | RESOURCES | CHROMATOGRAMS



Rxi-1ms Columns (fused silica)

nonpolar phase; Crossbond dimethyl polysiloxane

- General-purpose columns for arson accelerants, essential oils, hydrocarbons, pesticides, PCB congeners (e.g., Aroclor mixes), sulfur compounds, amines, solvent impurities, simulated distillation, oxygenates, gasoline range organics (GRO), refinery gases.
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- Temperature range: -60 °C to 330/350 °C.
- Equivalent to USP G1, G2, and G38 phases.



Rxi-5ms Columns (fused silica)

low-polarity phase; Crossbond diphenyl dimethyl polysiloxane

- General-purpose columns for semivolatiles, phenols, amines, residual solvents, drugs of abuse, pesticides, PCB congeners (e.g., Aroclor mixes), solvent impurities.
- Most inert column on the market.
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- Temperature range: -60 °C to 330/350 °C.
- Equivalent to USP G27 and G36 phases.



Rxi-XLB Columns (fused silica)

low-polarity proprietary phase

- General-purpose columns exhibiting extremely low bleed. Ideal for many GC-MS applications, including pesticides, PCB congeners (e.g., Aroclor mixes), PAHs.
- Unique selectivity.
- Temperature range: 30 °C to 360 °C.



Rxi-5Sil MS Columns (fused silica)

low-polarity phase; Crossbond 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane

- Engineered to be a low-bleed GC-MS column.
- Excellent inertness for active compounds.
- General-purpose columns—ideal for GC-MS analysis of semivolatiles, polycyclic aromatic compounds, chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, and hydrocarbons.
- Temperature range: -60 °C to 350 °C.



Rxi-35Sil MS Columns (fused silica)

midpolarity Crossbond phase

- Special selectivity and excellent inertness for substituted polar compounds, such as drugs, pesticides, herbicides, PCBs, phenols, etc.
- Provides superior separation for cannabinoids.
- Very low-bleed phase for GC-MS analysis.
- Extended temperature range.



Rxi-17 Columns (fused silica)

midpolarity phase; Crossbond diphenyl dimethyl polysiloxane

- General-purpose columns for pesticides, herbicides, rosin acids, phthalate esters, triglycerides, sterols.
- Temperature range: 40 °C to 320 °C.



Rxi-17Si MS Columns (fused silica)

midpolarity Crossbond phase

- Excellent inertness and selectivity for active environmental compounds, such as PAHs.
- Low bleed for use with sensitive detectors, such as MS.
- 340/360 °C upper temperature limits.
- Equivalent to USP phase G3.



Rxi-PAH Columns (fused silica)

midpolarity proprietary phase

- Ideal for EFSA PAH4 analysis—separates all priority compounds: benz[a]anthracene, chrysene, benzo[b]fluoranthene, and benzo[a]pyrene.
- Best resolution of chrysene from interfering PAHs, triphenylene, and cyclopenta[cd]pyrene.
- Complete separation of benzo [b], [k], [j], and [a] fluoranthenes.
- 360 °C thermal stability allows analysis of low-volatility dibenzo pyrenes.



Rxi-1301Si MS Columns (fused silica)

midpolarity Crossbond phase

- Highest thermal stability in the industry ensures dependable, accurate MS results and increased uptime.
- Stabilized cyano phase selectivity improves the performance of existing methods. Ideal for solvents, glycols, and other polar compounds.
- Rigorous QC testing ensures inertness and accurate, reliable data for multiple compound classes.
- Maximum temperature: 320 °C.



Rxi-624Si MS Columns (fused silica)

midpolarity Crossbond phase

- Low-bleed, high-thermal stability column—maximum temperatures up to 300–320 °C.
- Inert—excellent peak shape for a wide range of compounds.
- Selective—G43 phase highly selective for volatile organics and residual solvents, great choice for USP<467>.
- Manufactured for column-to-column reproducibility—well suited for validated methods.



Rxi-1HT Columns (fused silica)

nonpolar phase; dimethyl polysiloxane

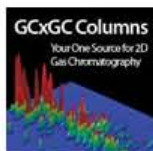
- 40% longer lifetime from specially designed fused silica tubing.
- Columns processed for high-temperature applications, such as high molecular weight hydrocarbons.
- Temperature range: -60 to 400 °C.



Rxi-5HT Columns (fused silica)

low-polarity phase; diphenyl dimethyl polysiloxane

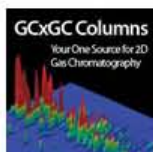
- 40% longer lifetime from specially designed fused silica tubing.
- Columns processed for high-temperature applications, such as mineral oil.
- Temperature range: -60 to 400 °C.



Rxi-1ms Secondary Columns for GCxGC (fused silica)

nonpolar phase; Crossbond dimethyl polysiloxane

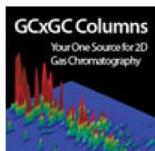
- Convenient 2 m length is ideal for use as a secondary column in GCxGC analyses.
- General purpose columns.
- Temperature range: -60 °C to 330/350 °C (bleed tested temperature/maximum operating temperature).



Rxi-XLB Secondary Columns for GCxGC (fused silica)

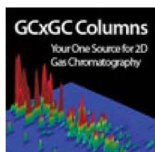
low polarity proprietary phase

- Convenient 2 m length is ideal for use as a secondary column in GCxGC analyses.
- General purpose columns exhibiting extremely low bleed.
- Unique selectivity.
- Temperature range: -60 to 330/350 °C (bleed tested temperature/maximum operating temperature).



Rxi-5Sil MS Secondary Columns for GCxGC (fused silica) low-polarity phase; Crossbond 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane

- Convenient 2 m length is ideal for use as a secondary column in GCxGC analyses.
- Engineered to be a low bleed GC/MS column.
- Excellent inertness for active compounds.
- General purpose columns.
- Temperature range: -60 °C to 350 °C.



Rxi-17Sil MS Secondary Columns for GCxGC (fused silica) midpolarity Crossbond phase

- Convenient 2 m length is ideal for use as a secondary column in GCxGC analyses.
- 340/360 °C upper temperature limits.
- Excellent inertness and selectivity for active environmental compounds, such as PAHs.
- Low-bleed for use with sensitive detectors, such as MS.



GCxGC Selectivity Kit (0.15 mm)

- Wide range of stationary phases offers orthogonal separations.
- High thermal stability increases system ruggedness.
- Unrivaled column inertness for accurate analysis of active compounds.
- 0.15, 0.18, or 0.25 mm ID formats accommodate varying sample capacities, speeds, and detectors.
- Secondary columns come in convenient 2 m lengths for economical methods development.



GCxGC Selectivity Kit (0.18 mm)

- Wide range of stationary phases offers orthogonal separations.
- High thermal stability increases system ruggedness.
- Unrivaled column inertness for accurate analysis of active compounds.
- 0.15, 0.18, or 0.25 mm ID formats accommodate varying sample capacities, speeds, and detectors.
- Secondary columns come in convenient 2 m lengths for economical methods development.



GCxGC Selectivity Kit (0.25 mm)

- Wide range of stationary phases offers orthogonal separations.
- High thermal stability increases system ruggedness.
- Unrivaled column inertness for accurate analysis of active compounds.
- 0.15, 0.18, or 0.25 mm ID formats accommodate varying sample capacities, speeds, and detectors.
- Secondary columns come in convenient 2 m lengths for economical methods development.



Rxi Guard/Retention Gap Columns (fused silica)

- Extend column lifetime.
- Excellent inertness—obtain lower detection limits for active compounds.
- Sharper chromatographic peaks by utilizing retention gap technology.
- Maximum temperature: 360 °C.



Pure Chromatography

Restek Corporation, U.S., 110 Benner Circle, Bellefonte, PA 16823

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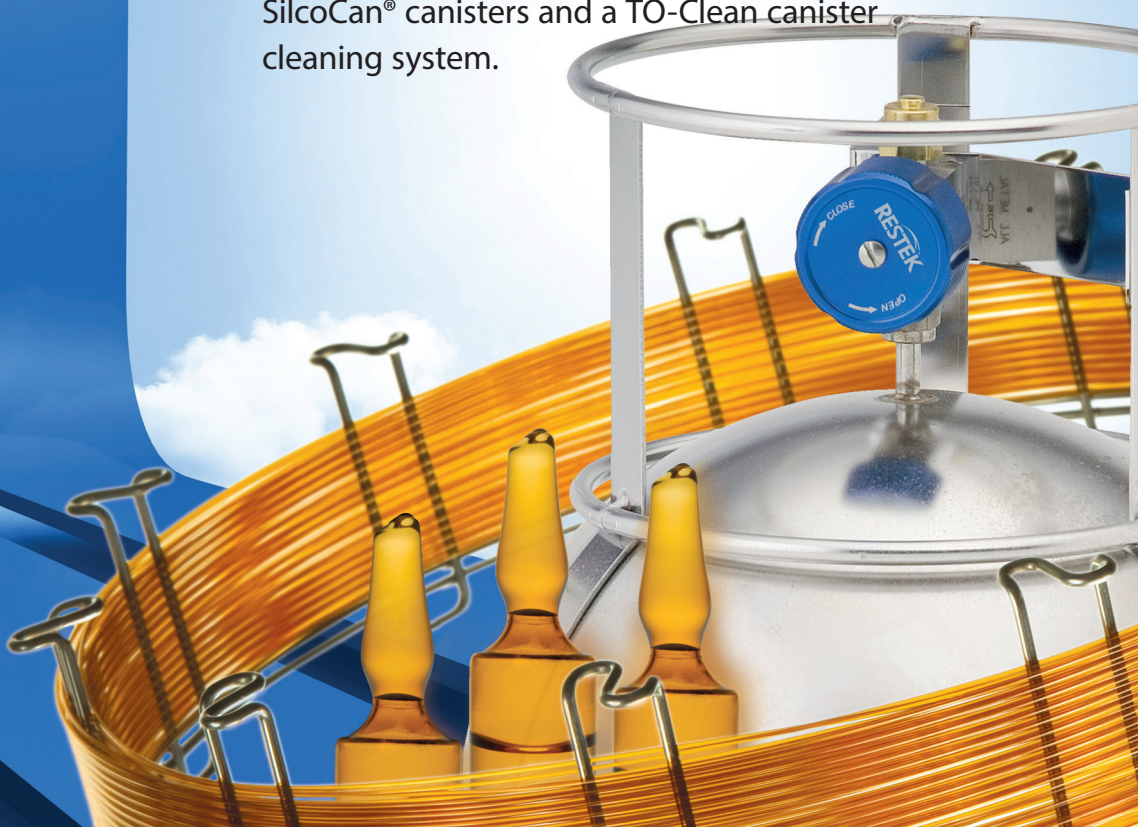


A Company of Owners



Increase Productivity With Restek's Faster GC Method for VOCs in Air

- **Analyze samples in about half the time** on Rxi®-5Sil MS (30 m x 0.32 mm ID, 1.00 µm) columns compared to typical 60 m column setups.
- **Reliably meet Method TO-15 performance requirements** and ensure accurate reporting at trace levels with inert SilcoCan® air sampling canisters.
- **Prevent contamination** with highly inert SilcoCan® canisters and a TO-Clean canister cleaning system.



RESTEK

Pure Chromatography

www.restek.com

Increase Productivity With Restek's Faster GC Method for VOCs in Air

Restek's new short column faster GC method produces accurate and reliable results in about half the time of typical analytical approaches.

Labs analyzing volatile organic compounds (VOCs), such as EPA method TO-15 analytes, typically employ 60 m GC columns, which require a relatively lengthy total cycle time for each sample. However, Restek has developed a faster short column GC method for analyzing VOCs in air samples. Using our 30 m column setup and procedure combined with highly inert SilcoCan® air sampling canisters, accurate results can be achieved and method requirements can be met in approximately half the time of conventional approaches, which results in increased lab productivity and profitability.

Many labs currently use EPA Method TO-15 to analyze VOCs in air. This performance-based guidance document specifies sampling and analytical procedures, but only requires that the chosen analytical setup to meet certain performance criteria. This allows analysts to optimize analytical methods as technology improves. Restek has developed a new faster GC method for analyzing VOCs in air samples that meets method performance criteria through the use of a more efficient, selective, and shorter Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm) and an inert SilcoCan® air sampling canister. This approach allows samples to be analyzed in less time (Table I) and with greater confidence.

The Rxi®-5Sil MS column (cat. # 13654) is more than adequate to quantify the standard suite of 65 components included in Method TO-15 (Figure 1). GC run times are just 16.5 minutes, approximately half that of a typical analysis on a 60 m column. The same coelutions observed on the 30 m column are also seen on the 60 m column, but because these compounds are not isobaric, they can be easily distinguished using MS detection, which is required for this method.

By meeting method criteria faster using a shorter Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm), labs can increase sensitivity, reduce consumables costs, and improve overall productivity.

Learn how Restek's faster GC solution can improve your productivity when analyzing TO-15 VOCs in air on the following pages or visit www.restek.com/rapidTO-15 for our complete method evaluation!

Table I: Analyze more samples per day with Restek's faster GC approach based on an Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm).

Column Length	MDL (±0.5 ppbv)	Replicate Precision (±25%)	Audit Accuracy (±30%)	Analysis Time (min)	Column Cooling Time (min)	Total Cycle Time (min)	Runs/Day
30 m	0.06 ppbv (scan mode) 35.9 pptv (SIM mode)	4.29%	-2.82%	16.5	5	21.5	67
60 m	Meets requirement	Meets requirement	Meets requirement	29.9	5	34.9	41

Tips for Success



Sample with highly inert SilcoCan® whole air sampling canisters. Our innovative deactivation prevents surface reactivity, ensuring accurate sampling of active polar and/or sulfur-containing compounds.

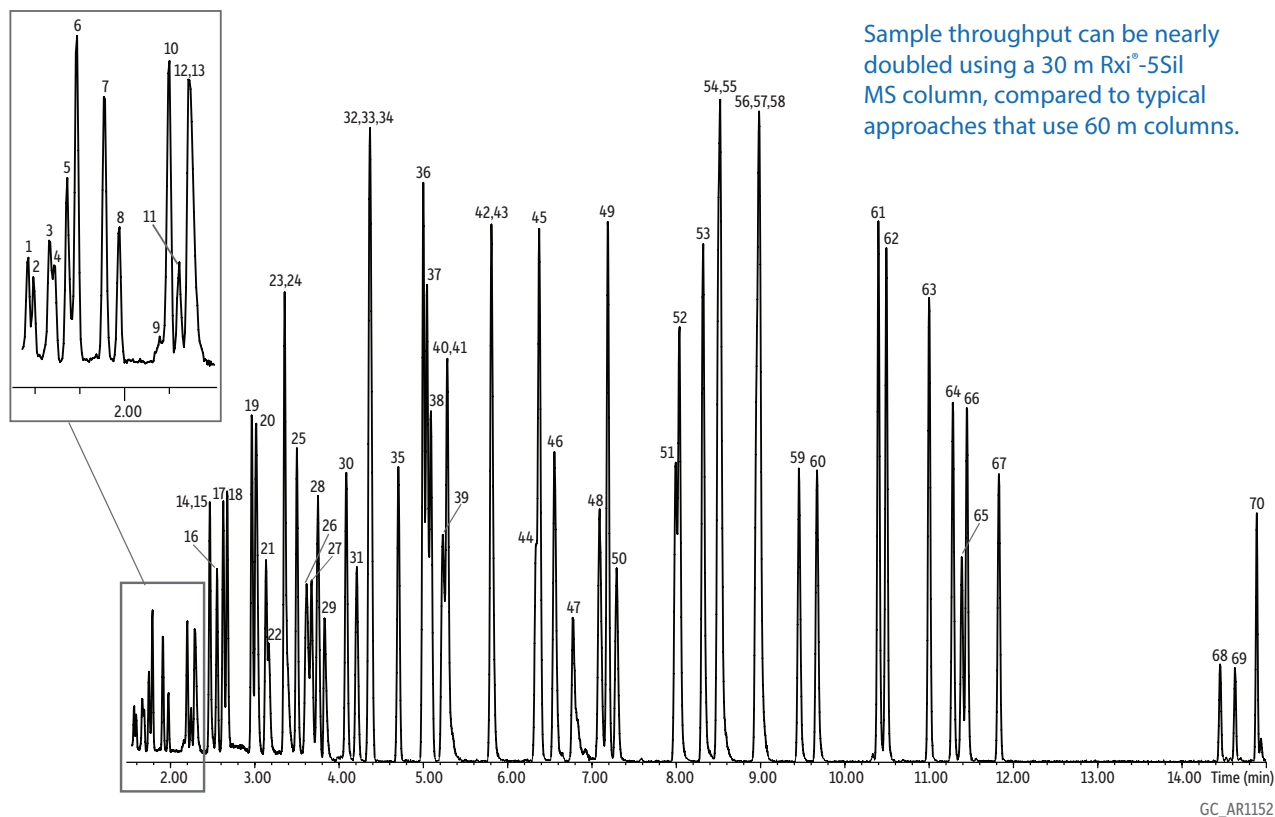


Use Restek's faster GC method to increase lab productivity. Compared to typical methods based on a 60 m column, Restek's approach uses an Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm) to meet Method TO-15 requirements in almost half the time. Get the full application note here: restek.com/rapidTO-15



Keep your canisters clean. Don't let contamination compromise your results. There's no better way to keep your whole air sampling canisters clean than with a TO-Clean canister cleaning system. This high capacity cleaning oven is fully automated, easy to use, and dramatically increases lab efficiency.

Figure 1: Analyze all 65 Method TO-15 VOCs in just 16.5 min on a 30 m x 0.32 mm ID, 1.00 µm Rxi®-5Sil MS column.



Sample throughput can be nearly doubled using a 30 m Rxi®-5Sil MS column, compared to typical approaches that use 60 m columns.

Peaks	tr (min)				
1. Propylene	1.57	24. Hexane*	3.36	48. Dibromochloromethane	7.09
2. Dichlorodifluoromethane (Freon® 12)	1.60	25. <i>cis</i> -1,2-Dichloroethene	3.50	49. Tetrachloroethene	7.19
3. Chloromethane	1.67	26. Ethyl acetate	3.62	50. 1,2-Dibromoethane	7.29
4. 1,2-Dichlorotetrafluoroethane (Freon® 114)	1.68	27. Bromochloromethane (IS)	3.67	51. Chlorobenzene-d5 (IS)	7.99
5. Vinyl chloride	1.74	28. Chloroform	3.75	52. Chlorobenzene	8.04
6. 1,3-Butadiene	1.79	29. Tetrahydrofuran	3.83	53. Ethylbenzene	8.32
7. Bromomethane	1.91	30. 1,1,1-Trichloroethane	4.09	54. <i>m</i> -Xylene	8.52
8. Chloroethane	1.98	31. 1,2-Dichloroethane	4.21	55. <i>p</i> -Xylene	8.52
9. Ethanol	2.16	32. Benzene	4.36	56. Styrene	8.95
10. Trichlorofluoromethane (Freon® 11)	2.20	33. Carbon tetrachloride	4.37	57. <i>o</i> -Xylene	8.98
11. Acrolein	2.25	34. Cyclohexane	4.39	58. Bromoform	9.00
12. Acetone	2.29	35. 1,4-Difluorobenzene (IS)	4.70	59. 1,1,2,2-Tetrachloroethane	9.46
13. Acetonitrile (contaminant)	2.29	36. Heptane	5.00	60. 4-Bromofluorobenzene**	9.67
14. 1,1-Dichloroethene	2.47	37. Trichloroethylene	5.04	61. 4-Ethyltoluene	10.40
15. Isopropyl alcohol	2.49	38. 1,2-Dichloropropane	5.09	62. 1,3,5-Trimethylbenzene	10.49
16. 1,1,2-Trichlorotrifluoroethane (Freon® 113)	2.55	39. Methyl methacrylate	5.23	63. 1,2,4-Trimethylbenzene	11.00
17. Methylene chloride	2.63	40. Bromodichloromethane	5.28	64. 1,3-Dichlorobenzene	11.28
18. Carbon disulfide	2.68	41. 1,4-Dioxane	5.32	65. Benzyl chloride	11.39
19. <i>trans</i> -1,2-Dichloroethene	2.97	42. 4-Methyl-2-pentanone (MIBK)	5.81	66. 1,4-Dichlorobenzene	11.45
20. Methyl <i>tert</i> -butyl ether (MTBE)	3.02	43. <i>cis</i> -1,3-Dichloropropene	5.81	67. 1,2-Dichlorobenzene	11.83
21. 1,1-Dichloroethane	3.13	44. <i>trans</i> -1,3-Dichloropropene	6.33	68. 1,2,4-Trichlorobenzene	14.46
22. Vinyl acetate	3.17	45. Toluene	6.37	69. Naphthalene	14.63
23. 2-Butanone (MEK)*	3.36	46. 1,1,2-Trichloroethane	6.55	70. Hexachlorobutadiene	14.89
		47. 2-Hexanone (MBK)	6.77		

*Peaks 23 and 24 share ion m/z 43; **Tuning standard

Column: Rxi®-5Sil MS, 30 m, 0.32 mm ID, 1.00 µm (cat.# 13654), **Sample:** TO-15 65 component mix (cat.# 34436), TO-14A internal standard/tuning mix (cat.# 34408), Diluent: Nitrogen, Conc.: 10.0 ppbv 400 mL injection, **Injection:** Direct, **Oven:** Oven Temp.: 32 °C (hold 1 min) to 150 °C at 9 °C/min to 230 °C at 33 °C/min, **Carrier Gas:** He, constant flow, Flow Rate: 1.5 mL/min, Linear Velocity: 44 cm/sec @ 32 °C, **Detector:** MS, Mode: Scan, Scan Program: **Group 1, Start Time (min) 0, Scan Range (amu) 35-250, Scan Rate (scans/sec) 3.32, Transfer Line Temp.: 230 °C, Analyzer Type:** Quadrupole, Source Temp.: 230 °C, Quad Temp.: 150 °C, Electron Energy: 69.9 eV, Solvent Delay Time: 1.0 min, Tune Type: BFB, Ionization Mode: EI, **Preconcentrator:** Nutech 8900DS, **Trap 1 Settings:** Type/Sorbent : Glass beads, Cooling temp.: -155 °C, Preheat temp: 5 °C, Preheat time: 0 sec, Desorb temp: 20 °C, Desorb flow: 5 mL/min, Desorb time: 360 sec, Bakeout temp: 200 °C, Flush flow: 120 mL/min, Flush time: 60 sec, Sweep flow: 120 mL/min, Sweep time: 60 sec, **Trap 2 Settings:** Type/Sorbent: Tenax®, Cooling temp.: -35 °C, Desorb temp: 190 °C, Desorb time: 30 sec, Bakeout temp: 200 °C, Bakeout time: 10 sec, **Cryofocuser:** Cooling temp.: -160 °C, Inject time: 140 sec, **Internal Standard:** Purge flow: 100 mL/min, Purge time: 6 sec, Vol.: 100 mL, ISTD flow: 100 mL/min, **Standard:** Size: 200 mL, Purge flow: 100 mL/min, Purge time: 6 sec, Sample flow: 100 mL/min, **Instrument:** HP6890 GC & 5973 MSD, **Acknowledgement:** Nutech

Set up for Success!

Set up for Success—How to Meet Method TO-15 Requirements While Reducing Analysis Time

In developing Restek's faster GC approach, a Nutech 8900DS preconcentrator from EST Analytical was paired with 6-L SilcoCan® air sampling canisters. The Nutech preconcentrator utilizes three cryogenically cooled traps to concentrate or focus target analytes (often referred to as "micro-scale purge-and-trap") for delivery to the GC-MS system. An Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 μ m, cat.# 13654) was selected based on its ability to separate trace levels of the target compounds while reducing analysis time. Total cycle time was further reduced through the 8900DS sample overlap feature, which allows the next sample to be preconcentrating while the current sample is being analyzed.

For the method evaluation, samples were prepared by preconcentrating 400 mL of sample with 100 mL of TO-14A internal standard/tuning mix (cat. # 34408) prepared at 20 ppbv. All samples were analyzed against a 1.0–10.0 ppbv calibration curve. MDLs, precision, and accuracy were determined as noted below Table II. Visit www.restek.com/rapidTO-15 for detailed descriptions of all calculations and procedures.

Results clearly demonstrate that criteria from section 11.1.1 of Method TO-15 were met (Table II). These requirements stipulate MDLs of ≤ 0.5 ppbv, replicate precision of $\pm 25\%$, and audit accuracy $\pm 30\%$ for concentrations normally expected in contaminated ambient air (0.5 to 25 ppbv). For the faster GC method, average scan and SIM mode MDLs were 0.06 ppbv and 35.9 pptv, respectively; average replicate precision was 4.29% difference; and average audit accuracy for all 65 targeted TO-15 VOCs was -2.82%. Since the two-point replicate precision approach in Method TO-15 also includes sampling variation, the precision of the analytical system alone was evaluated using 7 replicate analyses of a 5.00 ppbv standard. An average %RSD of 6.86% was obtained, indicating the preconcentrator and GC-MS setup generated very reproducible results.

In addition, section 10.5.5 of Method TO-15 states that for the initial calibration the %RSD for the relative response factor (RRF) for each compound in the calibration table must be less than 30% with at most two exceptions up to a limit of 40%. Table II shows that this criterion was also met and, in addition, a broader-range linearity study (0.1 to 10 ppb) demonstrated that good linearity was achieved for compounds across a range of volatilities (Figure 2).

Restek's faster GC method for analyzing VOCs in air lets you improve sample throughput while increasing sensitivity and achieving method requirements. Since Method TO-15 performance criteria are easily met with shorter total cycle times, you can run more samples per day and have confidence in the data you report.

Taking a Closer Look—How Does a Shorter Column Increase Sensitivity?

For GC, the biggest barriers to good sensitivity are column activity and band broadening. If a column is not inert, response for active compounds can be reduced through adsorption and/or band broadening due to tailing. Broader peaks mean shorter peaks, which result in decreased signal-to-noise ratios and, therefore, decreased sensitivity. By using an inert Rxi®-5Sil MS column, adsorption and tailing are kept to a minimum. Band broadening can also occur due to the high mobility of gases. The longer a compound takes to elute from a column, the broader the peak will be, reducing sensitivity for later-eluting compounds, especially during lengthy analyses on long columns. This type of band broadening can be mitigated by reducing run times or increasing the GC oven ramp rate. Shorter columns naturally lend themselves to short run times as well as fast oven ramp rates because compounds are eluted more quickly from the column. By switching from a 60 m column to a 30 m column, analysis time is cut in half, oven ramp rate is doubled, and signal-to-noise values are increased, which ensures better sensitivity.

Figure 2: Confidently analyze a wide range of VOCs from lighter dichlorodifluoromethane to heavier 1,2-dichlorobenzene, as well as reactive polar VOCs such as acrolein.



Generate accurate standards easily with Restek's jumbo syringe!

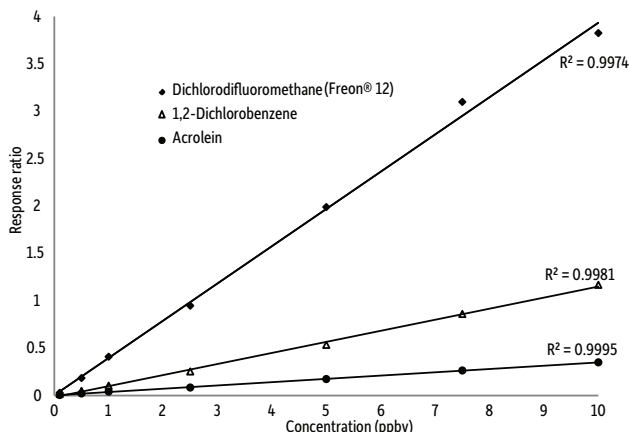


Table II: Method requirements were easily met for blank, MDL, precision, and accuracy criteria using Restek's faster GC approach with an Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm) and an inert SilcoCan® air sampling canister.

Analyte	Average Blank Concentration (pptv) ¹	Calibration (%RSD) ²	Scan MDL (ppbv) ³	SIM MDL (pptv) ⁴	Replicate Precision (%Difference) ⁵	Precision (%RSD) ⁶	Audit Accuracy (%) ⁷
Propylene	BDL	8.51	0.10	66.9	1.69	9.08	12.8
Dichlorodifluoromethane (Freon 12)	BDL	6.22	0.05	33.4	1.79	7.82	1.74
Chloromethane	BDL	7.63	0.02	38.8	0.89	6.59	1.29
1,2-Dichlorotetrafluoroethane (Freon 114)	BDL	18.9	0.08	65.3	3.33	7.71	-1.99
Vinyl chloride	BDL	5.60	0.05	37.6	0.15	7.12	-7.24
1,3-Butadiene	ND	6.44	0.15	34.0	3.25	5.12	-5.06
Bromomethane	ND	6.86	0.05	26.4	3.63	5.84	-4.86
Chloroethane	ND	10.5	0.06	78.0	3.30	6.07	-5.34
Ethanol	160	21.4	0.19	94.6	6.34	9.01	-4.06
Trichlorofluoromethane (Freon 11)	BDL	17.2	0.08	21.9	5.25	10.8	-0.63
Acrolein	BDL	9.96	0.09	31.0	1.04	6.70	-10.7
Acetone	BDL	10.8	0.14	45.1	6.60	5.55	1.20
Isopropyl alcohol	BDL	13.2	0.05	50.9	8.50	10.2	5.79
1,1-Dichloroethene	ND	14.5	0.03	23.4	3.53	6.07	-1.54
1,1,2-Trichlorotrifluoroethane (Freon 113)	BDL	25.0	0.09	23.5	4.45	5.84	7.99
Methylene chloride	BDL	12.7	0.05	56.3	4.75	5.68	2.11
Carbon disulfide	BDL	7.12	0.03	38.0	5.14	7.61	-1.89
trans-1,2-Dichloroethene	ND	8.14	0.05	39.9	4.89	6.46	0.37
Methyl tert-butyl ether (MTBE)	ND	5.17	0.03	42.8	3.41	6.53	-2.74
1,1-Dichloroethane	ND	18.4	0.03	25.2	4.23	6.36	-5.87
Vinyl acetate	ND	2.94	0.05	33.0	1.22	7.06	1.94
2-Butanone (MEK)	ND	7.47	0.06	39.9	6.07	7.34	0.89
Hexane	BDL	11.8	0.02	37.8	0.27	6.91	-6.81
cis-1,2-Dichloroethene	ND	4.88	0.02	21.7	3.22	5.67	-0.80
Ethyl acetate	ND	3.28	0.08	99.4	2.93	13.6	-4.63
Chloroform	ND	11.6	0.02	11.9	4.47	6.64	-1.51
Tetrahydrofuran	ND	7.97	0.08	41.6	0.12	9.72	6.01
1,1,1-Trichloroethane	BDL	22.6	0.04	15.4	3.28	6.22	-4.70
1,2-Dichloroethane	ND	5.67	0.04	15.7	3.67	5.34	2.94
Benzene	BDL	8.92	0.02	61.2	9.55	6.60	-1.17
Carbon tetrachloride	BDL	27.5	0.04	38.8	4.85	6.04	2.33
Cyclohexane	ND	29.8	0.05	40.7	4.00	5.61	-0.16
Heptane	ND	3.71	0.04	28.0	13.55	5.41	-2.46
Trichloroethylene	BDL	3.85	0.03	18.4	0.96	5.95	-0.09
1,2-Dichloropropane	ND	3.72	0.03	24.6	1.36	6.48	0.47
Methyl methacrylate	ND	18.6	0.14	20.7	3.53	7.75	-1.63
1,4-Dioxane	ND	11.5	0.08	19.6	0.13	7.10	0.90
Bromodichloromethane	ND	4.53	0.04	22.6	2.04	7.08	2.71
4-Methyl-2-pentanone (MIBK)	ND	2.46	0.08	24.3	6.87	6.24	1.90
cis-1,3-Dichloropropene	BDL	4.05	0.04	8.30	0.80	7.59	-0.86
trans-1,3-Dichloropropene	ND	2.44	0.05	20.4	8.30	5.86	0.79
Toluene	BDL	4.98	0.03	17.0	6.70	5.67	-3.04
1,1,2-Trichloroethane	BDL	4.30	0.05	14.3	0.58	5.73	-1.64
2-Hexanone (MBK)	ND	10.2	0.11	94.5	4.82	8.15	2.91
Dibromochloromethane	BDL	3.27	0.03	33.3	3.68	6.02	1.46
Tetrachloroethene	BDL	2.70	0.00	18.7	0.88	5.98	4.21
1,2-Dibromoethane	BDL	2.28	0.04	17.6	7.85	6.63	1.77
Chlorobenzene	ND	8.27	0.05	17.4	2.93	4.91	-3.37
Ethylbenzene	BDL	20.3	0.03	34.3	4.01	6.10	-12.3
m-Xylene	BDL	6.00	0.04	12.1	5.51	6.70	-14.3
p-Xylene	BDL	5.91	0.04	13.1	5.51	6.70	-14.3
Styrene	ND	1.60	0.05	29.2	3.34	6.89	-17.7
o-Xylene	ND	6.38	0.02	24.7	3.76	7.50	-13.9
Bromoform	BDL	3.09	0.05	12.1	5.88	6.34	-13.0
1,1,2,2-Tetrachloroethane	BDL	5.87	0.06	20.4	8.30	7.99	-9.79
4-Ethyltoluene	ND	3.01	0.05	59.1	7.03	7.63	-16.8
1,3,5-Trimethylbenzene	BDL	4.13	0.05	49.5	5.98	6.43	-17.1
1,2,4-Trimethylbenzene	ND	1.86	0.07	68.2	5.09	4.92	-14.1
1,3-Dichlorobenzene	ND	5.18	0.07	33.7	5.75	7.07	-11.8
Benzyl chloride	ND	23.2	0.05	44.2	4.58	7.42	-13.5
1,4-Dichlorobenzene	BDL	3.04	0.06	36.8	7.78	6.66	-11.8
1,2-Dichlorobenzene	BDL	6.26	0.07	36.4	6.92	7.72	-11.9
1,2,4-Trichlorobenzene	ND	15.9	0.24	39.0	7.39	6.42	11.0
Naphthalene	ND	17.7	0.15	70.3	3.37	6.82	15.1
Hexachlorobutadiene	ND	6.58	0.17	20.7	6.32	3.18	3.03

¹ Determined by SIM analysis of six SilcoCan® air monitoring canisters (cat. # 24142-650) filled with (50% RH) nitrogen to 30 psig and stored for 3 days.

² RRF from five-point calibration curve in scan mode.

³ Calculated as the standard deviation of seven replicate analyses of a 0.20 ppbv standard and the Student's t test value for 99% confidence.

⁴ Calculated as the standard deviation of seven replicate analyses of a 75.0 pptv standard and the Student's t test value for 99% confidence.

⁵ Calculated as the absolute value of the difference between analyses of two canisters divided by their average value and expressed as a percentage.

⁶ The average %RSD obtained from seven replicate analyses in scan and seven replicate analyses in SIM.

⁷ Determined from a 10.0 ppbv audit standard.

BDL – Below detection limit

ND – Not detected

Meet Clean Canister Requirements

Pair our faster GC-MS analysis with rugged, inert SilcoCan® whole air sampling canisters and TO-Clean canister cleaning system to ensure contaminant-free samples.



24282

Humidify reliably with Restek's humidification chamber.



24285

Ensure accurate canister pressure and vacuum in the field and lab with Ashcroft® test gauges.

Meet Clean Canister Requirements with SilcoCan® Whole Air Sampling Canisters and the TO-Clean Canister Cleaning System

Preventing sample contamination is a critical part of obtaining accurate results when analyzing VOCs in air samples. Section 8.4.1 of Method TO-15 addresses canister cleaning and certification. This section stipulates that any canister that has not tested clean (compared to direct analysis of humidified zero air of less than 0.2 ppbv of targeted VOCs) should not be used.

In addition to our short column GC-MS method, we used SilcoCan® whole air sampling canisters (cat. # 24141-650) fitted with Parker® diaphragm valves and gauges that were cleaned using a TO-Clean canister cleaning system (cat. # 22916). These sampling canisters were chosen because they are deactivated with Siltek® passivation treatment, which results in a highly inert surface that does not react with active compounds. All canisters were cleaned in a TO-Clean system using the procedure detailed in Table III. Blank samples were generated by pressurizing clean canisters with humidified (50% RH) nitrogen to 30 psig, storing them for 3 days at room temperature (to simulate sample handling/shipping times), and then analyzing them in selected ion monitoring (SIM) mode for cleanliness.

Table III: Recommended canister cleaning procedure conducted at 100 °C with 50% RH nitrogen.

Cycle	Evacuation Vacuum (mTorr)	Pressurization Pressure (psig)
1	500 (Hold for 60 min)	30
2	500 (Hold for 60 min)	30
3	500 (Hold for 60 min)	30
Final	50	30 (Only for blanks)

The combination of the inert SilcoCan® whole air sampling canisters and the cleaning efficiency of the TO-Clean system produced clean blanks that met Method TO-15 criteria of less than 0.2 ppbv for all target analytes. With the exception of ethanol, which at 160 pptv still passes performance criteria, all 65 components were either not detected or were below detection limits. Good results were obtained even for active compounds (e.g., acrolein), polar compounds (e.g., isopropyl alcohol, methyl ethyl ketone), and heavier semivolatile compounds (e.g., *m*- and *p*- xylenes).

Restek's Faster GC Solution for Analyzing VOCs in Air—Meet Method Requirements While Increasing Sample Throughout

Labs testing VOCs in air can substantially increase productivity, while meeting Method TO-15 performance requirements, by adopting Restek's faster GC approach. As demonstrated here, the use of an Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm) paired with a highly inert SilcoCan® air sampling canister allows all requirements to be met in about half the time required by conventional 60 m setups. In addition, the shorter column increases sensitivity, which improves accuracy at trace levels. By combining the shorter column with SilcoCan® whole air sampling canisters and an easy-to-use, high efficiency TO-Clean canister cleaning systems, labs can improve productivity with confidence in data quality.

Review our complete method evaluation at www.restek.com/rapidTO-15

Recommended Products

SilcoCan® Air Sampling Canisters

Ideal for low-level reactive sulfur (5-20 ppb), TO-14A, or TO-15 compounds

- High quality, metal-to-metal seal, $2/3$ -turn valve with stainless steel diaphragms.
- Sizes to support a wide range of sampling needs.
- 2-port or 3-port valve available; 3-port valve includes -30" Hg/60 psi vacuum/pressure gauge (other gauges available).
- Unsurpassed inertness, even for sulfur-containing or brominated compounds.
- For critical applications, order a Siltek®-treated valve—add suffix “-650” to the catalog number of the canister.

Dimensions/Weights of Air Canisters

Can Volume—	Dimensions: height x sphere diameter—	Weight	
1 liter—	8.5 x 5.25" (21.6 x 13.3 cm)—	2.25 lbs (1.02 kg)	
3 liter—	11.5 x 7.25" (29.2 x 18.4 cm)—	3.50 lbs (1.59 kg)	
6 liter—	12.5 x 9.25" (31.8 x 23.5 cm)—	5.75 lbs (2.61 kg)	
15 liter—	17.0 x 12.25" (43.2 x 31.1 cm)—	11.75 lbs (5.33 kg)	

Description	1 L Volume	3 L Volume	6 L Volume	15 L Volume
	cat.#	cat.#	cat.#	cat.#
w/ Parker Diaphragm Valve, Siltek Treated, and Gauge*	24140-650	24141-650	24142-650	24143-650

Do not exceed canister maximum pressure of 40 psig.

*Range of standard gauge is -30" Hg to 60 psi.



Canisters are the gold standard for ambient VOC monitoring.

TO-Clean Canister Cleaning System

High capacity, fully automated, easy-to-use canister cleaning oven dramatically increases lab efficiency.

- EPA Method TO-14A/15 compliant.
- Powerful pump can achieve 50 mTorr in 30 minutes for twelve 6 L canisters.
- Custom-built trays for different canister sizes.
- Humidifier provides humidified nitrogen to improve cleaning process.
- One-year limited warranty.
- Fully assembled and ready to use.

Description	qty.	cat.#
TO-Clean Oven, 120 V, 60 Hz	ea.	22916
TO-Clean Oven, 220/230 V, 50/60 Hz	ea.	22917

Shipping: FedEx Ground, unless otherwise requested. Costs vary depending on ship-to location.

Note: Ovens are built on demand; therefore, a ten-week lead time is required on all orders. A limited cancellation and return policy applies to TO-Clean ovens; contact Restek Customer Service for details.



Specifications:

TO-Clean Oven
Dimensions: 44"H x 48"W x 27"D
Weight: 525 lb

Cart
Dimensions: 29"H x 48"W x 30"D
Weight: 486 lb

Dewar
Weight: 5 lb

Rxi®-5Sil MS Columns (fused silica)

(low polarity phase; Crossbond® 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane)

- Engineered to be a low-bleed GC-MS column.
- Excellent inertness for active compounds.
- General-purpose columns—ideal for GC-MS analysis of semivolatiles, polycyclic aromatic compounds, chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, and hydrocarbons.
- Temperature range: -60 °C to 350 °C.

Description	temp. limits	qty.	cat.#
30 m, 0.32 mm ID, 1.00 µm	-60 to 320/350 °C	ea.	13654

Visit www.restek.com/air
for our complete
line of air sampling
accessories

**Environmental Air Monitoring Gas Standards**

Our high-quality air monitoring gas calibration standards are provided by Spectra/Linde and Scott/Air Liquide—meeting lab requirements for two separate sources of calibration standards. Each comes with a Certificate of Analysis and unique serial number.

TO-15 65 Component Mix (65 components)

Acetone	<i>trans</i> -1,2-Dichloroethene	Methylene chloride
Acrolein	1,2-Dichloropropane	Methyl <i>tert</i> -butyl ether (MTBE)
Benzene	<i>cis</i> -1,3-Dichloropropene	Methyl methacrylate
Benzyl chloride*	<i>trans</i> -1,3-Dichloropropene	Naphthalene
Bromodichloromethane	1,4-Dioxane	2-Propanol
Bromoform	Ethanol*	Propylene
Bromomethane	Ethyl acetate	Styrene
1,3-Butadiene	Ethyl benzene	1,1,2,2-Tetrachloroethane
2-Butanone (MEK)	Ethylene dibromide	Tetrachloroethene
Carbon disulfide*	(1,2-dibromoethane)	Tetrahydrofuran
Carbon tetrachloride	4-Ethyltoluene	Toluene
Chlorobenzene	Trichlorofluoromethane	1,2,4-Trichlorobenzene
Chloroethane	(Freon 11)	1,1,1-Trichloroethane
Chloroform	Dichlorodifluoromethane	1,1,2-Trichloroethane
Chloromethane	(Freon 12)	Trichloroethene
Cyclohexane	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1,2,4-Trimethylbenzene
Dibromochloromethane	1,2-Dichlorotetrafluoroethane (Freon 114)	1,3,5-Trimethylbenzene
1,2-Dichlorobenzene	Heptane	Vinyl acetate
1,3-Dichlorobenzene	Hexachloro-1,3-butadiene	Vinyl chloride
1,4-Dichlorobenzene	Hexane	<i>m</i> -Xylene
1,1-Dichloroethane	2-Hexanone (MBK)	<i>o</i> -Xylene
1,2-Dichloroethane	4-Methyl-2-pentanone (MIBK)	<i>p</i> -Xylene
1,1-Dichloroethene		
<i>cis</i> -1,2-Dichloroethene		

1 ppm in nitrogen, 104 liters @ 1,800 psi
cat.# 34436 (ea.)

*Stability of this compound cannot be guaranteed.
No data pack available. Quantity discounts not available.

TO-14A Internal Standard/Tuning Mix (4 components)

Bromochloromethane
1-Bromo-4-fluorobenzene (4-Bromofluorobenzene)
Chlorobenzene-d5
1,4-Difluorobenzene

1 ppm in nitrogen, 104 liters @ 1,800 psi
cat.# 34408 (ea.)

No data pack available. Quantity discounts not available.

Gas standards are subject to hazardous materials shipping fees by most freight carriers. All calibration gas standards are nonreturnable due to DOT hazardous shipping requirements.

RESTEK
Pure Chromatography

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22 (of 72) 2016/Rxi

NEW! Rxi®-1301Sil MS GC Columns

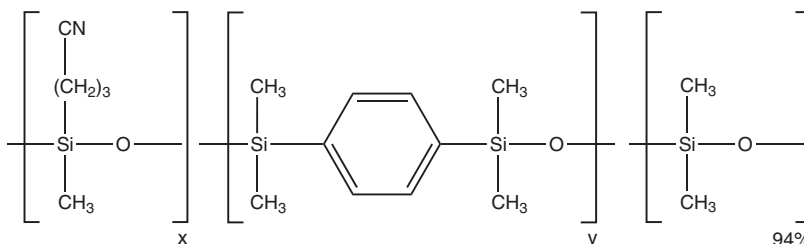
The Selectivity You Need Without the Bleed



- Highest thermal stability in the industry ensures **dependable, accurate MS results and increased uptime.**
- Stabilized cyano phase selectivity **improves the performance of existing methods.** Ideal for solvents, glycols, and other polar compounds.
- Rigorous QC testing ensures inertness and **accurate, reliable data for multiple compound classes.**
- Maximum temperature: up to 320 °C

Cyano-based 1301 columns are general use GC columns that are well suited for the analysis of solvents across a range of volatilities. The cyano stationary phase provides more retention of polar compounds than a 5-type column; however, cyano-based stationary phases are prone to high bleed and poor robustness, limiting their utility. The new Rxi®-1301Sil MS column from Restek is a silarylene-based cyano stationary phase that not only offers the column selectivity needed for analyzing less volatile compounds, but also provides stable column chemistry which results in lower column bleed and improved robustness (Figure 1).

Figure 1: The new Rxi®-1301Sil MS column from Restek features a silarylene backbone, which results in a highly stable cyano phase with lower bleed and greater robustness than typical 1301-type columns.

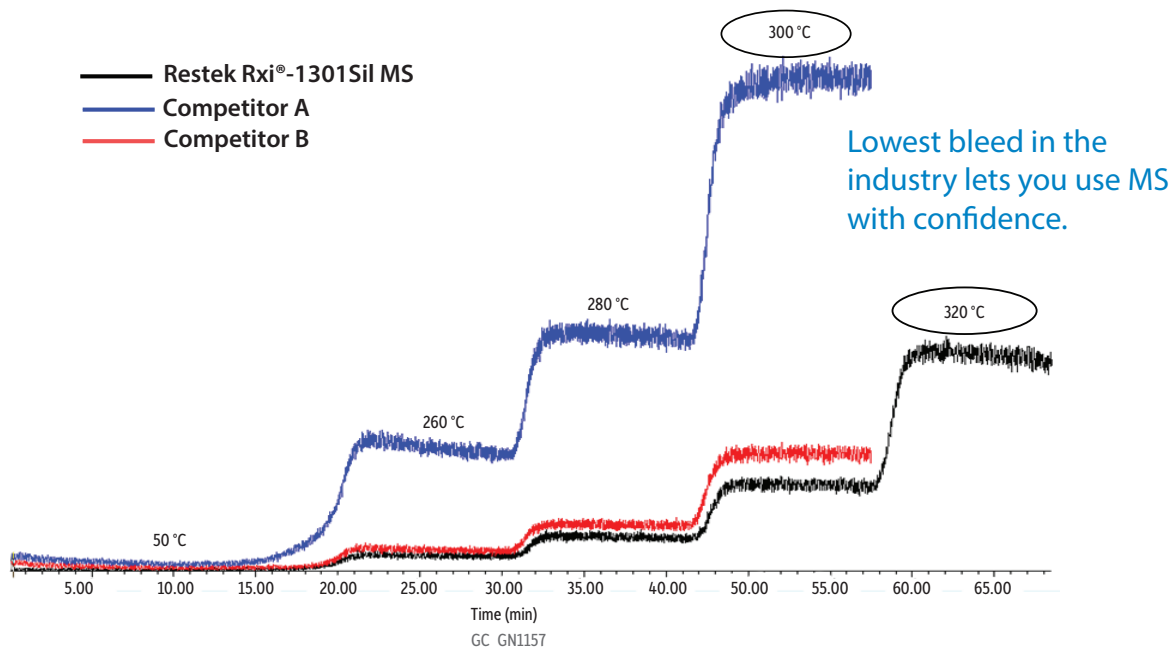


The low maximum operating temperature that is characteristic of non-silarylene cyano phases (<300 °C) is a well known drawback to using traditional 1301 columns for volatiles analysis. Due to their high bleed and low maximum temperatures, many 1301 columns do not perform well for MS analyses. In contrast, the robust Rxi®-1301Sil MS column works extremely well for MS applications because it offers the highest maximum temperature and lowest bleed in the industry (Figure 2), leading to much more reliable and accurate MS results. The exceptionally high thermal stability of the column produces robust performance and allows for more aggressive thermal ramping to eliminate carryover of high molecular weight compounds between analyses (i.e., increased uptime).

In addition to providing stable column chemistry with 1301 selectivity and the lowest bleed/highest temperature limits in the industry, the Rxi®-1301Sil MS column is designed to provide a high degree of inertness. Each Rxi®-1301Sil MS column is tested with a QC mix that includes both acidic and basic probes to ensure inertness across multiple compound classes (Figure 3). Greater column inertness improves peak shape and response, ensuring more accurate quantitative results.

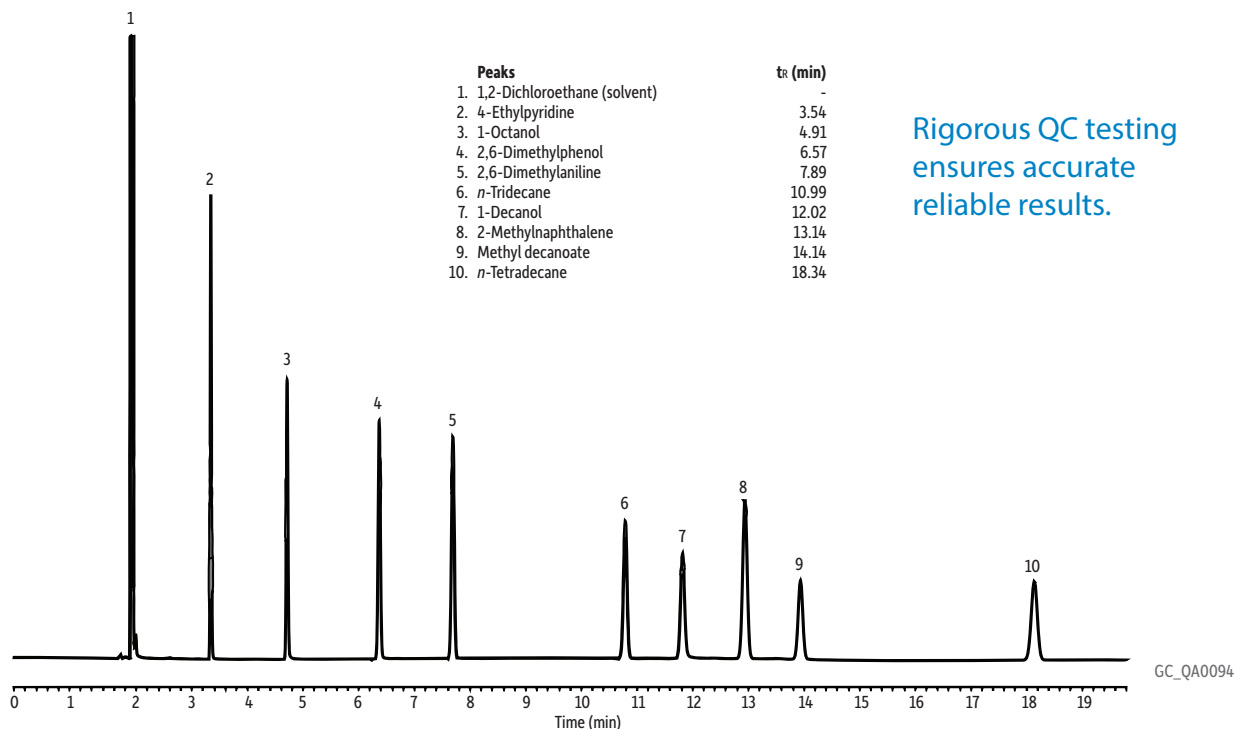
The new Rxi®-1301Sil MS column is ideal for the analysis of multiple compound classes across a range of polarities and volatilities. With its stable cyano-based selectivity and high thermal stability, it is the best 1301-type column for robust MS analyses.

Figure 2: Bleed for the Rxi®-1301Sil MS column is lower at 320 °C than the bleed generated by competitor columns, even when used at their lower operating temperatures.



Column Rxi®-1301Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 16094); **Injection** split (split ratio 100:1), Liner: Sky® 4 mm Precision® liner w/wool (cat.# 23305.1), Inj. Temp.: 270 °C; **Oven** Oven Temp.: 50 °C (hold 10 min) to 260 °C at 20 °C/min (hold 10 min) to 280 °C at 20 °C/min (hold 10 min) to 300 °C at 20 °C/min (hold 10 min) to 320 °C at 20 °C/min (hold 10 min); **Carrier Gas** He, constant flow, Flow Rate: 1.0 mL/min; **Detector** MS, Mode: Scan, Transfer Line Temp.: 300 °C, Analyzer Type: Quadrupole, Source Temp.: 270 °C, Quad Temp.: 150 °C, Ionization Mode: EI, Scan Range: 50 - 500 amu; **Instrument** Agilent 7890A GC & 5975C MSD; **Notes** Competitor columns were only programmed to 300 °C, as this is their maximum programmable temperature. The maximum programmable temperature of the Rxi®-1301Sil MS column is 320 °C. Competitor A and B Columns: 30 m x 0.25 mm x 0.25 µm

Figure 3: The Rxi®-1301Sil MS column shows a high degree of inertness for both acidic and basic compounds, ensuring good peak shape for a wide range of analytes.



Column: Rxi®-1301Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 16094); **Sample:** Rxi®-1301Sil MS quality control test mix, Diluent: 1,2-Dichloroethane, Conc.: 500 µg/mL; **Injection:** Inj. Vol.: 1 µL split (split ratio 100:1), Liner: 4 mm Sky® single taper w/wool (cat.# 23303.5), Inj. Temp.: 250 °C; **Oven:** Oven Temp.: 115 °C (hold 20 min); **Carrier Gas:** He, constant pressure (15.69 psi, 108.2 kPa); Linear Velocity: 27.28 cm/sec @ 115 °C, Dead Time: 1.882 min @ 115 °C; **Detector:** FID @ 320 °C, Make-up Gas Flow Rate: 30 mL/min, Make-up Gas Type: N₂, Hydrogen flow: 40 mL/min, Air flow: 400 mL/min, Data Rate: 10 Hz; **Instrument:** Agilent/HP6890 GC

NEW Rxi®-1301Sil MS Columns (fused silica) (midpolarity Crossbond® phase)

- Highest thermal stability in the industry ensures dependable, accurate MS results and increased uptime.
- Stabilized cyano phase selectivity improves the performance of existing methods. Ideal for solvents, glycols, and other polar compounds.
- Rigorous QC testing ensures inertness and accurate, reliable data for multiple compound classes.
- Maximum temperature: up to 320 °C

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.25 µm	-60 to 320 °C		16094	16096
	1.00 µm	-60 to 320 °C		16095	16097
0.32 mm	0.25 µm	-60 to 320 °C		16098	
	1.00 µm	-60 to 320 °C		16099	16100
	1.50 µm	-60 to 320 °C		16104	16105
0.53 mm	1.00 µm	-60 to 320 °C	16101	16102	
	1.50 µm	-60 to 320 °C		16103	
	3.00 µm	-60 to 280/300 °C		16106	16107



True Blue Performance—Exceptionally Inert Sky® Inlet Liners

Sky® 4.0 mm ID Precision® Inlet Liner w/ Wool
For Agilent GCs equipped with split/splitless inlets



ID x OD x L	qty.	cat.#
Precision, Sky Technology, Borosilicate Glass with Quartz Wool 4.0 mm x 6.3 mm x 78.5 mm	ea.	23305.1
Precision, Sky Technology, Borosilicate Glass with Quartz Wool 4.0 mm x 6.3 mm x 78.5 mm	5-pk.	23305.5
Precision, Sky Technology, Borosilicate Glass with Quartz Wool 4.0 mm x 6.3 mm x 78.5 mm	25-pk.	23305.25

Sky® 4.0 mm ID Single Taper Inlet Liner w/ Wool
For Agilent GCs equipped with split/splitless inlets



ID x OD x L	qty.	cat.#
Single Taper, Sky Technology, Borosilicate Glass with Quartz Wool 4.0 mm x 6.3 mm x 78.5 mm	ea.	23303.1
Single Taper, Sky Technology, Borosilicate Glass with Quartz Wool 4.0 mm x 6.3 mm x 78.5 mm	5-pk.	23303.5
Single Taper, Sky Technology, Borosilicate Glass with Quartz Wool 4.0 mm x 6.3 mm x 78.5 mm	25-pk.	23303.25

Sky® 2.0 mm ID Straight Inlet Liner
For Agilent GCs equipped with split/splitless inlets



ID x OD x L	qty.	cat.#
Straight, Sky Technology, Borosilicate Glass 2.0 mm x 6.5 mm x 78.5 mm	ea.	23313.1
Straight, Sky Technology, Borosilicate Glass 2.0 mm x 6.5 mm x 78.5 mm	5-pk.	23313.5
Straight, Sky Technology, Borosilicate Glass 2.0 mm x 6.5 mm x 78.5 mm	25-pk.	23313.25

*** 100% SATISFACTION GUARANTEE:** If your Sky® inlet liner does not perform to your expectations for any reason, simply contact Restek® Technical Service or your local Restek® representative and provide a sample chromatogram showing the problem. If our GC experts are not able to quickly and completely resolve the issue to your satisfaction, you will be given an account credit or replacement product (same cat.#) along with instructions for returning any unopened product. (Do not return product prior to receiving authorization.) For additional details about Restek's return policy, visit www.restek.com/warranty



Instrument Supplies

Premium Non-Stick BTO® Septa

- Preconditioned and ready to use to 400 °C inlet temperature.*
- Bleed and temperature optimized; ideal for demanding GC and GC-MS applications.



Septum Diameter	50-pk.	100-pk.
5 mm CenterGuide	27082	27083
9 mm CenterGuide	27084	27085
9.5 mm (3/8")	27086	27087
10 mm	27088	27089
11 mm (7/16") CenterGuide	27090	27091
11.5 mm CenterGuide	27092	27093
12.7 mm (1/2") CenterGuide	27094	27095
17 mm CenterGuide	27096	27097
Shimadzu Plug	27098	27099

Dual Vespel® Ring Cross-Disk Inlet Seals for Agilent GCs

- Ideal for high-flow split applications >500 mL/min.
- Washerless, leak-tight seals.

0.8 mm ID Dual Vespel Ring Cross-Disk Inlet Seal	2-pk. cat.#	10-pk. cat.#
Gold-Plated	22083	22084
Siltek-Treated	22085	22086



Viton® O-Rings for Agilent GCs

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

Description	Max Temp	Similar to Agilent part #	10-pk. cat.#	50-pk. cat.#
Viton O-Rings for Agilent GCs	300 °C	5188-5365	22241	22242



Note: Due to differences in inlet design, the actual septum temperature for a given inlet setpoint can vary by manufacturer. Restek recommends using only BTO® septa in Thermo TRACE and Focus GCs.

*For 17 mm inlets, the maximum temperature is 330 °C. For all injectors, minimum recommended operating temperature for BTO® septa is 250 °C.

Instrument Supplies



Restek® Electronic Leak Detector

Don't let a small leak turn into a costly repair—protect your analytical column by using a Restek® leak detector.

- Audible tone indicates the severity of a leak.
- Redesigned circuitry offers 12 hours of operation between charges.
- Detects a broad range of gases; EX rated for use with hydrogen and other explosive gases.*

Backed by a one-year warranty, the Restek® leak detector is the industry standard for performance and affordability in handheld leak detectors.

Description	qty.	cat.#
Leak Detector With Hard-Sided Carrying Case and Universal Charger Set (U.S., UK, European, Australian)	ea.	22655
Small Probe Adaptor for Leak Detector	ea.	22658
Dynamic Duo Combo Pack (Restek Leak Detector and ProFLOW 6000 Flowmeter)	kit	22654
Soft-Sided Storage Case for Leak Detector or ProFLOW 6000 Flowmeter	ea.	22657
AC/DC Adaptor Car Charger	ea.	22652
Universal AC Power Adaptor	ea.	22653

*Caution: The Restek® electronic leak detector is designed to detect trace amounts of hydrogen in a noncombustible environment. It is NOT designed for determining leaks in a combustible environment. A combustible gas detector should be used for determining combustible gas leaks under any condition. When using it to detect hydrogen, the Restek® electronic leak detector may only be used for determining trace amounts in a GC environment. Avoid using liquid leak detectors on a GC! Liquids can be drawn into the system and/or into the leak detector.

Speed Up and Simplify GC Method Development With Restek's EZGC® Online Suite

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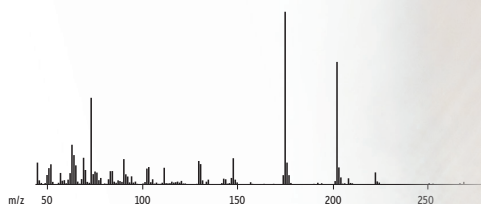
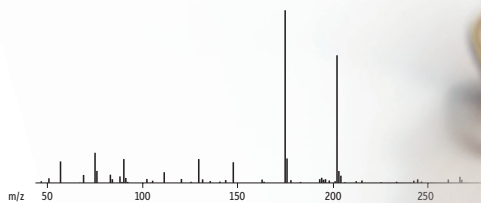
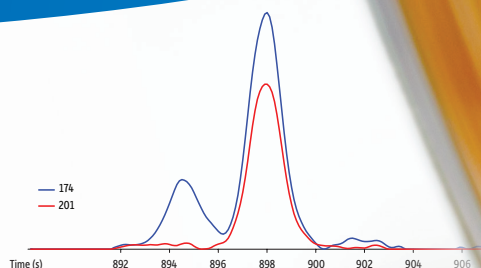
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Rxi[®]-5SiI MS Columns

Rugged, Low-Bleed Performance for
Challenging GC-MS Work

Part of the Rxi[®] GC Column Family

- Accurate MS data
- The right results fast
- Maximize instrument uptime

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27 (of 72) 2016/Rxi

Rxi®-5Sil MS Columns from Restek Give Rugged, Low-Bleed Performance for Challenging GC-MS Work

In every industry, testing methods are becoming more stringent, limits of detection are dropping, and deadlines are getting tighter. Newer GC-MS and GC-MS/MS instruments have been developed to increase overall detectability, but all too often instrument performance is compromised by use of an analytical column that produces high levels of bleed. Column bleed occurs when the stationary phase is lost during exposure to high temperatures or extreme conditions. Column bleed can negatively impact data quality and complicate software integration. In addition, it can contaminate sensitive MS sources, resulting in more downtime due to frequent cleaning. Restek's Rxi®-5Sil MS columns are rugged enough to withstand high temperatures and harsh conditions and still provide the low bleed levels needed for accurate, reliable MS performance.

Why Choose an Rxi®-5Sil MS Column?

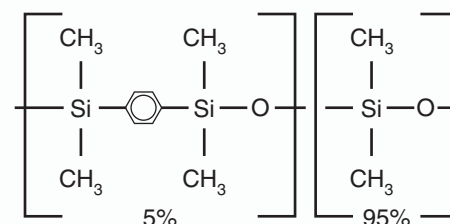
Feature	Benefit
Robust, stable column chemistry	Maximize instrument uptime. Save money and stay productive with long column lifetime, less conditioning, and less detector maintenance.
Enhanced selectivity	Ensure accurate data with optimum resolution.
Low bleed (high thermal stability)	Excellent MS data quality, low background noise, low detection limits, and fast analysis times.
Restek controls the entire manufacturing process	Reliable column-to-column accuracy and reproducibility ensures consistent performance and increased confidence in your data.
Available in Integra-Guard® formats (integrated guard and analytical columns)	Get the protection of a guard column without the risk of problems caused by a poor connection.

What Makes an Rxi®-5Sil MS Column so Unique?

Rxi®-5Sil MS columns contain a silarylene-modified stationary phase, which provides nearly identical selectivity to traditional 5-type phases, but with much greater thermal stability. This is accomplished by incorporating phenylene groups into the polysiloxane backbone, forming silarylene copolymers that increase phase rigidity and prevent phase bleed (Figure 1). The silarylene copolymer reduces column bleed and increases robustness, allowing for a higher maximum temperature and longer column lifetime—even when exposed to harsh matrix components or derivatization reagents.

In addition to employing a silarylene-stabilized stationary phase, Restek controls all facets of column manufacturing: we draw our own fused silica tubing, manufacture polymers, and individually check each column against industry standard specifications for column performance parameters such as efficiency, selectivity, inertness, and bleed. By choosing a Restek Rxi®-5Sil MS column, you are ensuring you will get the maximum value from your MS investment. Regardless of your industry, if your GC-MS method requires high temperatures or other challenging conditions, using a long-lasting Rxi®-5Sil MS column can help you improve both data quality and instrument productivity.

Figure 1: The silarylene-based Rxi®-5Sil MS phase structure is exceptionally robust, making it ideal for GC-MS work at high temperatures and with harsh matrices.



Rugged Rxi®-5Sil MS columns are ideal for trace-level GC-MS analyses of a broad range of compounds. Review the example applications shown here; then try an Rxi®-5Sil MS column for yourself!

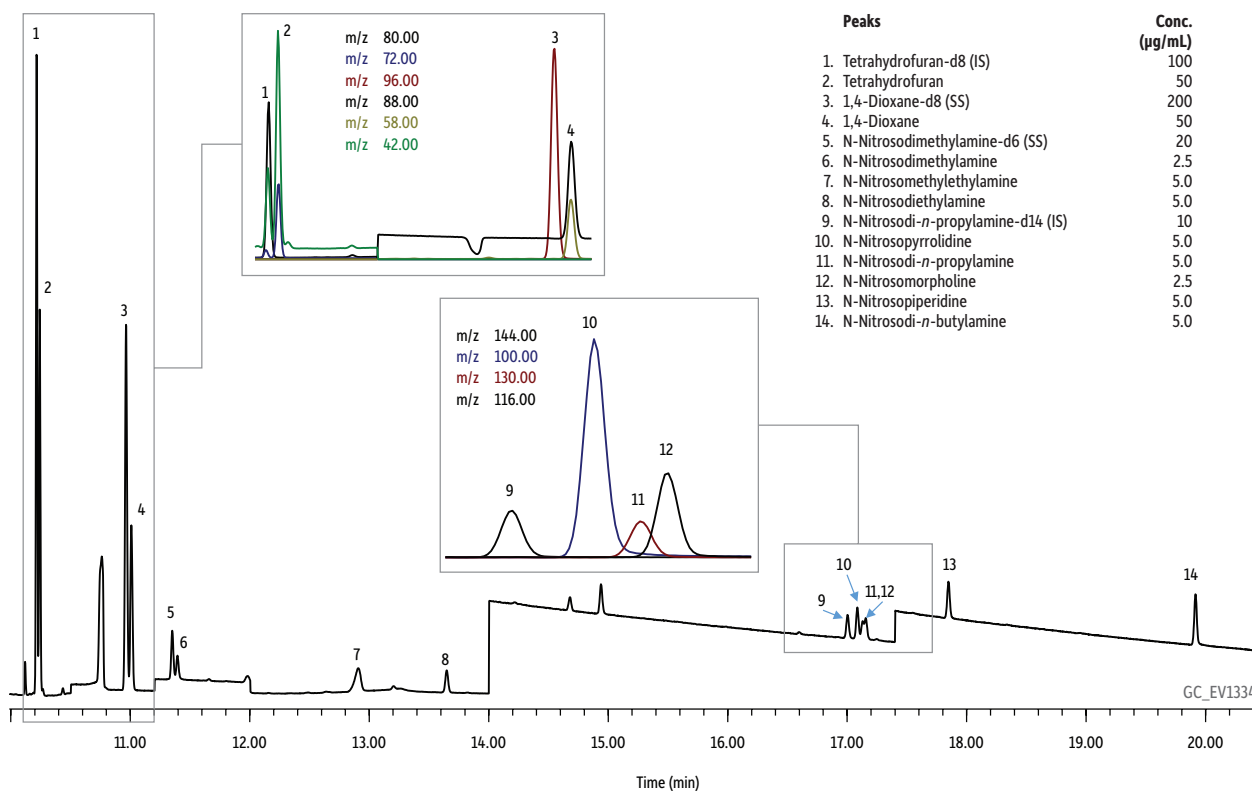
High Thermal Stability Rxi®-5Sil MS Columns Provide Accurate MS Results for Nitrosamines and 1,4-Dioxane at Trace Levels in Drinking Water

1,4-Dioxane and various nitrosamines are carcinogenic drinking water contaminants. 1,4-Dioxane is a common additive used to stabilize chlorinated solvents; it is introduced into groundwater through the improper disposal of solvents. Nitrosamines are an emerging class of contaminants and are byproducts of drinking water disinfection. As shown in Figure 2, Restek has developed a simple combined method for trace-level determination of 1,4-dioxane and nitrosamines in drinking water that can be run on a relatively inexpensive GC-MS in EI mode, rather than by GC-MS/MS or by GC-MS in PCI mode. This method relies on the concurrent solvent recondensation–large volume splitless injection (CSR-LVSI) described by Magni and Porzano [1,2] to introduce sufficient analyte mass onto the column. Although drinking water samples are relatively clean, the large volume injection introduces co-extracted matrix interferences onto the column. The temperature stability of the Rxi®-5Sil MS column allows for a high-temperature hold after each analysis to ensure that carryover is not a source of interference in subsequent analyses.

Tech Tip: For complete full method conditions and an explanation of CSR-LVSI and its benefits, visit www.restek.com and enter EVAN1922A-UNV in the search.



Figure 2: Rxi®-5Sil MS columns allow the combined analysis of low levels of 1,4-dioxane and various nitrosamine drinking water contaminants using CSR-LVSI and GC-MS.



Column: Rxi®-5Sil MS, 30 m, 0.25 mm ID, 1.00 µm (cat.# 13653) using Rxi® guard column 10 m, 0.53 mm ID (cat.# 10073) with SGE® µ-junction; Sample: N-Nitrosodimethylamine-d6 (cat.# 33910), 1,4-Dioxane-d8 (cat.# 30614), N-Nitrosodi-n-propylamine-d14 (cat.# 33911), Tetrahydrofuran-d8 (cat.# 30112), Nitrosamine calibration mix, Method 521 (cat.# 31898), Appendix IX mix #1, revised (cat.# 32459); Diluent: Dichloromethane; For full list of conditions search for chromatogram# GC_EV1334 at www.restek.com

[1] P. Magni, T. Porzano, Concurrent solvent recondensation large sample volume splitless injection, J. Sep. Sci. 26 (2003).

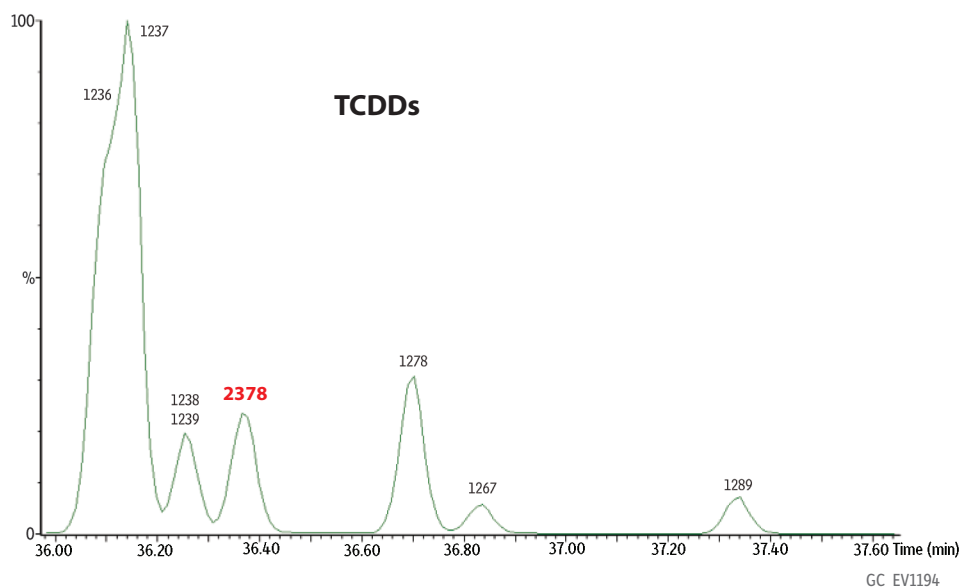
[2] Patent No: U.S. 6,955,709 B2.

Rxi®-5Sil MS Columns Accurately Determine Dioxins and Furans in Challenging Matrices

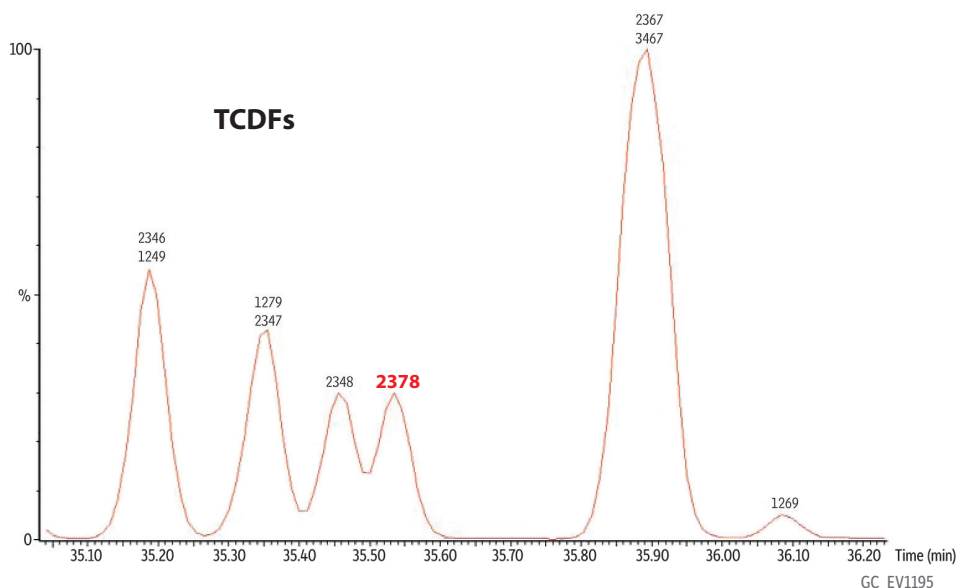
Chlorinated dioxins and furans comprise a large class of persistent organic pollutants (POPs) that are known to bioaccumulate and to biomagnify, which significantly impact human health and the environment. Dioxin analyses are challenging in that there are a total of 210 potential compounds and isomers in the classes of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Only 17 of these compounds are toxic; however, the toxic species must be chromatographically resolved from other interfering dioxins or

Figure 3: The Rxi®-5Sil MS column allows separation of toxic congeners from interfering dioxins and furans. In addition, its high temperature tolerance allows matrix interferences to be removed using high-temperature holds between analytical runs.

Tetrachlorinated Dibenzodioxins (TCDDs)



Tetrachlorinated Dibenzofurans (TCDFs)



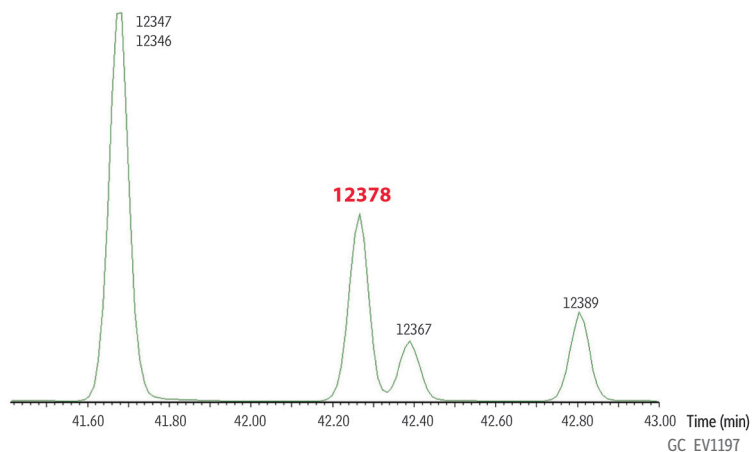
Column: Rxi®-5Sil MS, 60 m, 0.18 mm ID, 0.10 µm (cat.# 43607); **Sample:** Fly ash extract; **Diluent:** Nonane; **Injection:** Inj. Vol.: 1 µL splitless; **Liner:** 2 mm splitless liner (cat.# 20712); **Oven:** 120 °C (hold 1 min) to 160 °C at 10 °C/min to 300 °C at 2.5 °C/min; **Carrier Gas:** He, constant flow; **Flow Rate:** 1 mL/min; **Detector:** Waters AutoSpec Ultima mass spectrometer; **Source Temp.:** 280 °C; **Ionization Mode:** EI, electron ionization at 40 eV; **Notes:** Red indicates toxicity; **Acknowledgement:** Chromatogram courtesy of Karen MacPherson, Li Shen, Terry Kolic, and Eric Reiner at the Ontario Ministry of the Environment.



furans in order to obtain accurate measurements of the amount of toxic compounds in a sample. When the Rxi®-5Sil MS column is used in conjunction with Restek's Rtx®-Dioxin2 column, full, unequivocal quantification of all dioxins can be achieved. On its own, the Rxi®-5Sil MS fully resolves 15 of the 17 toxic congeners, including 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF) (Figure 3), which is something that traditional 5-type phases cannot accomplish. In addition, the 350 °C maximum temperature of the Rxi®-5Sil MS column allows elution of interfering matrix components between analyses.

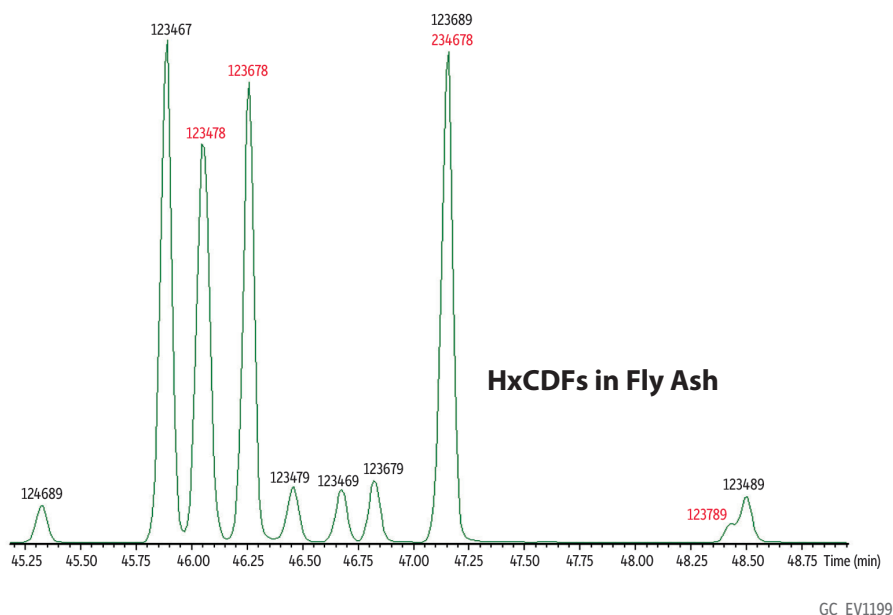
Pentachlorinated Dibenzodioxins (PeCDDs)

PeCDDs in Fly Ash



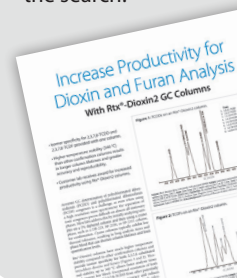
Hexachlorinated Dibenzofurans (HxCDFs)

HxCDFs in Fly Ash



Tech Tip: The Rtx®-Dioxin2 column is recommended for use with the Rxi®-5Sil MS column for comprehensive, accurate quantification of dioxin congeners. In contrast with the traditional cyano-type phase used for this analysis, the Rtx®-Dioxin2 column has a maximum temperature of 340 °C, allowing it to be used in the same oven as the Rxi®-5Sil MS column in order to increase productivity.

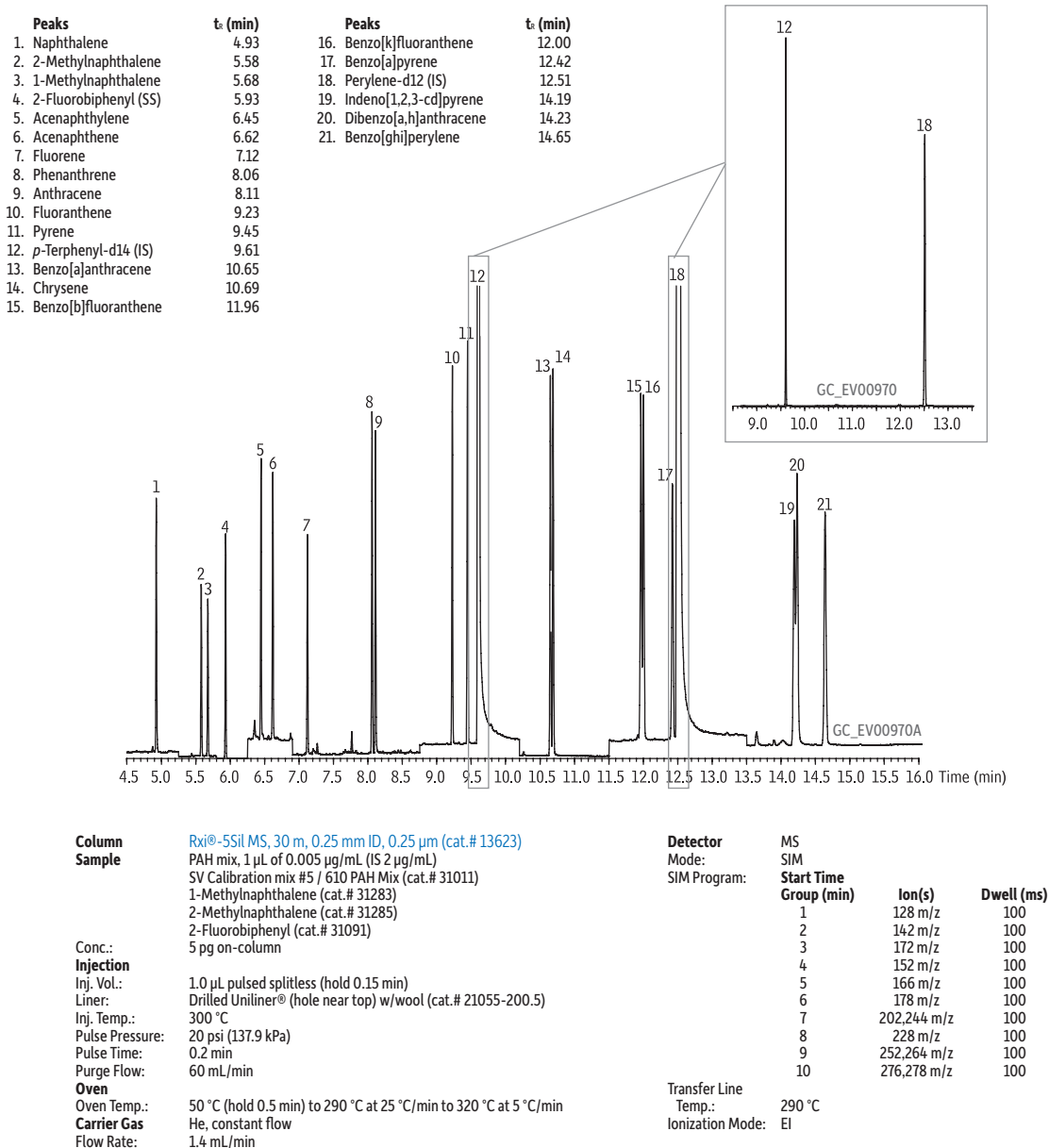
To learn more about dioxin analysis and how one lab improved their productivity, visit www.restek.com and enter GNTS1511-UNV in the search.



Get the Right Results Fast—Accurately Detect Key Polycyclic Aromatic Hydrocarbons Using Thermally Stable Rxi®-5Sil MS Columns

Polycyclic aromatic hydrocarbons (PAHs) are byproducts of combustion and are created when products like coal, oil, gas, or garbage are not completely burned. PAHs persist in the environment and bioaccumulate. While some PAHs have no toxic potential, other PAHs (e.g., benz[a]anthracene) have considerable toxicological impacts, including carcinogenicity. PAHs are relatively inert and respond very well for GC-MS analyses; however, PAH analyses are complicated in that the compounds of interest encompass a relatively wide volatility range with the heaviest PAHs eluting at high oven temperatures. As shown in Figure 4, the high maximum temperature of the Rxi®-5Sil MS column allows for fast elution of even the heavier PAHs, reducing run times and eliminating carryover of matrix components into subsequent runs. Additionally, the low bleed of the Rxi®-5Sil MS column allows for very low-level SIM analyses for PAHs without interference from bleed ions.

Figure 4: Accurately quantify low levels of a wide range of PAHs without interference from column bleed using robust Rxi®-5Sil MS columns.





Maximize Instrument Uptime: Rxi®-5Sil MS Columns Even Withstand Exposure to Derivatization Reagents

In addition to its utility in other industries, the rugged, low-bleed performance of the Rxi®-5Sil MS column makes it well suited to the needs of clinical and forensic laboratories. The outstanding robustness imparted by the Rxi®-5Sil MS column stationary phase allows labs to analyze more biological samples per column than when using standard 5-type phases, which reduces both downtime and expenditures for consumables. Analysis of amphetamines in urine or whole blood is a common, yet challenging, test procedure for these labs as amphetamines are basic compounds that should be derivatized prior to GC analysis. Derivatization reagents can produce harsh byproducts that cause phase degradation in GC columns. As shown in Figure 5, the Rxi®-5Sil MS column stands up to derivatization reagents extremely well, ensuring a long life for your analytical column.

Another very common test procedure is the analysis of cannabinoids in urine. This test requires GC-MS analysis of low levels of delta-9-tetrahydrocannabinol (THC) metabolites in a difficult and dirty biological matrix. Additionally, derivatized cannabinoids have high molecular weights and elute at high oven temperatures. Column bleed at these higher temperatures can cause interference with low-level cannabinoids, reducing response and complicating integration. The rugged stationary phase of the Rxi®-5Sil MS column ensures the low bleed required for this high-temperature, trace-level analysis with the robustness to stand up to dirty biological matrix components (Figure 6).

Figure 5: Robust Rxi®-5Sil MS columns do not break down under harsh conditions, such as exposure to the derivatization reagents used in amphetamines analysis. (Compounds shown are HFAA derivatives.)

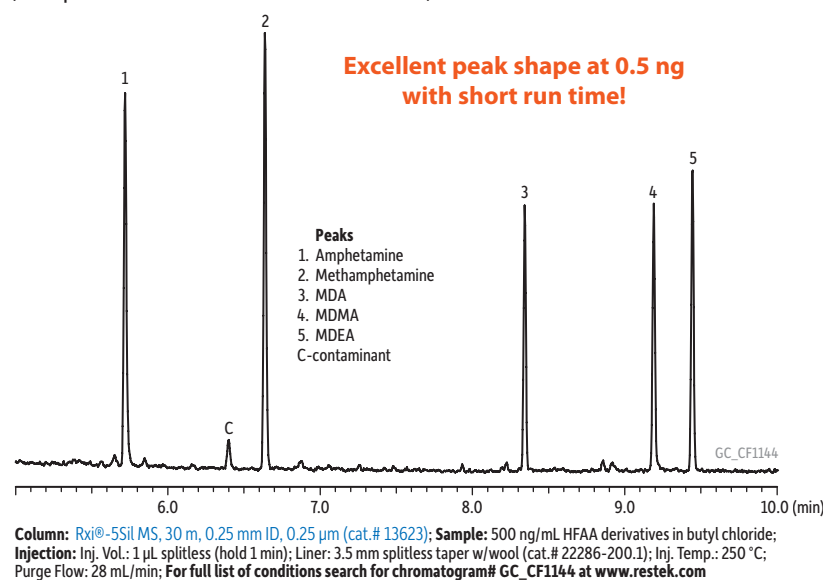
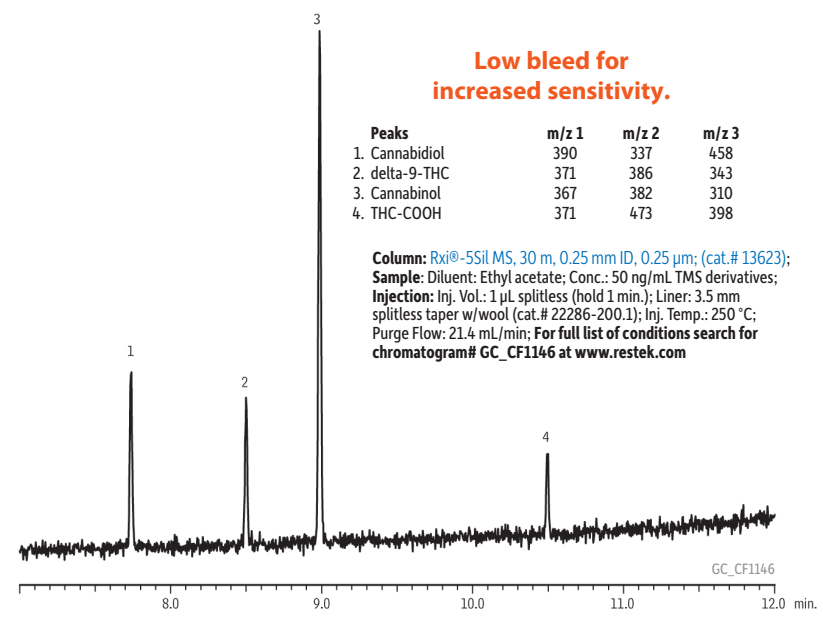


Figure 6: High signal response is obtained for derivatized cannabinoids at just 0.05 ng on-column, due to the low-bleed characteristics of the Rxi®-5Sil MS column. (Compounds shown are TMS derivatives.)



Tech Tip: For other clinical and forensic applications on the Rxi®-5Sil MS column, visit www.restek.com and enter CFB1302A-UNV in the search.



Restek's Rxi®-5Sil MS column offers the rugged, low-bleed performance needed for difficult GC-MS analyses across many industries. Make your next column purchase an Rxi®-5Sil MS column and save time and money with fewer column replacements.

Rugged, Low-Bleed Performance for Challenging GC-MS Work

If your GC-MS method requires high temperatures, harsh derivatization reagents, or involves dirty matrices, you will benefit from using a robust, low-bleed Rxi®-5Sil MS column from Restek.

Rxi®-5Sil MS Columns (fused silica)

(low-polarity phase; Crossbond® 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane)

- Engineered to be a low-bleed GC-MS column.
- Excellent inertness for active compounds.
- General-purpose columns—ideal for GC-MS analysis.
- Available with Integra-Guard® integrated guard columns. Get the protection without the connection!
- Temperature range: -60 °C to 350 °C.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.25 µm	-60 to 320/350 °C	13620	13623	13626
	0.50 µm	-60 to 320/350 °C	13635	13638	—
	1.00 µm	-60 to 320/350 °C	13650	13653	13697
0.32 mm	0.25 µm	-60 to 320/350 °C	13621	13624	—
	0.50 µm	-60 to 320/350 °C	—	13639	—

ID	df	temp. limits	20-Meter cat.#	40-Meter cat.#	60-Meter cat.#
0.18 mm	0.10 µm	-60 to 320/350 °C	—	—	43607
0.18 mm	0.18 µm	-60 to 320/350 °C	43602	43605	—
0.36 mm	0.36 µm	-60 to 320/350 °C	43604	—	—



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Rxi[®]-5Si1 MS

Assured Performance for Forensic Applications

- Exceptional column inertness means greater certainty and lower detection limits.
- Versatile selectivity lets you keep analyzing samples instead of changing columns between methods.
- Robust, low-bleed phase results in better sensitivity and longer column lifetime.

Rxi®-5Sil MS Columns...

Whether analyzing postmortem samples or supporting athletic or workplace drug testing, toxicology labs are challenged with producing critical evidence that stands up under scrutiny. Increased pressure for fast, definitive results is driving labs to investigate standardized procedures and certifications aimed at reducing variability. GC column choice plays a vital role in data quality and using rugged, versatile Rxi®-5Sil MS capillary columns is an easy way to improve chromatography performance and simplify lab operations.

For years, “5” type (5% diphenyl/95% dimethyl polysiloxane) columns have been recognized as the column of choice for analyzing drugs of abuse, because they offer higher selectivity and retention for functionalized compounds than “1” type columns (100% dimethyl polysiloxane). While the selectivity of 5 type columns has many forensic applications, column performance can vary significantly among these columns. Some 5 type columns have inadequate deactivations, causing tailing peaks, or are poorly stabilized, resulting in high bleed levels, reduced sensitivity, and shorter column lifetimes. Rxi®-5Sil MS columns are based on a silarylene phase (Figure 1) that offers improved inertness and stability compared to typical 5 type columns.

Toxicology labs interested in improved data quality can increase confidence in results and reduce downtime by using Rxi®-5Sil MS columns. Exceptional inertness increases accuracy and precision at trace levels, while ruggedness assures low bleed and long column lifetime. As shown on the following pages, these versatile columns can improve lab efficiency and data quality for many different drugs of abuse, including cannabinoids, benzodiazepines, cocaine, opiates, and amphetamines.

Figure 1: Rxi®-5Sil MS columns: phase structure results in a more inert, low-bleed column with broad selectivity for a wide range of compounds.

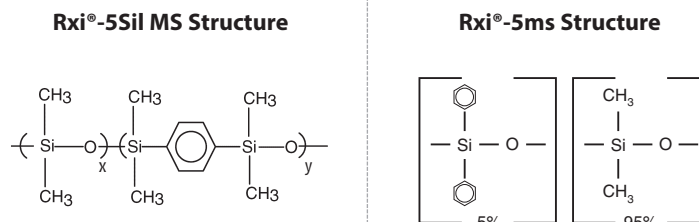
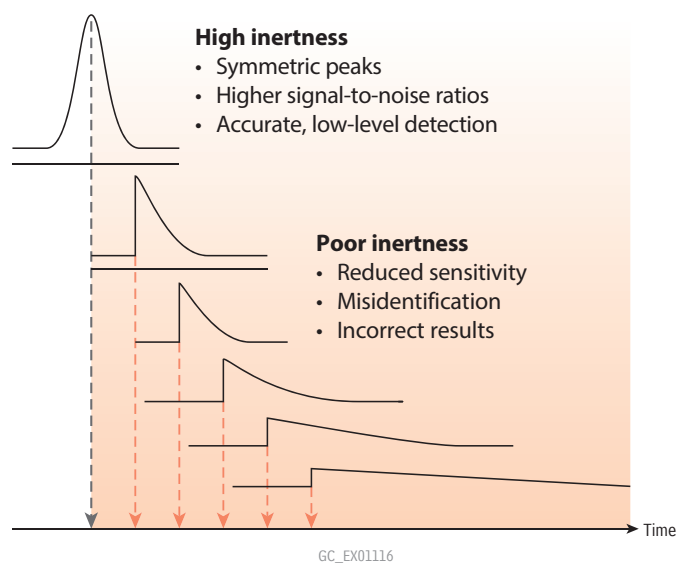


Figure 2: As column activity increases, signal decreases and retention time shifts.

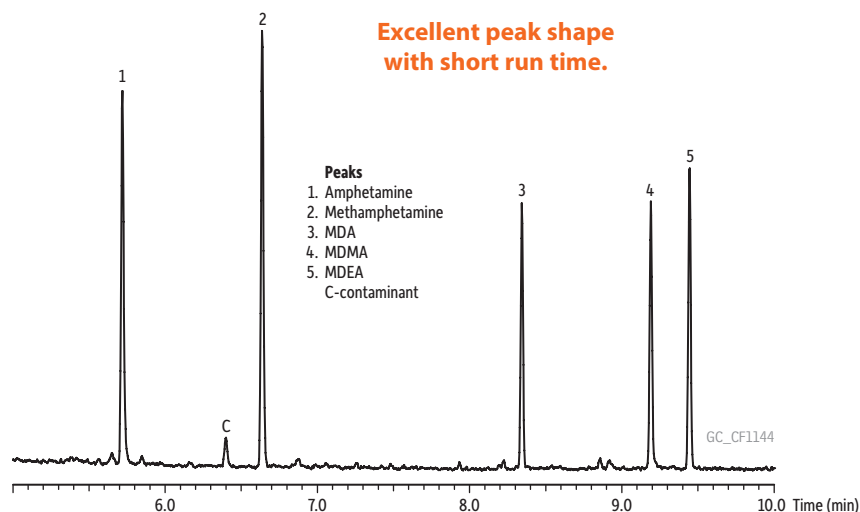


Exceptional Inertness Means Greater Certainty and Lower Detection Limits

Column inertness improves peak shape, which greatly affects the signal-to-noise ratio and, therefore, analytical sensitivity. Rxi®-5Sil MS columns are exceptionally inert, ensuring symmetric peak shape and high response for a wide range of analyte chemistries. In addition to influencing signal-to-noise ratios, column inertness also affects retention time stability, which is an important factor for correct peak identification. Inertness is critical because peak tailing will increase as column activity increases, causing retention times to shift (Figure 2). Analyzing derivatized amphetamines or cocaine and its metabolites on highly inert Rxi®-5Sil MS columns results in symmetric peak shapes and excellent low-level response (Figures 3 and 4).

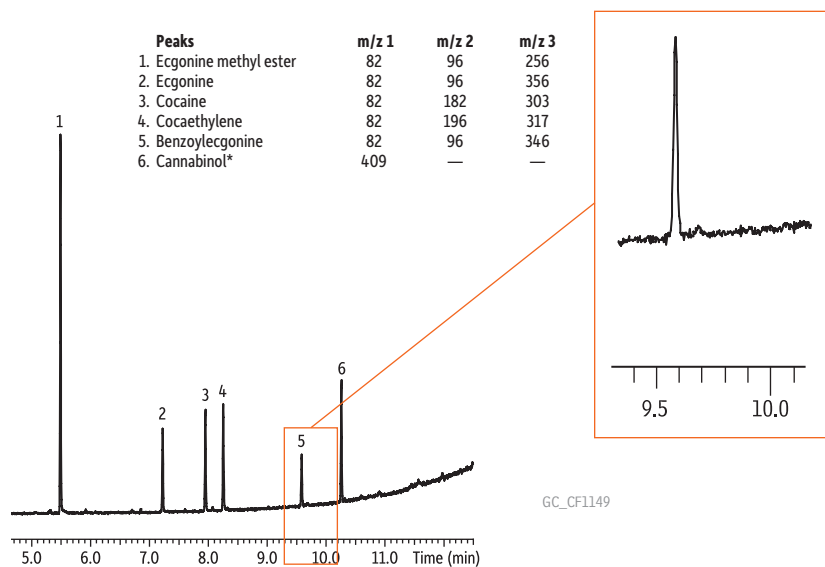
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Figure 3: Robust, inert Rxi®-5Sil MS columns do not break down under harsh conditions, such as exposure to the derivatization reagents used in amphetamines analysis. Compounds shown are HFAA derivatives.



Column: Rxi®-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 13623); **Sample:** 500 ng/mL HFAA derivatives in butyl chloride; **Injection:** Inj. Vol.: 1 µL splitless (hold 1 min); Liner: 3.5 mm splitless taper w/wool (cat.# 22286-200.1); Inj. Temp.: 250 °C; Purge Flow: 28 mL/min; **Oven:** Oven Temp: 75 °C to 300 °C at 15 °C/min; Carrier Gas: He, constant linear velocity, 45 cm/sec, 13.5 psi, 93.1 kPa @ 75 °C; **Detector:** MS, Scan; Transfer Line Temp.: 250 °C; Analyzer Type: Quadrupole; Source Temp.: 200 °C; Electron Energy: 70 eV; Solvent Delay Time: 4 min; Tune Type: PFTBA; Ionization Mode: EI; Scan Range: 40-300 amu; Scan Rate: 5 scans/sec; **Instrument:** Shimadzu 2010 GC & QP2010+ MS.

Figure 4: Low levels of derivatized cocaine and its metabolites can also be reliably separated on Rxi®-5Sil MS columns.



Column: Rxi®-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 13623); **Sample:** 100 ng/mL in butyl chloride; **Injection:** Inj. Vol.: 1 µL splitless (hold 1 min); Liner: single taper w/wool (cat.# 22286-200.1); Inj. Temp.: 250 °C; Purge Flow: 20 mL/min; **Oven:** Oven Temp: 100 °C to 200 °C at 30 °C/min to 300 °C at 15 °C/min; Carrier Gas: He, constant linear velocity, 40 cm/sec, 12.5 psi, 86.2 kPa @ 100 °C; **Detector:** MS, SIM; Transfer Line Temp.: 310 °C; Source Temp.: 250 °C; Solvent Delay Time: 4 min.; Tune Type: PFTBA; Ionization Mode: EI; **Instrument:** Shimadzu 2010 GC & QP2010+ MS; **Notes:** Samples were prepared as follows: Standards brought to dryness under nitrogen, then 50 µL BSTFA + 1%TMCS (cat.# 35606) added. 50 µL pyridine was then added, and samples were incubated at 70 °C for 30 min. After incubation, samples were diluted with butyl chloride.

* Used as derivatization check

Lower Detection Limits with Ground-Breaking Column Technology

Rxi® technology unifies outstanding inertness, low bleed, and high reproducibility into a single high performance column line. Take variation out of the equation and get the most consistent results for trace level analysis with Rxi® columns.

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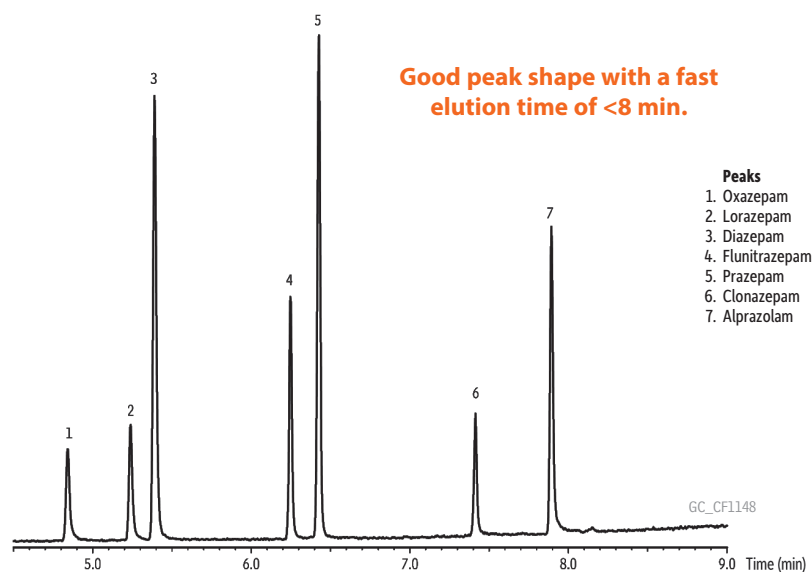
Rxi®-5Sil MS Columns...

Optimized Selectivity Lets You Keep Analyzing Samples Instead of Changing Columns Between Methods

While the inertness of Rxi®-5Sil MS columns exceeds typical 5 type columns, the selectivity is similar and is ideal for many toxicological applications. A wide range of analyte classes can be reliably separated on Rxi®-5Sil MS columns, including structurally-related compounds, such as benzodiazepines. Benzodiazepines are often analyzed on a fluorinated phase (e.g. Rtx®-200), but the selectivity of the Rxi®-5Sil MS column provides complete separation of all peaks of interest (Figure 5). Since a fluorinated column is no longer necessary, more time can be spent running samples with fewer time-consuming column changes between methods.

In addition to benzodiazepines, the selectivity of the Rxi®-5Sil MS column is also well-suited for the analysis of several common classes of drugs of abuse including cannabinoids, cocaine and its metabolites, opiates, and amphetamines. The Miami Dade Medical Examiner's Laboratory provides another example of how Rxi®-5Sil MS columns can simplify analyses and improve lab efficiency. The versatility and robustness of the Rxi®-5Sil MS column assisted the lab in streamlining operations by reducing time-consuming column changes and maintenance. One of the applications routinely run on this column is the analysis of opiates (Figure 6). The selectivity of the Rxi®-5Sil MS column gives excellent separation between all compounds, and very low limits of detection are achieved since bleed is minimal. In addition, the column stands up extremely well to the derivatization reagents used prior to analysis, further increasing throughput by reducing instrument downtime for maintenance. The Rxi®-5Sil MS column also produces excellent chromatography for cannabinoids (Figure 7).

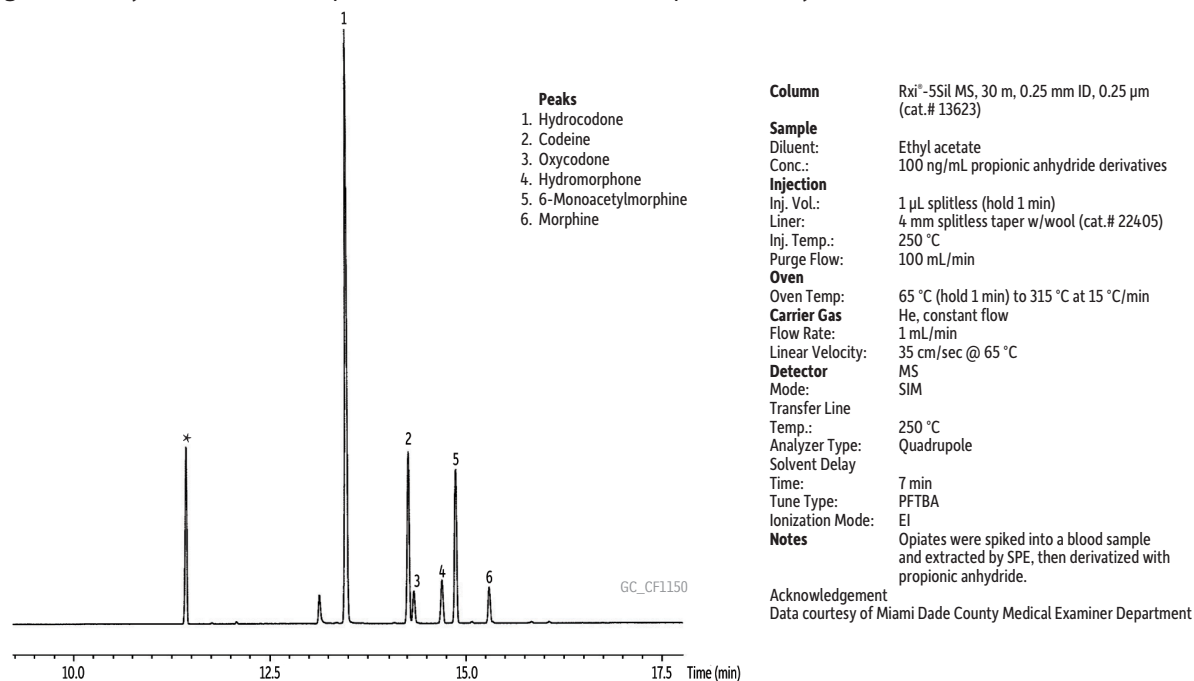
Figure 5: No need to change columns to analyze benzodiazepines—Rxi®-5Sil MS columns give excellent separation of structurally-related benzodiazepines.



Column: Rxi®-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 13623); **Sample:** 15 µg/mL in butyl chloride; **Injection:** Inj. Vol.: 1 µL splitless (hold 1 min); **Liner:** 3.5 mm splitless taper w/wool (cat.# 22286-200.1); **Inj. Temp.:** 280 °C; **Purge Flow:** 32.2 mL/min (20:1 split); **Oven:** Oven Temp: 200 °C to 330 °C at 15 °C/min (hold 3 min); **Carrier Gas:** He, constant linear velocity, 50 cm/sec, 23.7 psi, 163.4 kPa @ 200 °C; **Detector:** MS, Scan; **Transfer Line Temp:** 280 °C; **Analyzer Type:** Quadrupole; **Source Temp.:** 200 °C; **Electron Energy:** 70 eV; **Solvent Delay Time:** 4 min; **Tune Type:** PFTBA; **Ionization Mode:** EI; **Scan Range:** 50-350 amu; **Scan Rate:** 5 scans/sec; **Instrument:** Shimadzu 2010 GC & QP2010+ MS

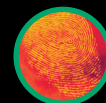
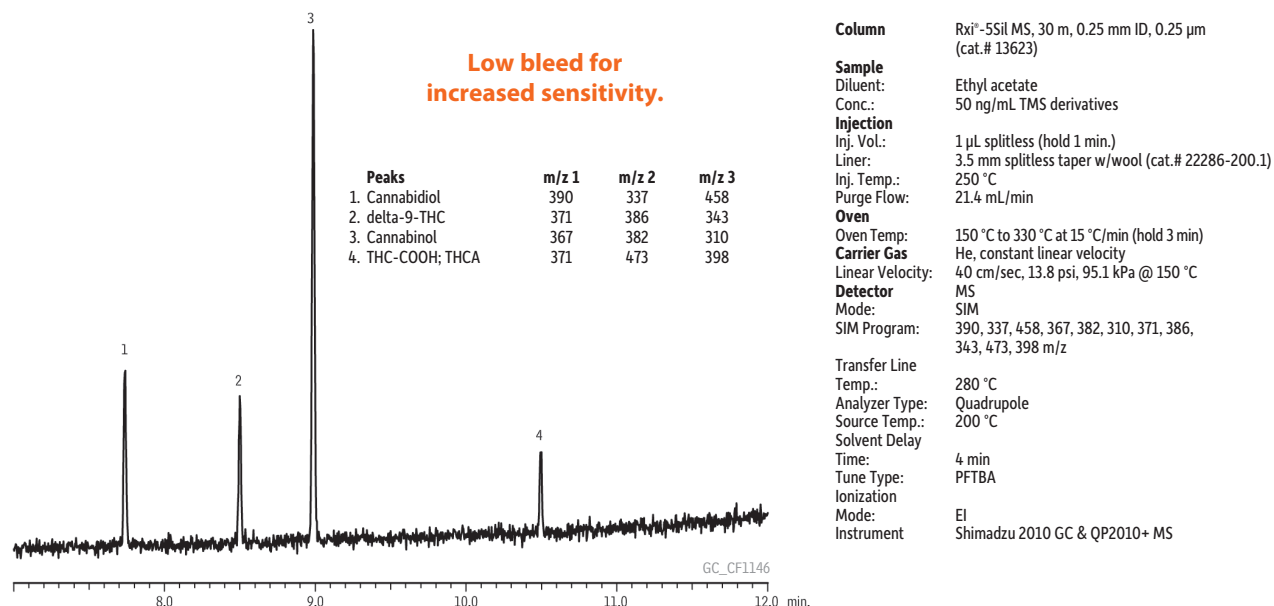
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Figure 6: Analysis of derivatized opiates on an Rxi®-5Sil MS column performed by the Miami Dade Medical Examiner's lab.



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Figure 7: High signal response due to column inertness and efficiency, combined with low bleed, results in maximum sensitivity for derivatized cannabinoids (50 ng/mL).



Rxi®-5Sil MS Columns...

Robust, Low-Bleed Phase Results in Better Sensitivity and Longer Column Lifetime

Many drug assays require that compounds be derivatized prior to analysis. Derivatization not only allows for GC analysis of compounds not otherwise amenable to gas chromatography, it also helps to produce unique, high molecular weight fragments that assist with GC-MS quantitation. While derivatization has its advantages, derivatization reagents and their byproducts are extremely harsh and can reduce column lifetimes by damaging the stationary phase. Phase damage usually manifests as increased bleed and tailing of active compounds. The unique Rxi®-5Sil MS stationary phase, with its embedded arylene groups, provides a more rigid matrix that is less likely to be damaged by derivatization reagents or their byproducts.

As a test of column lifetime, an Rxi®-5Sil MS column was subjected to repeated injections of high concentration HFBA, a harsh derivatization reagent, as well as prolonged exposure to the column's maximum operational temperature during each injection. Throughout lifetime testing, column bleed and inertness were tested by analyzing a mixture of active test compounds that tail severely on less inert columns. After 400 injections, no change in bleed or inertness was observed (Figures 8 and 9). The enhanced stability of Rxi®-5Sil MS columns reduces phase bleed, resulting in longer column lifetimes and improved performance with sensitive mass spectrometry detectors.

Conclusion

Rxi®-5Sil MS columns are ideal for toxicology labs interested in improving data quality by increasing certainty and reducing downtime. These columns have similar selectivity to conventional 5 type columns, but are significantly more inert and robust. Rxi®-5Sil MS columns provide more accurate trace-level results and reduced downtime for column changes, offering labs a valuable tool for improving methods for the routine analysis of drugs of abuse.

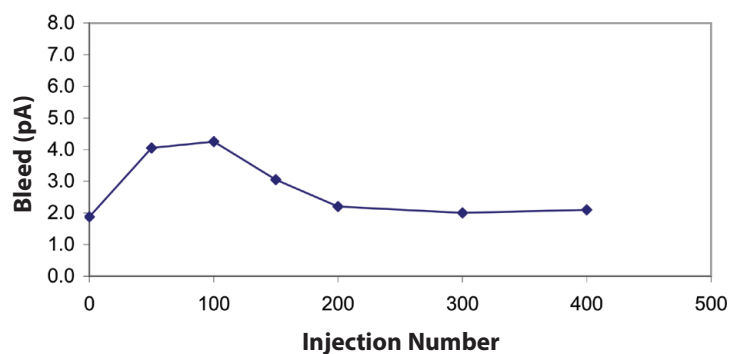
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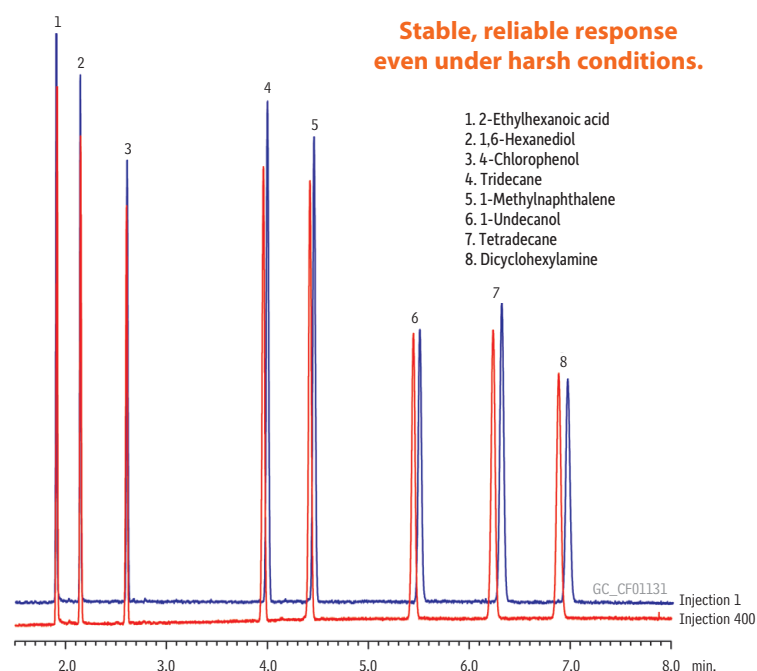
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Figure 8: Low column bleed results in long column lifetimes, saving labs replacement costs.



Column bleed over 400 injections of HFBA derivatization reagent. Column was held at the maximum isothermal temperature.

Figure 9: Rugged Rxi®-5Sil MS columns produce consistent retention times, even after 400 injections of derivatization reagent.



Column: Rxi®-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 13623); Sample: Column test mix (cat.# 35226); Inj.: 1.0 µL split (split ratio 1:60), 4 mm recessed single taper (cat.# 20983); Inj. temp.: 250 °C; Carrier gas: helium, constant pressure; Linear velocity: 36 cm/sec @ 125 °C; Oven temp.: 125 °C; Det: FID @ 320 °C; Instrument: Agilent 6890

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Restek's low-bleed MS columns exceed requirements of the most sensitive mass spectrometers.

Rxi®-5Sil MS Columns (fused silica)

(low polarity phase; Crossbond® 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane)

- Engineered to be a low-bleed GC-MS column.
- Excellent inertness for active compounds.
- General-purpose columns—ideal for GC-MS analysis of drugs of abuse.
- Temperature range: -60 °C to 320/350 °C.

The Rxi®-5Sil MS stationary phase incorporates phenyl groups in the polymer backbone. This improves thermal stability, reduces bleed, and makes the phase less prone to oxidation. Rxi®-5Sil MS columns are ideal for GC-MS applications requiring high sensitivity, including use in ion trap systems.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#
0.25 mm	0.25 µm	-60 to 320/350 °C	13620	13623
	0.50 µm	-60 to 320/350 °C	13635	13638
0.32 mm	0.25 µm	-60 to 320/350 °C	13621	13624
	0.50 µm	-60 to 320/350 °C		13639

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Description	qty.	cat.#
15 m, 0.25 mm ID, 0.25 µm Rxi-5Sil MS w/10 m Integra-Guard Column	ea.	13620-127
30 m, 0.25 mm ID, 0.25 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13623-124
30 m, 0.25 mm ID, 0.25 µm Rxi-5Sil MS w/10 m Integra-Guard Column	ea.	13623-127
15 m, 0.25 mm ID, 0.50 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13635-124
30 m, 0.25 mm ID, 0.50 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13638-124
30 m, 0.25 mm ID, 0.50 µm Rxi-5Sil MS w/10 m Integra-Guard Column	ea.	13638-127
30 m, 0.32 mm ID, 0.50 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13639-125

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ID x OD x L	qty.	cat.#
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4.0 mm x 6.5 mm x 78.5 mm	ea.	23303.1
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	23303.5
4.0 mm x 6.5 mm x 78.5 mm	25-pk.	23303.25

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ID x OD x L	qty.	cat.#
Single Taper, Sky Technology, Borosilicate Glass		
4.0 mm x 6.5 mm x 78.5 mm	ea.	23302.1
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	23302.5
4.0 mm x 6.5 mm x 78.5 mm	25-pk.	23302.25

Recommended for Split Injection

Sky® 4.0 mm ID Precision® Inlet Liner w/ Wool
For Agilent GCs equipped with split/splitless inlets



ID x OD x L	qty.	cat.#
Precision, Sky Technology, Borosilicate Glass with Quartz Wool		
4.0 mm x 6.3 mm x 78.5 mm	ea.	23305.1
4.0 mm x 6.3 mm x 78.5 mm	5-pk.	23305.5
4.0 mm x 6.3 mm x 78.5 mm	25-pk.	23305.25

Sky® 4.0 mm ID Cyclo Inlet Liner

For Agilent GCs equipped with split/splitless inlets



ID x OD x L	qty.	cat.#
Cyclo, Sky Technology, Borosilicate Glass		
4.0 mm x 6.3 mm x 78.5 mm	ea.	23312.1
4.0 mm x 6.3 mm x 78.5 mm	5-pk.	23312.5
4.0 mm x 6.3 mm x 78.5 mm	25-pk.	23312.25

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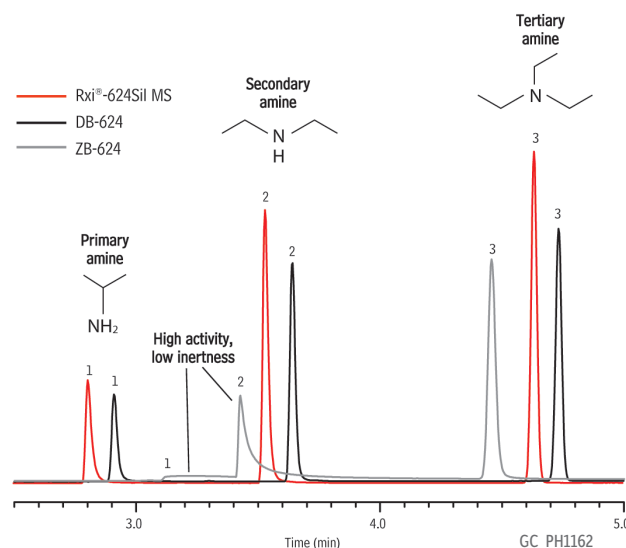
Increase Confidence in Data Accuracy

While mid polarity 624 columns are widely used for analyzing polar analytes and volatile organic compounds (VOCs), not all columns combine the selectivity needed for critical separations with the high inertness and low bleed that can further improve data quality. Whether you are developing methods for residual solvents, analyzing environmental VOCs, or running other applications for volatile organics, you can improve data quality with Rxi®-624Sil MS columns. These new columns incorporate a new stationary phase chemistry, unique column deactivation, and optimized manufacturing process that is specifically designed to provide the high inertness and thermal stability needed for greater accuracy and lower detection limits. The unique selectivity, inertness, and thermal stability of the Rxi®-624Sil MS column make it ideal for numerous applications, from detecting impurities in pharmaceuticals to monitoring environmental VOCs.

Exceptional Inertness Provides Better Peak Shape, Higher Sensitivity, and More Accurate Data

Column inertness is difficult to achieve, but critical to improving data quality. The deactivation process used for Rxi®-624Sil MS columns yields a fully passivated surface that is demonstrably more inert than other 624 columns. Comprehensive deactivation results in higher responses, more symmetrical peaks, and easy, accurate integration, even for active compounds at low levels (Figures 1 and 2). Rxi®-624Sil MS columns, with their superior deactivation, provide the inertness needed for improved linearity, greater accuracy, and lower detection limits.

Figure 1 Highly inert Rxi®-624Sil MS columns provide better peak shape and simplify integration for active compounds at low levels (5 ng on-column).



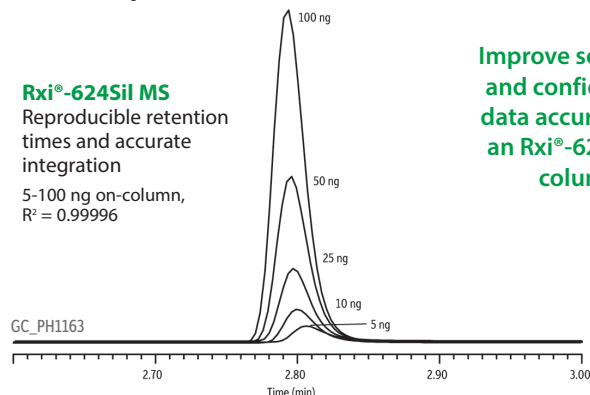
Highly inert Rxi®-624Sil MS columns give excellent peak symmetry.

Peaks	Conc. (µg/mL)
1. Isopropylamine	100
2. Diethylamine	100
3. Triethylamine	100

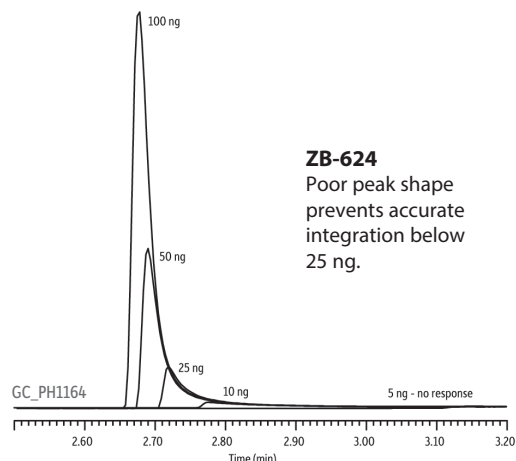
Column	Rxi®-624Sil MS, 30 m, 0.32 mm ID, 1.8 µm (cat.# 13870)
Sample	DMSO
Diluent:	100 µg/mL
Conc.:	
Injection	
Inj. Vol.:	1 µL split (split ratio 20:1)
Liner:	5 mm Single Gooseneck with Wool (cat.# 22973-200.1)
Inj. Temp.:	250 °C
Oven	
Oven Temp:	50 °C (hold 1 min.) to 200 °C at 20 °C/min. (hold 5 min.)
Carrier Gas	He, constant flow
Linear Velocity:	37 cm/sec.
Detector	FID @ 250 °C
Instrument	Agilent/HP6890 GC

Figure 2 Active compounds like isopropylamine can be more accurately integrated on an Rxi®-624Sil MS column, lowering limits of quantification (LOQs) and increasing data accuracy.

Same conditions as Figure 1.



Improve sensitivity and confidence in data accuracy with an Rxi®-624Sil MS column.



Lowest Bleed 624 Available—Assured GC-MS Compatibility

In addition to providing greater inertness and more accurate results for active compounds, the Rxi®-624Sil MS column offers higher temperature stability than any other column in its class (Table I, Figure 3). Even though most 624 columns provide adequate selectivity for polar compounds, poor thermal stability results in stationary phase bleed that can reduce column lifetime, decrease detector sensitivity, and interfere with the quantification of later eluting compounds. The highly effective stationary phase bonding chemistry of the Rxi®-624Sil MS column ensures extremely low bleed up to 320°C. While other 624 columns generate too much bleed to be useful for continuous mass spectrometry work, the Rxi®-624Sil MS column is fully compatible with both quadrupole and ion trap mass spectrometers. In addition to MS compatibility, higher thermal stability results in more stable baselines, longer column lifetimes, and improved method reproducibility.

Table I The Rxi®-624Sil MS column has the highest thermal stability of any 624 column.

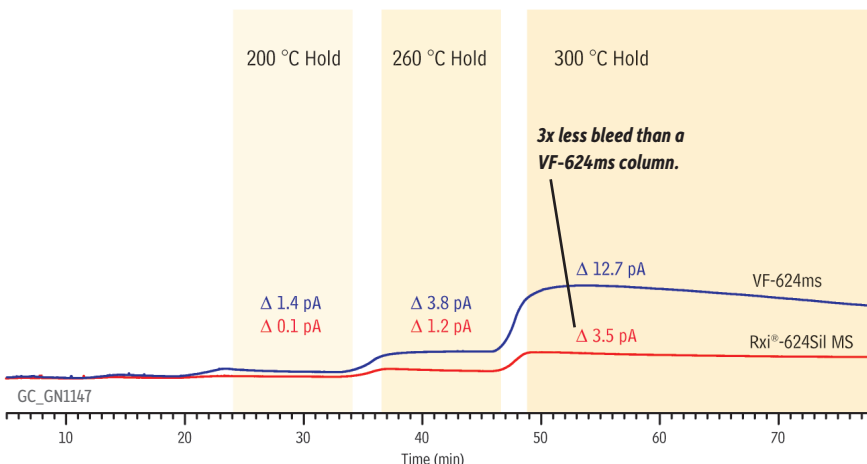
Column	Manufacturer	Maximum Programmable Temperature
Rxi-624Sil MS	Restek	320 °C
VF-624ms	Varian	300 °C
DB-624	Agilent J&W	260 °C
ZB-624	Phenomenex	260 °C

Data obtained from company website or literature for a 30 m x 0.25 mm x 1.4 µm df column.

Figure 3 The Rxi®-624Sil MS column has the lowest bleed of any column in its class and provides true GC-MS capability.

High thermal stability Rxi®-624Sil MS columns offer:

- Longer column lifetime.
- GC-MS compatibility.
- Improved method reproducibility.
- Stable baseline.



Columns: 30 m, 0.25 mm ID, 1.4 µm (Columns are of equivalent dimensions and were tested after equivalent conditioning.) Complete analytical conditions for chromatogram GC_GN1147 are available at www.restek.com

Rxi®-624Sil MS Columns (fused silica)

(midpolarity Crossbond® silarylene phase; similar to 6% cyanopropylphenyl/94% dimethyl polysiloxane)

- Low bleed, high thermal stability column—maximum temperatures up to 320 °C.
- Inert—excellent peak shape for a wide range of compounds.
- Selective—highly selective for residual solvents, great choice for USP<467>.
- Manufactured for column-to-column reproducibility—well-suited for validated methods.

ID	df	temp. limits	20-Meter	30-Meter	60-Meter	75-Meter	105-Meter
0.18mm	1.00µm	-20 to 300/320°C	13865				
0.25mm	1.40µm	-20 to 300/320°C		13868	13869 NEW		
0.32mm	1.80µm	-20 to 300/320°C		13870	13872		
0.53mm	3.00µm	-20 to 280/300°C		13871	13873 NEW	13874 NEW	13875 NEW



get more

For more information on the new Rxi®-624Sil MS column, visit www.restek.com and review our technical literature.

- Volatile Impurities Method Development (flyer PHFL1245)
- Residual Solvent Analysis: Implementing USP<467> (flyer PHFL1018A)
- Optimized Volatiles Analysis Ensures Fast VOC Separations (application note EVAN1271)

NEW! Rxi®-624Sil MS Columns:

Assure Reliable Separation of Volatile Impurities in Pharmaceuticals



In the pharmaceutical industry, timing and certainty are everything. Time-to-market is a key driver for new drugs, and efficient batch testing is critical for releasing approved products. Whether developing new methods or conducting routine analysis, increasing productivity depends on choosing the right column for the application. Rxi®-624Sil MS columns provide enhanced retention of polar compounds and volatile analytes, as well as full MS compatibility, making them the best choice for many drug analyses.

Fast, Effective Method Development

Often, 1 and 5 type columns are used initially for GC-MS method development because of their thermal stability; however, their nonpolar character results in poor retention for polar compounds, which increases method development time. In contrast, effective methods can be developed quickly on mid polarity Rxi®-624Sil MS columns, because they provide greater retention and selectivity for polar compounds as well as good thermal stability. For example, highly volatile, polar alkyl halide genotoxic impurities are difficult to retain on 1s and 5s, but Rxi®-624Sil MS columns provide the retention needed to ensure adequate separation (Figure 4). Increased retention makes GC-MS analysis easier to control and ultimately allows faster method development.

Improving Results for Routine Analysis

Once a drug is approved, fast, reliable methods are needed for routine batch analysis. Establishing system suitability is an important part of these procedures and a major factor in overall lab productivity. Rxi®-624Sil MS columns provide the optimized selectivity and guaranteed reproducibility needed to increase pass rates. For example, batch throughput can be improved for residual solvent testing under USP <467> by using a column that provides increased resolution for system suitability components (Figure 5). Greater resolution of critical pairs means higher system suitability pass rates, which allows more batches to be analyzed per shift.

Optimized phase chemistry, complete column deactivation, and tightly-controlled manufacturing make Rxi®-624Sil MS columns the best choice for many pharmaceutical applications. With better retention of polar volatiles, lower bleed, and higher inertness, Rxi®-624Sil MS columns can improve lab productivity by allowing new methods to be developed quickly and routine applications to be run more reliably.

learn more

For more pharmaceutical applications on Rxi®-624Sil MS columns, visit www.restek.com and download flyer PHFL1245.

TECH TIP!



Tim Herring, Technical Service Specialist

When running USP <467> by headspace, using a smaller bore liner (1 mm) can improve system suitability pass rates. Larger bore liners (4 mm) are used with direct liquid injection because the sample is vaporized in the injection port and the liner must be able to accommodate the solvent expansion volume. In contrast, in headspace analysis, the sample is vaporized in a vial instead of the injection port, so a large volume liner is not needed, and in fact it can be deleterious. In headspace methods, using a smaller bore liner reduces band broadening by increasing linear velocity, allowing faster sample transfer and improving resolution.

Resolution passes USP <467> criteria when using a 1 mm liner (red line), but fails if a 4 mm liner is used (black line).

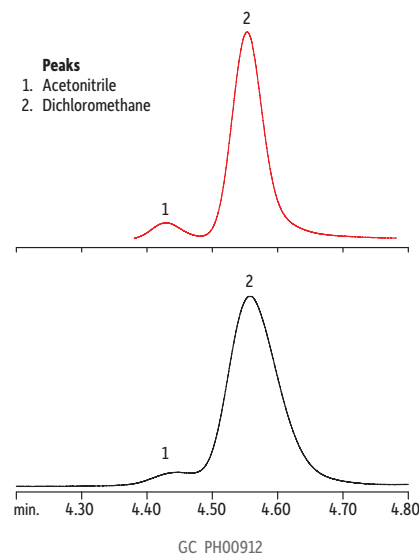


Figure 4 Polar compounds, such as alkyl halides, are highly retained on mid polarity Rxi®-624Sil MS columns, making method development faster and easier than on a nonpolar 1 or 5 type column.

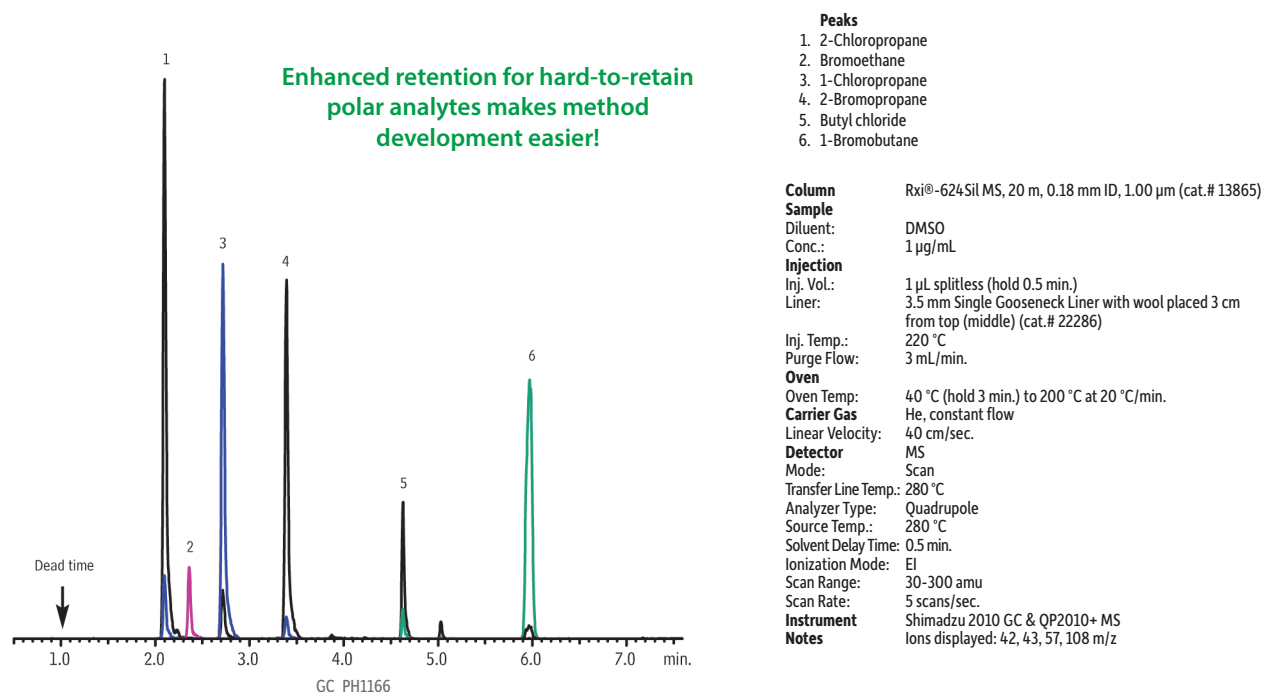
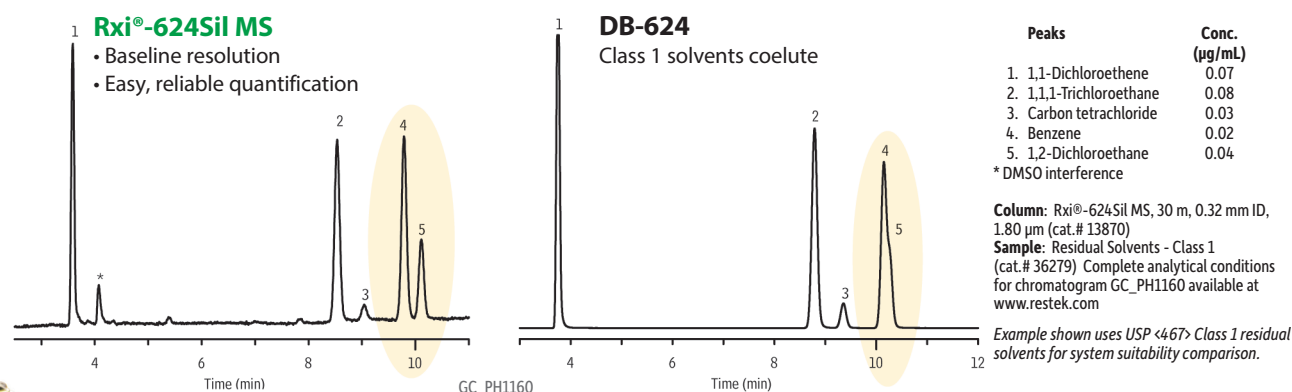


Figure 5 System suitability pass rates can be improved with Rxi®-624Sil MS columns. The innovative polymer chemistry provides greater resolution of critical pairs that are difficult to separate on other 624 type columns.



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A perfect match for validated residual solvent methods

Save time and money with mixes prepared to your specific solvent set and concentrations. The more you buy the less you pay per ampul!

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NEW! Rxi®-624Sil MS Columns:

Increase Sample Throughput for Environmental VOCs

Fast sample throughput is a primary concern for environmental labs interested in improving productivity. Volatiles methods typically are time-consuming, but developing optimized procedures can be challenging because compound lists are extensive and analytes vary significantly in chemical characteristics. The selectivity and inertness of Rxi®-624Sil MS columns make them ideal for optimizing environmental volatiles methods for better resolution and faster analysis time.

Establishing conditions that maximize sample throughput can be difficult, because conditions optimized for speed can result in problematic coelutions, while conditions optimized for resolution can result in long analysis times. The exceptional inertness of Rxi®-624Sil MS columns produces highly symmetrical peaks for active compounds, which improves resolution and allows separations to be maintained even under faster conditions. Here, an optimized method was developed using an Rxi®-624Sil MS column to maintain adequate resolution, while throughput was maximized by synchronizing purge and trap cycles with instrument cycles.

Improve Productivity and Resolve Critical Pairs

Initially, several critical pairs were chosen for computational modeling using Pro ezGC software. The temperature program first determined by the software provided the best resolution, but also resulted in an analysis time of 19 minutes. Since the purge and trap cycle time was 16.5 minutes, other conditions were evaluated to see if adequate resolution could be maintained using a faster instrument cycle. The final program, shown in Figure 6, reduced instrument downtime by better synchronizing purge and trap cycles with instrument cycles, and also provided excellent resolution. Using these conditions, up to 36 samples can be analyzed following EPA Method 8260 in a typical 12-hour shift.

Labs interested in optimizing both sample throughput and resolution of VOCs can adopt the synchronized conditions established here on Rxi®-624Sil MS columns to maximize productivity and assure accurate, reliable results.

For the complete application, visit www.restek.com/adv002



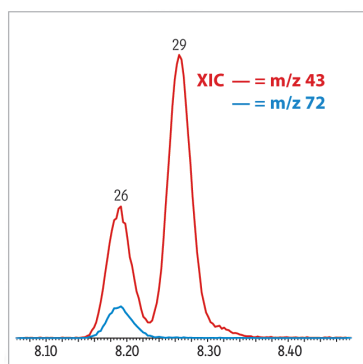
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- Measures volumetric flow for most gases across a range of 0.5-500 mL/min.
- NIST traceable calibration.
- Ex rating (electrical apparatus for explosive gas atmospheres) for hydrogen and related gas types.
- Accuracy of $\pm 2\%$ of flow or ± 0.2 mL/min., whichever is greater.
- Data output via USB port.

Go to www.restek.com/flowmeter for product features.



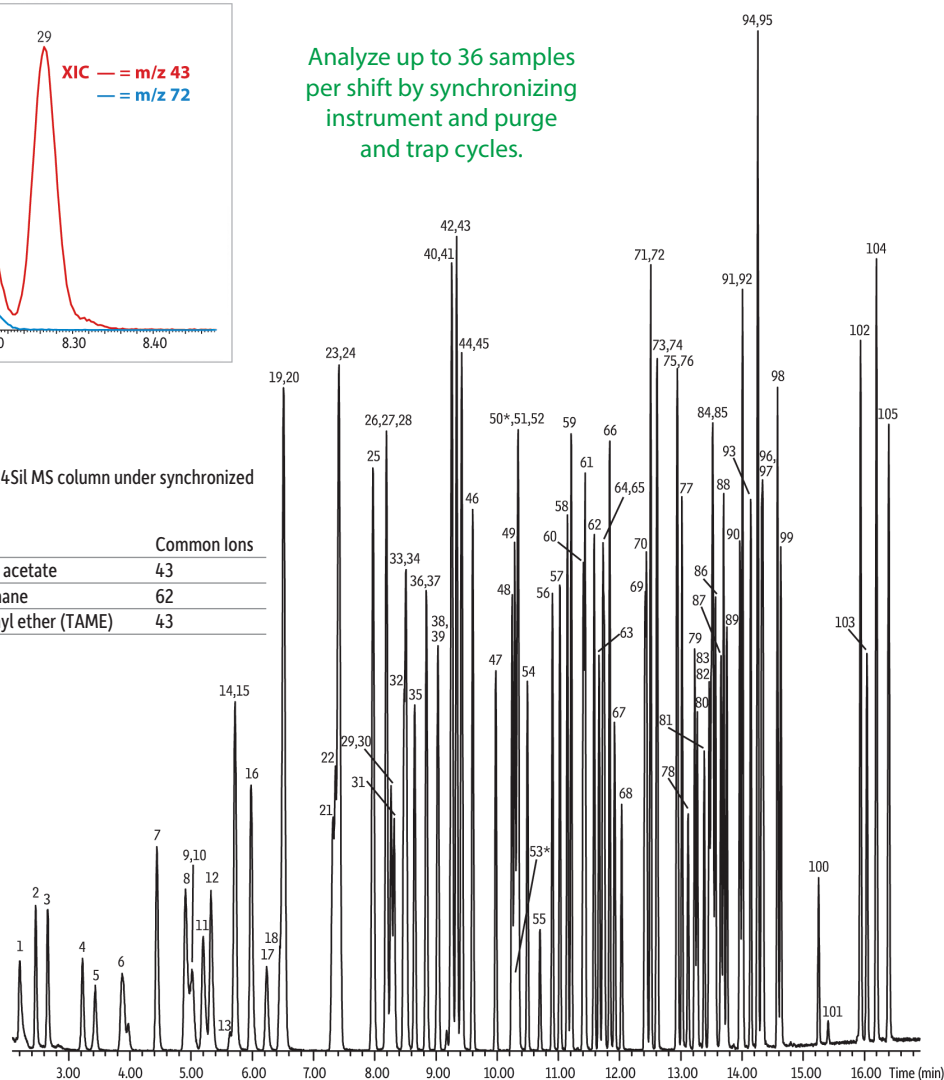
Figure 6 Using an Rxi®-624Sil MS column under optimized conditions increases productivity by assuring good resolution and minimal downtime when analyzing environmental volatiles.



Analyze up to 36 samples per shift by synchronizing instrument and purge and trap cycles.

Critical pairs resolved using an Rxi®-624Sil MS column under synchronized conditions:

Peak #s	Compounds	Common Ions
26/29	2-butanone (MEK)/ethyl acetate	43
41/42	benzene/1,2-dichloroethane	62
41/45	benzene/ <i>tert</i> -amyl methyl ether (TAME)	43



For peak identifications and conditions visit www.restek.com and enter chromatogram GC_EV1169 in the search function.

Rxi®-624Sil MS Columns (fused silica)

(midpolarity Crossbond® silarylene phase; similar to 6% cyanopropylphenyl/94% dimethyl polysiloxane)

ID	df	temp. limits	20-Meter	30-Meter	60-Meter	75-Meter	105-Meter
0.18mm	1.00µm	-20 to 300/320°C	13865				
0.25mm	1.40µm	-20 to 300/320°C		13868	13869	NEW	
0.32mm	1.80µm	-20 to 300/320°C		13870	13872		
0.53mm	3.00µm	-20 to 280/300°C		13871	13873	NEW	13875



New Sky™ inlet liners are easy to recognize as the best choice for optimal chromatography. All Sky™ liners come in specially marked boxes and are packaged in ultra-clean blister packs.

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NEW Rxi®-PAH GC Column

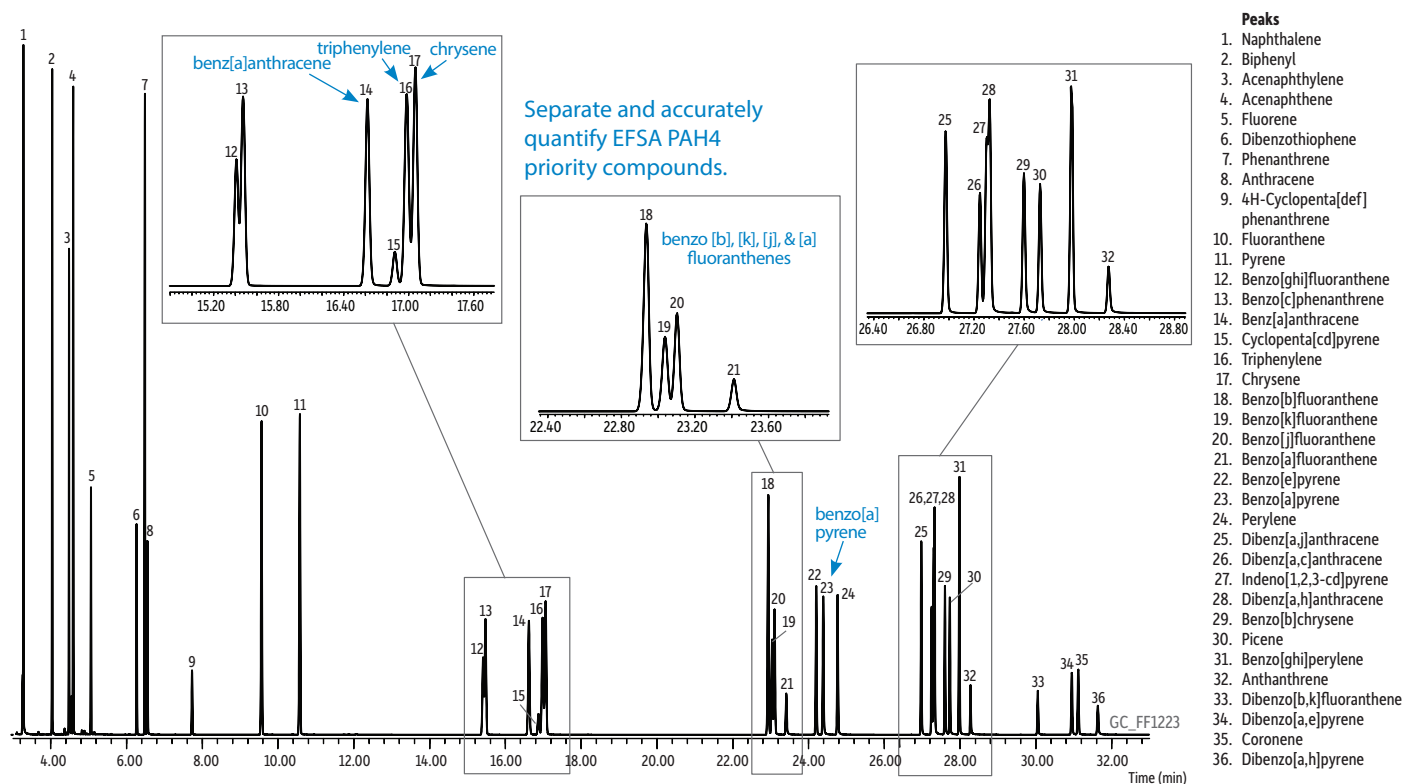
Resolve Important Isobaric Polycyclic Aromatic Hydrocarbons for Food Safety and Environmental Methods

- Separation of **all** EFSA PAH4 compounds: benz[a]anthracene, chrysene, benzo[b]fluoranthene, and benzo[a]pyrene.
- **Best resolution** of chrysene from interfering PAHs, triphenylene and cyclopenta[cd]pyrene.
- **Complete separation** of benzo [b], [k], [j], and [a] fluoranthenes.
- 360 °C thermal stability allows analysis of low volatility dibenzo pyrenes.



Rxi®-PAH GC columns were designed by Restek with a higher phenyl-content stationary phase that provides a unique selectivity to separate important polycyclic aromatic hydrocarbons (PAHs) for food safety that cannot be distinguished by mass spectrometry. Even difficult priority compounds, such as the European Food Safety Authority (EFSA) PAH4, are easily separated and accurately quantified, results that cannot be achieved on typical GC columns. Arylene modification and surface bonding of the stationary phase increase thermal stability and ruggedness so relatively nonvolatile, higher molecular weight PAHs can be analyzed routinely without interference from column bleed. Excellent column efficiency means that the column can be trimmed for maintenance purposes many times without losing critical PAH separations, including those that are part of environmental methods, as well as food safety testing.

Figure 1: A 40 m x 0.18 mm x 0.07 µm Rxi®-PAH column produces excellent resolution of critical peaks in less than 33 minutes!



Column: Rxi®-PAH, 40 m, 0.18 mm ID, 0.07 µm (cat.# 49316); **Sample:** NIST SRM 2260a PAH mix; **Diluent:** Toluene; **Conc.:** 0.2 - 2 µg/mL (SRM 2260a PAH mix was diluted 5x in toluene); **Injection:** 0.5 µL pulsed splitless (hold 0.58 min); **Liner:** Sky® 2 mm single taper w/wool (cat.# 23316.1); **Inj. Temp.:** 275 °C; **Pulse Pressure:** 80 psi (551.6kPa); **Pulse Time:** 0.6 min; **Purge Flow:** 40 mL/min; **Oven:** 110 °C (hold 1 min) to 210 °C at 37 °C/min to 260 °C at 3 °C/min to 350 °C at 11 °C/min (hold 4.5 min); **Carrier Gas:** He, constant flow; **Flow Rate:** 1.4 mL/min; **Detector:** MS; **Mode:** SIM; **Transfer Line Temp.:** 350 °C; **Analyzer Type:** Quadrupole; **Source Temp.:** 350 °C; **Quad Temp.:** 200 °C; **Solvent Delay Time:** 3.00 min; **Tune Type:** PFTBA; **Ionization Mode:** EI; **Instrument:** Agilent 7890A GC & 5975C MSD. For SIM program and quant ion information, visit www.restek.com and enter GC_FF1223 in the search.



NEW GC Columns for PAH Analysis— Perfect for EFSA PAH4 Priority Compounds!

Whether you want more resolution or faster analysis times, new Rxi®-PAH columns have the selectivity and efficiency you need. Choose the configuration that is best for your separation.

Cat.#	Length	ID	df	Description
49316	40 m	0.18 mm	0.07 µm	Narrow inside diameter, thinner film, faster analysis, excellent separation of important PAHs, less sample loading capacity
49317	60 m	0.25 mm	0.10 µm	0.25 mm inner diameter, better sample loading capacity, highest resolution of important PAHs, longer analysis than 0.18 mm column, thin film allows elution of dibenzo pyrenes
49318	30 m	0.25 mm	0.10 µm	0.25 mm inside diameter, better sample loading capacity, faster analysis time than 60 m column, adequate resolution of important PAHs, lower cost column

Recommended for PAH Analysis



23316

Sky® 2.0 mm ID Single Taper Inlet Liner

Suggested for
0.18 mm ID columns.

For Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty.	cat.#
Single Taper, Sky Technology, Borosilicate Glass		
2.0 mm x 6.5 mm x 78.5 mm	ea.	23315.1
2.0 mm x 6.5 mm x 78.5 mm	5-pk.	23315.5
2.0 mm x 6.5 mm x 78.5 mm	25-pk.	23315.25
Single Taper, Sky Technology, Wool, Borosilicate Glass		
2.0 mm x 6.5 mm x 78.5 mm	ea.	23316.1
2.0 mm x 6.5 mm x 78.5 mm	5-pk.	23316.5
2.0 mm x 6.5 mm x 78.5 mm	25-pk.	23316.25

Sky® 4.0 mm ID Single Taper Inlet Liner

Suggested for
0.25 mm ID columns.

For Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty.	cat.#
Single Taper, Sky Technology, Borosilicate Glass		
4.0 mm x 6.5 mm x 78.5 mm	ea.	23302.1
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	23302.5
4.0 mm x 6.5 mm x 78.5 mm	25-pk.	23302.25
Single Taper, Sky Technology, Wool, Borosilicate Glass		
4.0 mm x 6.5 mm x 78.5 mm	ea.	23303.1
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	23303.5
4.0 mm x 6.5 mm x 78.5 mm	25-pk.	23303.25

Dual Vespel® Ring Inlet Seals Washerless, leak-tight seals for Agilent GCs

- Does not require a separate washer.
- Requires less torque to seal.
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- Extends column lifetime by preventing oxygen from reaching the column.
- Same price as the regular inlet seals with washers.



Patented

0.8 mm ID Dual Vespel Ring Inlet Seal	2-pk.	10-pk.	50-pk.
Gold-Plated	21240	21241	23418
Siltek-Treated	21242	21243	23419
Stainless Steel	21238	21239	23420
1.2 mm ID Dual Vespel Ring Inlet Seal	2-pk.	10-pk.	
Gold-Plated	21246	21247	
Siltek-Treated	21248	21249	
Stainless Steel	21244	21245	

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- The Right Results Fast
- Maximized Instrument Uptime



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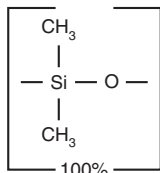
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Rxi®-1ms	2
Rxi®-5ms	3
Rxi®-XLB	3
Rxi®-5Sil MS	4
Rxi®-35Sil MS	4
Rxi®-17	5
Rxi®-17Sil MS	5
Rxi®-PAH	6
Rxi®-624Sil MS	6
Rxi®-1301Sil MS	6
Rxi®-1HT	7
Rxi®-5HT	7
Rxi® GCxGC	8-9
Rxi® Fast GC	10
Rxi® Guard/Retention Gap Columns	11



Rxi®-1ms Structure



Similar to: (100%-methyl)-polysiloxane

similar phases

HP-1ms, HP-1msUI, DB-1ms, DB-1msUI, Ultra-1, VF-1ms, ZB-1, ZB-1ms



Stringent quality testing ensures consistent performance, column to column and injection to injection.

Rxi®-1ms Columns (fused silica)

(nonpolar phase; Crossbond® dimethyl polysiloxane)

- General-purpose columns for arson accelerants, essential oils, hydrocarbons, pesticides, PCB congeners (e.g., Aroclor mixes), sulfur compounds, amines, solvent impurities, simulated distillation, oxygenates, gasoline range organics (GRO), refinery gases.
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- Temperature range: -60 °C to 330/350 °C.
- Equivalent to USP G1, G2, and G38 phases.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.25 µm	-60 to 330/350 °C	13320	13323	13326
	0.50 µm	-60 to 330/350 °C	13335	13338	13341
	1.00 µm	-60 to 330/350 °C	13350	13353	13356
0.32 mm	0.25 µm	-60 to 330/350 °C	13321	13324	13327
	0.50 µm	-60 to 330/350 °C	13336	13339	13342
	1.00 µm	-60 to 330/350 °C	—	13354	13357
	4.00 µm	-60 to 330/350 °C	—	13396	—
0.53 mm	0.50 µm	-60 to 330/350 °C	13337	13340	—
	1.00 µm	-60 to 330/350 °C	13352	13355	—
	1.50 µm	-60 to 330/350 °C	13367	13370	13373

ID	df	temp. limits	10-Meter cat.#	12-Meter cat.#	20-Meter cat.#	25-Meter cat.#	50-Meter cat.#
0.15 mm	0.15 µm	-60 to 330/350 °C	43800	—	43801	—	—
	2.0 µm	-60 to 330/350 °C	—	—	43802	—	—
0.18 mm	0.18 µm	-60 to 330/350 °C	—	—	13302	—	—
	0.36 µm	-60 to 330/350 °C	—	—	13311	—	—
0.20 mm	0.33 µm	-60 to 330/350 °C	—	13397	—	13398	13399

Rxi®-5ms Columns (fused silica)

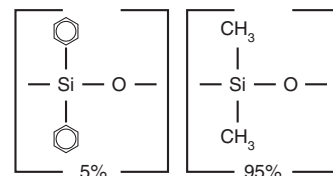
(low-polarity phase; Crossbond® diphenyl dimethyl polysiloxane)

- General-purpose columns for semivolatiles, phenols, amines, residual solvents, drugs of abuse, pesticides, PCB congeners (e.g., Aroclor mixes), solvent impurities.
- Most inert column on the market.
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- Temperature range: -60 °C to 330/350 °C.
- Equivalent to USP G27 and G36 phases.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.25 µm	-60 to 330/350 °C	13420	13423	13426
	0.40 µm	-60 to 330/350 °C	—	13481	—
	0.50 µm	-60 to 330/350 °C	13435	13438	13441
	1.00 µm	-60 to 330/350 °C	13450	13453	13456
0.32 mm	0.25 µm	-60 to 330/350 °C	13421	13424	13427
	0.50 µm	-60 to 330/350 °C	13436	13439	13442
	1.00 µm	-60 to 330/350 °C	13451	13454	13457
0.53 mm	0.25 µm	-60 to 330/350 °C	13422	13425	—
	0.50 µm	-60 to 330/350 °C	13437	13440	—
	1.00 µm	-60 to 330/350 °C	13452	13455	—
	1.50 µm	-60 to 330/350 °C	13467	13470	—

ID	df	temp. limits	12-Meter cat.#	20-Meter cat.#	25-Meter cat.#	50-Meter cat.#
0.18 mm	0.18 µm	-60 to 330/350 °C	—	13402	—	—
	0.30 µm	-60 to 330/350 °C	—	13409	—	—
	0.36 µm	-60 to 330/350 °C	—	13411	—	—
0.20 mm	0.33 µm	-60 to 330/350 °C	13497	—	13498	13499

Rxi®-5ms Structure



Similar to: (5%-phenyl)-methylpolysiloxane

similar phases

HP-5ms SemiVolatiles, HP-5ms, HP-5msUI, DB-5, Ultra-2, CP-Sil 8 CB, ZB-5, ZB-5msi

Rxi®-XLB Columns (fused silica)

(low-polarity proprietary phase)

- General-purpose columns exhibiting extremely low bleed. Ideal for many GC-MS applications, including pesticides, PCB congeners (e.g., Aroclor mixes), PAHs.
- Unique selectivity.
- Temperature range: 30 °C to 360 °C.

Improvements in polymer synthesis and tubing deactivation enable us to make inert, stable Rxi®-XLB columns especially well-suited for analyzing active, high molecular weight compounds with sensitive GC-MS systems, including ion trap detectors. Excellent efficiency, coupled with inertness, low bleed, and high thermal stability, make Rxi®-XLB columns ideal for analyzing semivolatile compounds in drinking water.

ID	df	temp. limits*	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.10 µm	30 to 340/360 °C	13705	13708	—
	0.25 µm	30 to 340/360 °C	13720	13723	13726
	0.50 µm	30 to 340/360 °C	—	13738	—
	1.00 µm	30 to 340/360 °C	—	13753	—
0.32 mm	0.25 µm	30 to 340/360 °C	—	13724	13727
	0.50 µm	30 to 340/360 °C	—	13739	—
	1.00 µm	30 to 340/360 °C	—	13754	—
0.53 mm	0.50 µm	30 to 320/360 °C	—	13740	—

ID	df	temp. limits	20-Meter cat.#
0.18 mm	0.18 µm	30 to 340/360 °C	43702

*Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

similar phases

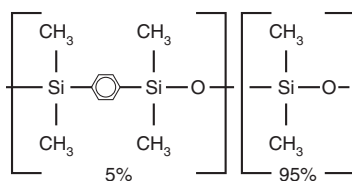
DB-XLB, VF-Xms, MR1, ZB-XLB

tech tip

Rxi®-XLB columns for Method 525

In combination with an Rxi®-XLB column, simple adjustments to the injection conditions can greatly improve sensitivity for active and high molecular weight Method 525 target compounds.

By eliminating contact between the sample and the hot metal surfaces in the injection port, a drilled Uniliner® inlet liner prevents analytes from degrading in the injection port.

Rxi®-5Sil MS Structure

Similar to: (5%-phenyl)-methylpolysiloxane

similar phases

DB-5ms, DB-5msUI, VF-5ms, ZB-5ms, ZB-SemiVolatiles, Rtx-5Sil MS

Rxi®-5Sil MS Columns (fused silica)

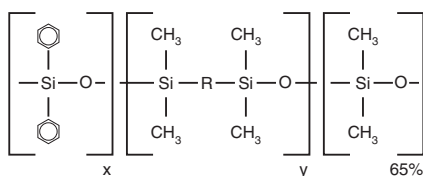
(low-polarity phase; Crossbond® 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane)

- Engineered to be a low-bleed GC-MS column.
- Excellent inertness for active compounds.
- General-purpose columns—ideal for GC-MS analysis of semivolatiles, polycyclic aromatic compounds, chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, and hydrocarbons.
- Temperature range: -60 °C to 350 °C.

The Rxi®-5Sil MS stationary phase incorporates phenyl groups in the polymer backbone. This improves thermal stability, reduces bleed, and makes the phase less prone to oxidation. Rxi®-5Sil MS columns are ideal for GC-MS applications requiring high sensitivity, including use in ion trap systems.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.10 µm	-60 to 320/350 °C	13605	13608	—
	0.25 µm	-60 to 320/350 °C	13620	13623	13626
	0.50 µm	-60 to 320/350 °C	13635	13638	—
	1.00 µm	-60 to 320/350 °C	13650	13653	13697
0.32 mm	0.25 µm	-60 to 320/350 °C	13621	13624	—
	0.50 µm	-60 to 320/350 °C	—	13639	—
	1.00 µm	-60 to 320/350 °C	—	13654	—
0.53 mm	1.50 µm	-60 to 320/330 °C	—	13670	—

ID	df	temp. limits	10-Meter cat.#	20-Meter cat.#	40-Meter cat.#	60-Meter cat.#
0.15 mm	0.15 µm	-60 to 320/350 °C	43815	43816	—	—
	2.0 µm	-60 to 320/350 °C	—	43817	—	—
0.18 mm	0.10 µm	-60 to 320/350 °C	—	—	—	43607
	0.18 µm	-60 to 320/350 °C	—	43602	43605	—
	0.36 µm	-60 to 320/350 °C	—	43604	—	—

Rxi®-35Sil MS Structure

Similar to: (35%-phenyl)-methylpolysiloxane

similar phases

DB-35ms, DB-35msUI, VF-35ms, MR2

Rxi®-35Sil MS Columns (fused silica)

(midpolarity Crossbond® phase)

- Special selectivity and excellent inertness for substituted polar compounds, such as drugs, pesticides, herbicides, PCBs, phenols, etc.
- Provides superior separation for cannabinoids.
- Very low-bleed phase for GC-MS analysis.
- Extended temperature range: 50 °C to 340/360 °C.

ID	df	temp. limits*	15-Meter cat.#	30-Meter cat.#
0.25 mm	0.25 µm	50 to 340/360 °C	13820	13823
	0.50 µm	50 to 340/360 °C	13835	13838
	1.00 µm	50 to 320/340 °C	13850	13853
0.32 mm	0.25 µm	50 to 340/360 °C	13821	13824
	0.50 µm	50 to 340/360 °C	13836	13839
	1.00 µm	50 to 320/340 °C	13851	13854
0.53 mm	0.50 µm	50 to 340/360 °C	13837	13840
	1.00 µm	50 to 325/340 °C	13852	13855
	1.50 µm	50 to 310/330 °C	13856	13857
	3.00 µm	50 to 280/300 °C	13858	13859

*Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

Rxi®-17 Columns (fused silica)

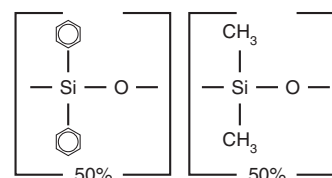
(midpolarity phase; Crossbond® diphenyl dimethyl polysiloxane)

- General-purpose columns for pesticides, herbicides, rosin acids, phthalate esters, triglycerides, sterols.
- Temperature range: 40 °C to 320 °C.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#
0.25 mm	0.25 µm	40 to 280/320 °C	13520	13523
	0.50 µm	40 to 280/320 °C	—	13538
	1.00 µm	40 to 280/320 °C	—	13553
0.32 mm	0.25 µm	40 to 280/320 °C	—	13524
	0.50 µm	40 to 280/320 °C	—	13539
	1.00 µm	40 to 280/320 °C	—	13554
0.53 mm	0.25 µm	40 to 280/320 °C	—	13525
	0.50 µm	40 to 280/320 °C	—	13540
	0.83 µm	40 to 280/320 °C	—	13569
	1.00 µm	40 to 280/320 °C	13552	13555
	1.50 µm	40 to 280/320 °C	—	13570

ID	df	temp. limits	20-Meter cat.#
0.18 mm	0.18 µm	40 to 280/320 °C	13502

Rxi®-17 Structure



Similar to: (50%-phenyl)-methylpolysiloxane

similar phases

HP-17, DB-17, DB-17ht, DB-608, ZB-50

Rxi®-17Sil MS Columns (fused silica)

(midpolarity Crossbond® phase)

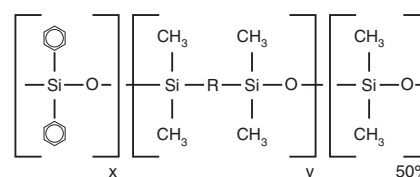
- Excellent inertness and selectivity for active environmental compounds, such as PAHs.
- Low bleed for use with sensitive detectors, such as MS.
- 340/360 °C upper temperature limits.
- Equivalent to USP phase G3.

ID	df	temp. limits*	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.25 µm	40 to 340/360 °C	14120	14123	14126
0.32 mm	0.25 µm	40 to 340/360 °C	14121	14124	—

ID	df	temp. limits	10-Meter cat.#	20-Meter cat.#
0.15 mm	0.15 µm	40 to 340/360 °C	43820	43821
0.18 mm	0.18 µm	40 to 340/360 °C	—	14102
	0.36 µm	40 to 340/360 °C	—	14111

*Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

Rxi®-17Sil MS Structure



Similar to: (50%-phenyl)-methylpolysiloxane

similar phases

DB-17ms, VF-17ms



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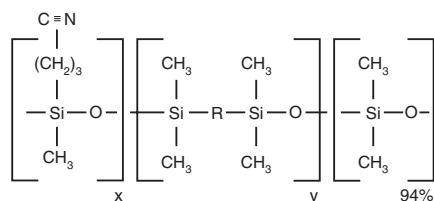
Rxi®-PAH Columns (fused silica)

(midpolarity proprietary phase)

- Ideal for EFSA PAH4 analysis—separates all priority compounds: benz[a]anthracene, chrysene, benzo[b]fluoranthene, and benzo[a]pyrene.
- Best resolution of chrysene from interfering PAHs, triphenylene, and cyclopenta[cd]pyrene.
- Complete separation of benzo [b], [k], [j], and [a] fluoranthenes.
- 360 °C thermal stability allows analysis of low-volatility dibenzo pyrenes.

ID	df	temp. limits	30-Meter cat.#	40-Meter cat.#	60-Meter cat.#
0.18 mm	0.07 µm	to 360 °C	—	49316	—
0.25 mm	0.10 µm	to 360 °C	49318	—	49317

Rxi®-624Sil MS (G43) Structure



Similar to: (6%-cyanopropyl(phenyl)-methylpolysiloxane)

similar phases

DB-624, VF-624ms, CP-Select 624 CB

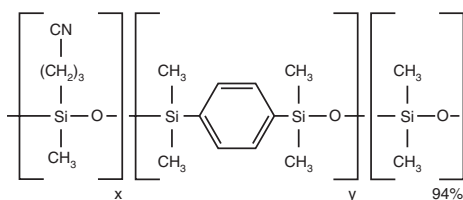
Rxi®-624Sil MS Columns (fused silica)

(midpolarity Crossbond® phase)

- Low-bleed, high-thermal stability column—maximum temperatures up to 320 °C.
- Inert—excellent peak shape for a wide range of compounds.
- Selective—G43 phase highly selective for volatile organics and residual solvents, great choice for USP <467>.
- Manufactured for column-to-column reproducibility—well-suited for validated methods.

ID	df	temp. limits	20-Meter cat.#	30-Meter cat.#	60-Meter cat.#	75-Meter cat.#	105-Meter cat.#
0.18 mm	1.00 µm	-20 to 300/320 °C	13865	—	—	—	—
0.25 mm	1.40 µm	-20 to 300/320 °C	—	13868	13869	—	—
0.32 mm	1.80 µm	-20 to 300/320 °C	—	13870	13872	—	—
0.53 mm	3.00 µm	-20 to 280/300 °C	—	13871	13873	13874	13875

Rxi®-1301Sil MS Structure



Similar to: (6%-cyanopropyl(phenyl)-methylpolysiloxane)

similar phases

VF-1301ms

Rxi®-1301Sil MS Columns (fused silica)

(midpolarity Crossbond® phase)

- Highest thermal stability in the industry ensures dependable, accurate MS results and increased uptime.
- Stabilized cyano phase selectivity improves the performance of existing methods. Ideal for solvents, glycols, and other polar compounds.
- Rigorous QC testing ensures inertness and accurate, reliable data for multiple compound classes.
- Maximum temperature: 320 °C.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.25 µm	-60 to 320 °C	—	16094	16096
	1.00 µm	-60 to 320 °C	—	16095	16097
	0.32 mm	0.25 µm	-60 to 320 °C	—	16098
0.32 mm	1.00 µm	-60 to 320 °C	—	16099	16100
	1.50 µm	-60 to 320 °C	—	16104	16105
	0.53 mm	1.00 µm	-60 to 320 °C	16101	16102
0.53 mm	1.50 µm	-60 to 320 °C	—	16103	—
	3.00 µm	-60 to 280/300 °C	—	16106	16107

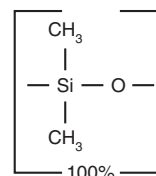
Rxi®-1HT Columns (fused silica)

(nonpolar phase; dimethyl polysiloxane)

- 40% longer lifetime from specially designed fused silica tubing.
- Columns processed for high-temperature applications, such as high molecular weight hydrocarbons.
- Temperature range: -60 to 400 °C.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#
0.25 mm	0.10 µm	-60 to 400 °C	13950	13951
	0.25 µm	-60 to 400 °C	—	13952
0.32 mm	0.10 µm	-60 to 400 °C	13953	13954
	0.25 µm	-60 to 400 °C	—	13955

Rxi®-1HT Structure



Similar to: (100%-methyl)-polysiloxane

similar phases

DB-1ht, ZB-1HTInferno

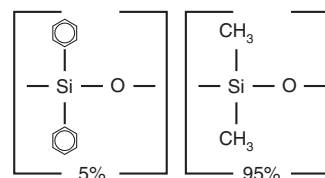
Rxi®-5HT Columns (fused silica)

(low-polarity phase; diphenyl dimethyl polysiloxane)

- 40% longer lifetime from specially designed fused silica tubing.
- Columns processed for high-temperature applications, such as mineral oil.
- Temperature range: -60 to 400 °C.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#
0.25 mm	0.10 µm	-60 to 400 °C	13905	13908
	0.25 µm	-60 to 400 °C	—	13923
0.32 mm	0.10 µm	-60 to 400 °C	13906	13909
	0.25 µm	-60 to 400 °C	—	13924
0.53 mm	0.15 µm	-60 to 380/400 °C	—	13910

Rxi®-5HT Structure



Similar to: (5%-phenyl)-methylpolysiloxane

similar phases

DB-5ht, VF-5ht, ZB-5HTInferno

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Restek GCxGC Columns: Your One Source for 2D Gas Chromatography

Why Use GCxGC?

GCxGC is a powerful multidimensional GC technique that combines two independent separations to accurately analyze highly complex samples. GCxGC involves two columns with differing stationary phase selectivity (orthogonal) that are press-fitted together in series and separated by a modulator. The first (primary) column performs an initial separation, and its effluent is continually focused and “injected” in defined cycles by the modulator onto the second (secondary) column, where another separation occurs. By choosing a secondary column that is orthogonal (has different selectivity) to the primary column, it is possible to separate and identify analytes that cannot be separated by the primary column. And, by keeping the secondary column very short, it is possible to maintain the separation produced by the primary column. Results generated through a series of high-speed chromatograms are plotted as a contour plot, sometimes known as a retention plane.

So, why use GCxGC? Because comprehensive two-dimensional gas chromatography allows you to perform separations that are simply not possible using standard one-dimensional chromatography!

Why Use Restek GCxGC Columns?

- Wide range of stationary phases offers orthogonal separations.
- High thermal stability increases system ruggedness.
- Unrivalled column inertness for accurate analysis of active compounds.
- 0.15, 0.18, and 0.25 mm ID formats accommodate varying sample capacities, speeds, and detectors.
- Secondary columns come in convenient 2 m lengths for economical methods development.

Restek has been performing comprehensive two-dimensional gas chromatography since its commercial inception. Our Innovations lab boasts multiple instruments dedicated to GCxGC applications, and we are continually exploring new application areas—including environmental, food safety, petroleum, forensics, fragrance, natural products, tobacco, metabolomics, and dietary supplements.

Restek's GCxGC secondary columns can be matched with any Restek® Rtx® or Rxi® primary column to create the perfect orthogonal separation for your application. See our combination guide below for help choosing your GCxGC columns. We also offer a range of complementary GC accessories—including Sky® inlet liners, the Restek® electronic leak detector, and Press-Tight® connectors—to boost your success with GCxGC.

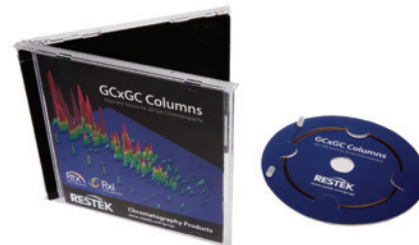
Restek GCxGC Column Combination Guide

To achieve ideal results in a GCxGC analysis, it is imperative that your primary and secondary columns feature orthogonal phases capable of producing differing separations. Use the chart below to find the perfect combination of Restek® columns to maximize the effectiveness of your GCxGC system.

Application Area	Primary Column		Secondary Column	
	Phase	Selectivity	Phase	Selectivity
Petrochemical	Rxi®-1ms	Nonpolar	Rxi®-17Sil MS	Midpolar, aromatic selective
Petrochemical	Rxi®-5Sil MS	Nonpolar	Rxi®-17Sil MS	Midpolar, aromatic selective
PAHs, environmental	Rxi®-17Sil MS	Midpolar, aromatic selective	Rxi®-1ms	Nonpolar
PAHs, environmental	Rxi®-17Sil MS	Midpolar, aromatic selective	Rxi®-5Sil MS	Nonpolar
PCBs, PBDEs, PAHs, environmental	Rxi®-XLB	Nonpolar	Rxi®-17Sil MS	Midpolar, aromatic selective
Mono-ortho, coplanar PCBs	Rxi®-1ms	Nonpolar	Rxi®-XLB	Planar selective
Mono-ortho, coplanar PCBs	Rxi®-5Sil MS	Nonpolar	Rxi®-XLB	Planar selective
Pesticides, nitroaromatics, halogenated compounds	Rxi®-1ms	Nonpolar	Rtx®-200	Midpolar, electronegative selectivity
Pesticides, nitroaromatics, halogenated compounds	Rxi®-5Sil MS	Nonpolar	Rtx®-200	Midpolar, electronegative selectivity
Pesticides, nitroaromatics, halogenated compounds	Rxi®-XLB	Nonpolar	Rtx®-200	Midpolar, electronegative selectivity
Flavors, fragrances	Rxi®-1ms	Nonpolar	Stabilwax®	Polar
Flavors, fragrances	Rxi®-5Sil MS	Nonpolar	Stabilwax®	Polar
Flavors, fragrances	Stabilwax®	Polar	Rxi®-1ms	Nonpolar
Flavors, fragrances	Stabilwax®	Polar	Rxi®-5Sil MS	Nonpolar

Primary GCxGC Columns (In order of increasing polarity)

Phase	L	ID	df	temp. limits	cat.#
Rxi-1ms	30 m	0.25 mm	0.25 μ m	-60 to 330/350 °C	13323
Rxi-5Sil MS	30 m	0.25 mm	0.25 μ m	-60 to 320/350 °C	13623
Rxi-XLB	30 m	0.25 mm	0.25 μ m	30 to 340/360 °C	13723
Rxi-17Sil MS	30 m	0.25 mm	0.25 μ m	40 to 340/360 °C	14123
Rtx-200	30 m	0.25 mm	0.25 μ m	-20 to 320/340 °C	15023
Stabilwax	30 m	0.25 mm	0.25 μ m	40 to 250/260 °C	10623



Secondary GCxGC Columns (In order of increasing polarity)

Phase	L	ID	df	temp. limits	cat.#
Rxi-1ms	2 m	0.15 mm	0.15 μ m	-60 to 330/350 °C	15114
	2 m	0.18 mm	0.18 μ m	-60 to 330/350 °C	15120
	2 m	0.25 mm	0.25 μ m	-60 to 330/350 °C	15127
Rxi-5Sil MS	2 m	0.15 mm	0.15 μ m	-60 to 330/350 °C	15113
	2 m	0.18 mm	0.18 μ m	-60 to 330/350 °C	15119
	2 m	0.25 mm	0.25 μ m	-60 to 330/350 °C	15126
Rxi-XLB	2 m	0.15 mm	0.15 μ m	30 to 340/360 °C	15115
	2 m	0.18 mm	0.18 μ m	30 to 340/360 °C	15121
	2 m	0.25 mm	0.25 μ m	30 to 340/360 °C	15128
Rxi-17Sil MS	2 m	0.15 mm	0.15 μ m	40 to 340/360 °C	15110
	2 m	0.18 mm	0.18 μ m	40 to 340/360 °C	15116
	2 m	0.25 mm	0.25 μ m	40 to 340/360 °C	15123
Rtx-200	2 m	0.15 mm	0.15 μ m	-20 to 320/340 °C	15111
	2 m	0.18 mm	0.18 μ m	-20 to 320/340 °C	15117
	2 m	0.25 mm	0.25 μ m	-20 to 320/340 °C	15124
Stabilwax	2 m	0.15 mm	0.15 μ m	40 to 250/260 °C	15112
	2 m	0.18 mm	0.18 μ m	40 to 250/260 °C	15118
	2 m	0.25 mm	0.25 μ m	40 to 250/260 °C	15125

To choose the perfect primary/
secondary column combination for
your application, use our guide on at

www.restek.com/gcxgc

GCxGC Secondary Column Selectivity Kits

Description	qty.	cat.#
GCxGC (0.15 mm) Selectivity Kit	kit	15129

Includes (each product also available separately)

Rxi-1ms	2 m x 0.15 mm x 0.15 μ m	ea.	15114
Rxi-5Sil MS	2 m x 0.15 mm x 0.15 μ m	ea.	15113
Rxi-XLB	2 m x 0.15 mm x 0.15 μ m	ea.	15115
Rxi-17Sil MS	2 m x 0.15 mm x 0.15 μ m	ea.	15110
Rtx-200	2 m x 0.15 mm x 0.15 μ m	ea.	15111
Stabilwax	2 m x 0.15 mm x 0.15 μ m	ea.	15112
Universal Press-Tight Connectors	Deactivated	5-pk.	20429

Description	qty.	cat.#
GCxGC (0.18 mm) Selectivity Kit	kit	15130

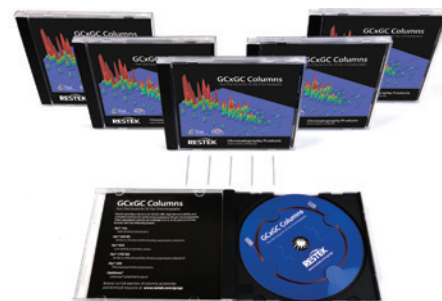
Includes (each product also available separately)

Rxi-1ms	2 m x 0.18 mm x 0.18 μ m	ea.	15120
Rxi-5Sil MS	2 m x 0.18 mm x 0.18 μ m	ea.	15119
Rxi-XLB	2 m x 0.18 mm x 0.18 μ m	ea.	15121
Rxi-17Sil MS	2 m x 0.18 mm x 0.18 μ m	ea.	15116
Rtx-200	2 m x 0.18 mm x 0.18 μ m	ea.	15117
Stabilwax	2 m x 0.18 mm x 0.18 μ m	ea.	15118
Universal Press-Tight Connectors	Deactivated	5-pk.	20429

Description	qty.	cat.#
GCxGC (0.25 mm) Selectivity Kit	kit	15131

Includes (each product also available separately)

Rxi-1ms	2 m x 0.25 mm x 0.25 μ m	ea.	15127
Rxi-5Sil MS	2 m x 0.25 mm x 0.25 μ m	ea.	15126
Rxi-XLB	2 m x 0.25 mm x 0.25 μ m	ea.	15128
Rxi-17Sil MS	2 m x 0.25 mm x 0.25 μ m	ea.	15123
Rtx-200	2 m x 0.25 mm x 0.25 μ m	ea.	15124
Stabilwax	2 m x 0.25 mm x 0.25 μ m	ea.	15125
Universal Press-Tight Connectors	Deactivated	5-pk.	20429



- Each kit includes one Rxi®-1ms, Rxi®-5Sil MS, Rxi®-17Sil MS, Rtx®-200, Rxi®-XLB, and Stabilwax® column.
- Comprehensive kit simplifies column selection for method developers and frequent GCxGC users alike.
- Included Press-Tight® connectors offer a reliable, hassle-free installation.

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Use a 20 m fast GC column in place of a standard 30 m column; a 10 m in place of a 15 m; and a 40 m in place of a 60 m.

also available

Rtx® and Stabilwax® columns for fast GC

Shorten Analysis Time and Boost Productivity With Restek® Fast GC Columns

The math is simple: the less time it takes to perform each analysis, the more samples your laboratory can process. The easiest way to reduce analysis time while still maintaining resolution of critical compounds is to use hydrogen as your carrier gas. If hydrogen is not an option, or if you already use it and want to go even faster, turn to the higher resolving power of smaller-bore capillary columns from Restek.

As column ID decreases, column efficiency (i.e., plates/meter) increases, allowing you to achieve the same, or even better, resolution using a shorter length—and significantly less time. Whether you are currently using 0.25 or 0.53 mm ID columns, you can shorten analysis times as much as twofold by switching to Restek® 0.15 mm ID fast GC columns. These high-efficiency columns speed up separations on your existing GC or GC-MS instrumentation—while maintaining resolution and meeting method criteria—so you can make more runs per shift with the same exceptional accuracy you've come to expect from Restek.

Fast GC 0.15 mm ID Columns

- Increase productivity up to 2x without sacrificing resolution.
- Compatible with your existing GC setup.
- Low bleed for maximum sensitivity and accurate GC-MS analyses.
- Thick films (up to 2 µm) eliminate loadability issues.
- OD similar to 0.25 mm columns for easy installation.
- Excellent as secondary columns for GCxGC.
- Available in a variety of stationary phases.

How to Get the Same Chromatogram With a Fast GC Column

For over 20 years, 0.15 mm ID columns have been proven to work in virtually any application field. When switching to a smaller-ID and shorter-length column, there are several things you must do in order for your new, faster method to give you the same chromatogram (i.e., separations) as your old method:

- 1) Choose a column with the same phase ratio.
- 2) Adapt the temperature program so that the analyte elution temperatures are the same.
- 3) Adjust the linear velocity. (For a good starting point, see your column's certificate of analysis.)

Following these guidelines will help ensure that you achieve similar chromatography (i.e., identical elution order and resolution)—in a fraction of the time.

Rxi®-1ms Columns for Fast GC (fused silica) (nonpolar phase; Crossbond® dimethyl polysiloxane)

ID	df	temp. limits	10-Meter cat.#	20-Meter cat.#
0.15 mm	0.15 µm	-60 to 330/350 °C	43800	43801

Rxi®-5Sil MS Columns for Fast GC (fused silica) (low-polarity phase; Crossbond® 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane)

ID	df	temp. limits	10-Meter cat.#	20-Meter cat.#
0.15 mm	0.15 µm	-60 to 320/350 °C	43815	43816
	2.0 µm	-60 to 320/350 °C	—	43817

Rxi®-17Sil MS Columns for Fast GC (fused silica) (midpolarity Crossbond® phase)

ID	df	temp. limits	10-Meter cat.#	20-Meter cat.#
0.15 mm	0.15 µm	40 to 340/360 °C	43820	43821

Chromatogram Search Tool

Search by compound name, synonym, CAS #, or keyword

www.restek.com/chromatograms



Rxi® Guard/Retention Gap Columns (fused silica)

- Extend column lifetime.
- Excellent inertness—obtain lower detection limits for active compounds.
- Sharper chromatographic peaks by utilizing retention gap technology.
- Maximum temperature: 360 °C.

Nominal ID	Nominal OD	5-Meter cat.#	5-Meter/6-pk. cat.#	10-Meter cat.#	10-Meter/6-pk. cat.#
0.25 mm	0.37 ± 0.04 mm	10029	10029-600	10059	10059-600
0.32 mm	0.45 ± 0.04 mm	10039	10039-600	10064	10064-600
0.53 mm	0.69 ± 0.05 mm	10054	10054-600	10073	10073-600

Fused Silica Capillary & PLOT Column Ferrule Guide

GC Column ID	Ferrule ID
0.15 mm	0.4
0.18 mm	0.4
0.25 mm	0.4
0.32 mm	0.5
0.53 mm	0.8

did you know?

We test our guard columns/transfer lines with a comprehensive test mix to ensure high inertness.

it's a fact

Use guard columns to:

- Reduce effects of dirty samples on column performance.
- Reduce downtime and maintenance.

Certificates of analysis for 5 m and 10 m Restek® guard columns are now provided electronically. To view and download your 5 m or 10 m guard column certificate, simply visit www.restek.com/documentation then enter your catalog # and serial #.

also available

Press-Tight® connectors.

www.restek.com/press-tight



Innovative Integra-Guard® Columns

Get the protection without the connection!

- No leaks for a more robust method.
- No column connections for easier, faster maintenance.
- No peak distortions due to connector dead volume and thermal capacity.

For analysts who find it inconvenient to make a leak-free connection between the guard column and the analytical column, we offer Integra-Guard® columns. These innovative columns incorporate both a guard column and an analytical column in a continuous length of tubing, eliminating the connection and all connection-associated problems! The guard column section is marked separately from the analytical column using high-temperature string.

A wide variety of our Integra-Guard® capillary columns are listed here. 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.

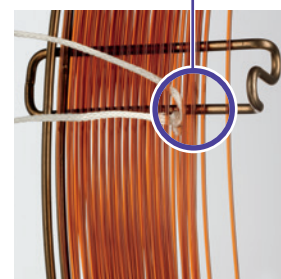
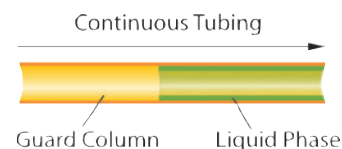
Description	qty.	cat.#
Rxi-5Sil MS		
15 m, 0.25 mm ID, 0.25 µm Rxi-5Sil MS w/10 m Integra-Guard Column	ea.	13620-127
30 m, 0.25 mm ID, 0.25 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13623-124
30 m, 0.25 mm ID, 0.25 µm Rxi-5Sil MS w/10 m Integra-Guard Column	ea.	13623-127
15 m, 0.25 mm ID, 0.50 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13635-124
30 m, 0.25 mm ID, 0.50 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13638-124
30 m, 0.25 mm ID, 0.50 µm Rxi-5Sil MS w/10 m Integra-Guard Column	ea.	13638-127
30 m, 0.32 mm ID, 0.50 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13639-125
30 m, 0.32 mm ID, 1.00 µm Rxi-5Sil MS w/5 m Integra-Guard Column	ea.	13654-125

Integra-Guard® columns are available for all phases listed for columns with 0.25, 0.32, or 0.53 mm ID.

Rtx® and Stabilwax® Integra-Guard® columns are also available.

If you don't see what you need here, contact Customer Service.

Integra-Guard® Built-In Guard Column



String indicates where the analytical column begins.

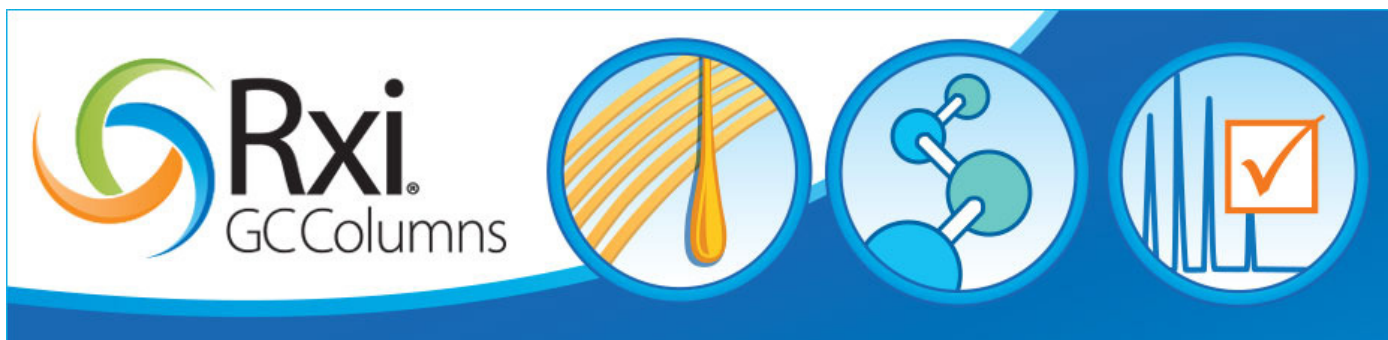
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DuraGuard, EZ-Guard, Guardian

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11



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Rxi® Column Cross-Reference Table - Lower Detection Limits with Ground-Breaking Column Technology

Our Column Cross-Reference Table makes it easy to choose the right Rxi® column.



Rapid Analysis of Steroid Hormones by GC/MS - Using the New Rxi®-1ms Column

GC/MS analysis of urinary steroid hormones is a demanding application, and the Rxi®-1ms column meets the requirements for low bleed and inertness better than any column we have tested. We analyzed a variety of derivatized steroid sex hormones in less than 25 minutes, with excellent resolution and symmetric peaks. At 300°C or above, bleed from the Rxi®-1ms column was negligible.



Totally Reliable Column-to-Column Performance

Rxi® columns demonstrate outstanding column-to-column reproducibility.



Ultra-Low Bleed Columns Improve Trace-Level Analysis

Learn how column bleed affects chromatography and why using Rxi® columns can improve your data.



GC Capillary Columns 101 Infographic Request

Phase polarity, film thickness, inner diameter, length—the choices you make for common GC capillary column specifications can affect your chromatography in so many ways, both good and bad. Join Restek on a quick tour through each of these factors for a fun and engaging overview of the variables that come into play when you select a GC capillary column. Whether you need a quick reminder of the fundamentals or your first taste of column chemistry, this infographic is a great place to start.



Rxi-5Sil MS Columns: Assured Performance for Forensic Applications

Rxi-5Sil MS columns produce excellent results for a number of forensic applications. The versatile selectivity separates a wide variety of compounds, which lets you keep analyzing samples instead of changing columns between methods. (PDF - 2MB)



Optimized Volatiles Analysis Ensures Fast VOC Separations

Analytical conditions for GC analysis of volatile organic compounds have been optimized to ensure good resolution of critical pairs, while maximizing sample throughput. Rxi®-624Sil MS columns are shown to outperform other 624s. (PDF - 1MB)



Rxi-624Sil MS Columns—Exceptionally Inert, Low Bleed Columns for Volatiles Analysis

Analyze volatile compounds and polar analytes with greater confidence using Rxi-624Sil MS columns. Optimized selectivity, higher inertness, and lower bleed result in reliable separations and accurate, trace-level determinations. Includes environmental and pharmaceutical applications. (PDF - 3MB)



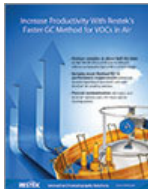
New Rxi-PAH GC Column; Resolve Important Isobaric Polycyclic Aromatic Hydrocarbons for Food Safety and Environmental Methods

Separate isobaric polycyclic aromatic hydrocarbons, including priority EFSA PAH4 compounds benz[a]anthracene, chrysene, benzo[b]fluoranthene, and benzo[a]pyrene, easily and accurately on an Rxi-PAH column. Whether you need more resolution or faster analysis, these new GC columns offer the selectivity and efficiency you need for food safety and environmental PAH analysis. (PDF - 1MB)



Accurately Determine Mineral Oil Hydrocarbons in Food and Packaging

Accurate testing for mineral oil hydrocarbons (MOHs) in food and packaging is imperative to the safety of our food supply. Turn to Restek for the certified reference materials (CRMs), HPLC columns, GC guard columns, and GC analytical columns you need for world-class analysis of mineral oil saturated hydrocarbons (MOSH) and mineral oil aromatic hydrocarbons (MOAH) via online LC/GC coupling. (PDF - 1MB)



Increase Productivity with Restek's Faster GC Method for Analyzing VOCs in Air

Labs analyzing VOCs in air can nearly double sample throughput while meeting all Method TO-15 performance requirements by adopting Restek's short column approach. As shown here, the use of an Rxi®-5Sil MS column (30 m x 0.32 mm ID, 1.00 µm) allows all requirements to be met in almost half the time required by typical 60 m setups. (PDF - 1MB)



Don't Overestimate Cannabidiol During Medical Cannabis Potency Testing by Gas Chromatography

Proper GC column choice is essential for accurate and robust medical cannabis potency testing. Using an Rxi®-35Sil MS column under the instrument conditions shown here allows fast, accurate reporting of cannabichromene and cannabidiol in medical marijuana samples. (PDF - 0MB)



Combined Determination of 1,4-Dioxane and Nitrosamine Contaminants in Drinking Water Using SPE and CSR-LVSI GC-MS

Typically, 1,4-dioxane and nitrosamines are analyzed in drinking water following separate extraction and analysis procedures, such as Methods 521 and 522. However, here we present a combined method that uses large volume splitless injection and GC-MS (SIM) to meet low part-per-trillion detection limits for these compounds in a fraction of the time required when running separate methods. (PDF - 1MB)



A Fast, Simple FET Headspace GC-FID Technique for Determining Residual Solvents in Cannabis Concentrates

As the cannabis industry expands, demand is increasing for analysis of residual solvents in cannabis concentrates in order to protect consumer safety. This application note details a simple, fast, accurate test for common residual solvents using full evaporation technique headspace GC-FID and an Rxi®-624Sil MS column. (PDF - 1MB)



A Preliminary FET Headspace GC-FID Method for Comprehensive Terpene Profiling in Cannabis

This application note describes an FET-HS-GC-FID method that was developed in hops for the analysis of terpenes in cannabis. Good chromatographic separation allowed quantification of critical compounds across the volatility range, including α-pinene, β-myrcene, α-humulene, β-caryophyllene, and caryophyllene oxide. (PDF - 1MB)



NEW! Rxi®-1301Sil MS GC Columns

The new Rxi®-1301Sil MS column is ideal for the analysis of multiple compound classes across a range of polarities and volatilities. With its cyano-based selectivity and high thermal stability, it is the best 1301-type column for robust MS analyses. (PDF - 2MB)



Rxi® GC Columns Brochure

Restek developed the Rxi® family of fused silica GC columns to help you solve the challenges you face in your lab on a daily basis. Let us worry about column inertness and lifetime, stability and reproducibility, bleed and peak shape. Take advantage of Restek® Pure Chromatography to get your work done right and get it done quickly. (PDF - 2MB)



Rxi® GC Columns Sales Sheet

Leverage the outstanding inertness, low bleed, and high reproducibility of Rxi® GC columns with 3-in-1 technology to gain accurate data, the right results fast, and maximized instrument uptime. (PDF - 3MB)



Rugged, Low-Bleed Performance for Challenging GC-MS Work

Across all industries, chromatographic testing methods are becoming more stringent, limits of detection are dropping, and deadlines are getting tighter. While GC-MS and GC-MS/MS instrumentation can improve detectability, column bleed can limit the potential of these powerful techniques. Restek's Rxi®-5Sil MS columns are rugged enough to withstand high temperatures and harsh conditions, and still provide the low bleed levels needed for accurate, reliable MS performance. (PDF - 4MB)



GC Capillary Columns 101 Infographic

Phase polarity, film thickness, inner diameter, length—the choices you make for common GC capillary column specifications can affect your chromatography in so many ways, both good and bad. Join Restek on a quick tour through each of these factors for a fun and engaging overview of the variables that come into play when you select a GC capillary column. Whether you need a quick reminder of the fundamentals or your first taste of column chemistry, this infographic is a great place to start. (PDF - 2MB)



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Speed Up and Simplify GC Method Development With

Restek's EZGC® Online Suite

Featuring Rxi® GC columns



- Model chromatograms
- Column recommendations
- Translate methods **NEW!**
- Calculate flows **NEW!**

Download today at www.restek.com/ezgc

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Lit. Cat.# GNSS2180-UNV



Rxi® Column Cross-Reference Table

Lower Detection Limits with Ground-Breaking Column Technology

POLARITY	nonpolar	Restek	Phase Description	Agilent	SGE	Phenomenex	Machery-Nagel	Supelco	
		Rxi-1ms	dimethyl polysiloxane (low bleed)	HP-1ms, HP-1ms UI, DB-1ms, DB-1ms UI, VF-1ms, Ultra-1	BP1	ZB-1, ZB-1ms	OPTIMA 1 MS, OPTIMA 1 MS Accent	SPB-1, Equity-1	
		Rxi-1HT	dimethyl polysiloxane	DB-1HT		ZB-1HTInferno			
		Rxi-5ms	diphenyl dimethyl polysiloxane (low bleed)	HP-5msSV, HP-5ms, HP-5ms UI, DB-5, Ultra-2, CP-Sil 8 CB	BP5ms	ZB-5, ZB-5ms	OPTIMA 5, OPTIMA 5 MS	SPB-5, Equity-5	
		Rxi-5Sil MS	1,4-bis(dimethylsiloxy) phenylene dimethyl polysiloxane	DB-5ms, DB-5msUI, VF-5ms	BPX5	ZB-5ms, ZB-SemiVolatiles	OPTIMA 5 MS Accent	SLB-5ms	
		Rxi-5HT	diphenyl dimethyl polysiloxane	DB-5ht, VF-5ht	HT5	ZB-5HTInferno	OPTIMA 5HT		
		Rxi-XLB	proprietary phase	DB-XLB, VF-Xms		MR1, ZB-XLB	OPTIMA XLB		
		Rxi-1301Sil MS	silarylene-based cyano	VF-1301ms					
		Rxi-624Sil MS	proprietary phase	DB-624, VF-624ms, CP-Select 624 CB	BP624		OPTIMA 624 LB		
	Rxi-35Sil MS	proprietary phase	DB-35ms, DB35msUI, VF-35ms	BPX35	MR2	OPTIMA 35 MS			
	polar	Rxi-PAH	proprietary phase	Restek Innovation					
		Rxi-17	diphenyl dimethyl polysiloxane	HP-17, DB-17, DB-17ht, DB-608		ZB-50	OPTIMA 17	SPB-17	
Rxi-17Sil MS		proprietary phase	DB-17ms, VF-17ms	BPX50		OPTIMA 17 MS			

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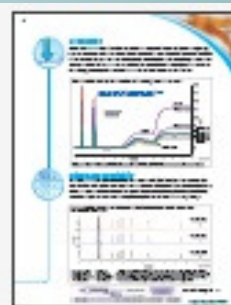
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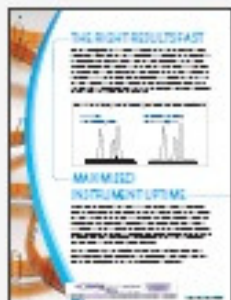
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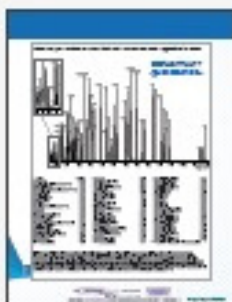
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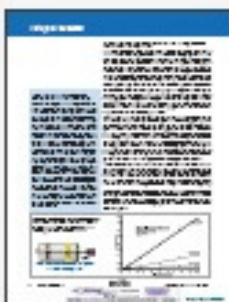
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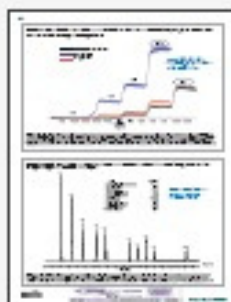
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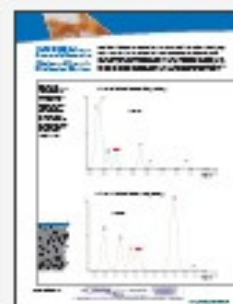
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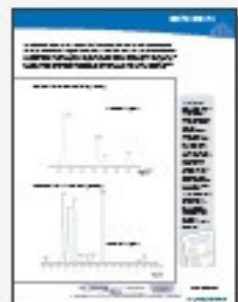
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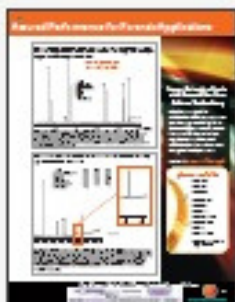
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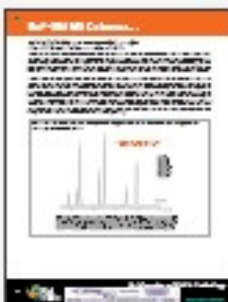
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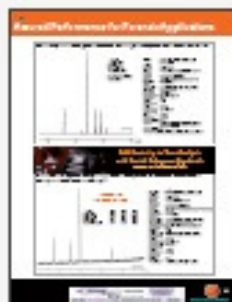
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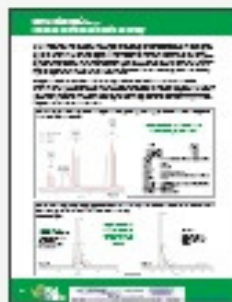
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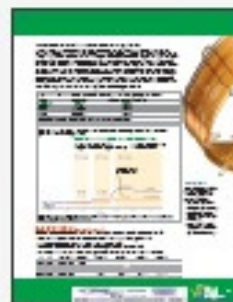
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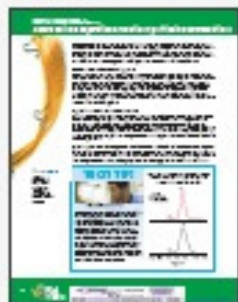
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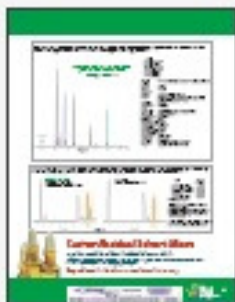
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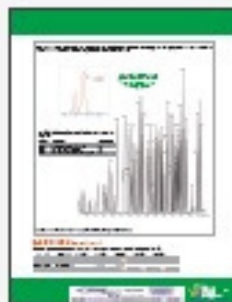
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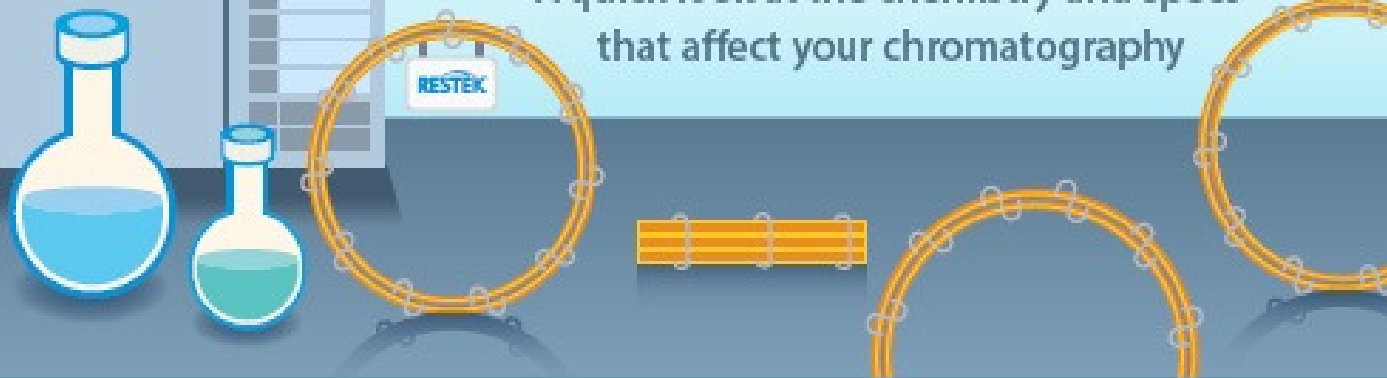


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GC CAPILLARY COLUMNS 101

A quick look at the chemistry and specs that affect your chromatography



Get the Right Results with Rxi® Columns



Now that you've got the basics down, visit www.restek.com/rxi to find the best Rxi® column for your application. Highly inert Rxi® columns give you the right results fast and their low bleed means less maintenance and maximum instrument uptime!

Get a Customized Solution in Seconds with Restek's EZGC® Web App

Find the right column for your application without ever making an Injection using Restek's EZGC® chromatogram modeler. Just copy/paste your analyte list into the web app and you'll get a recommended solution in seconds!
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PHASE POLARITY

LOW

MID

HIGH

Compound Retention

Nonpolar

Nonpolar & Polar

Polar

Temperature Stability

Higher

Moderate

Lower

Good For


Hydrocarbons
Semivolatiles
Sulfur compounds
Crude oils


Pesticides
Volatiles
Drugs of abuse


FAMES
Glycols
Alcohols
Ketones



TECH TIP: APPLICATION-SPECIFIC

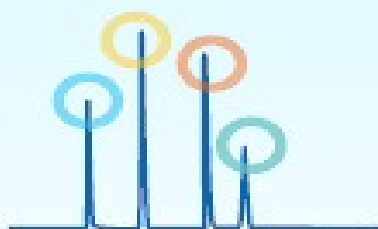
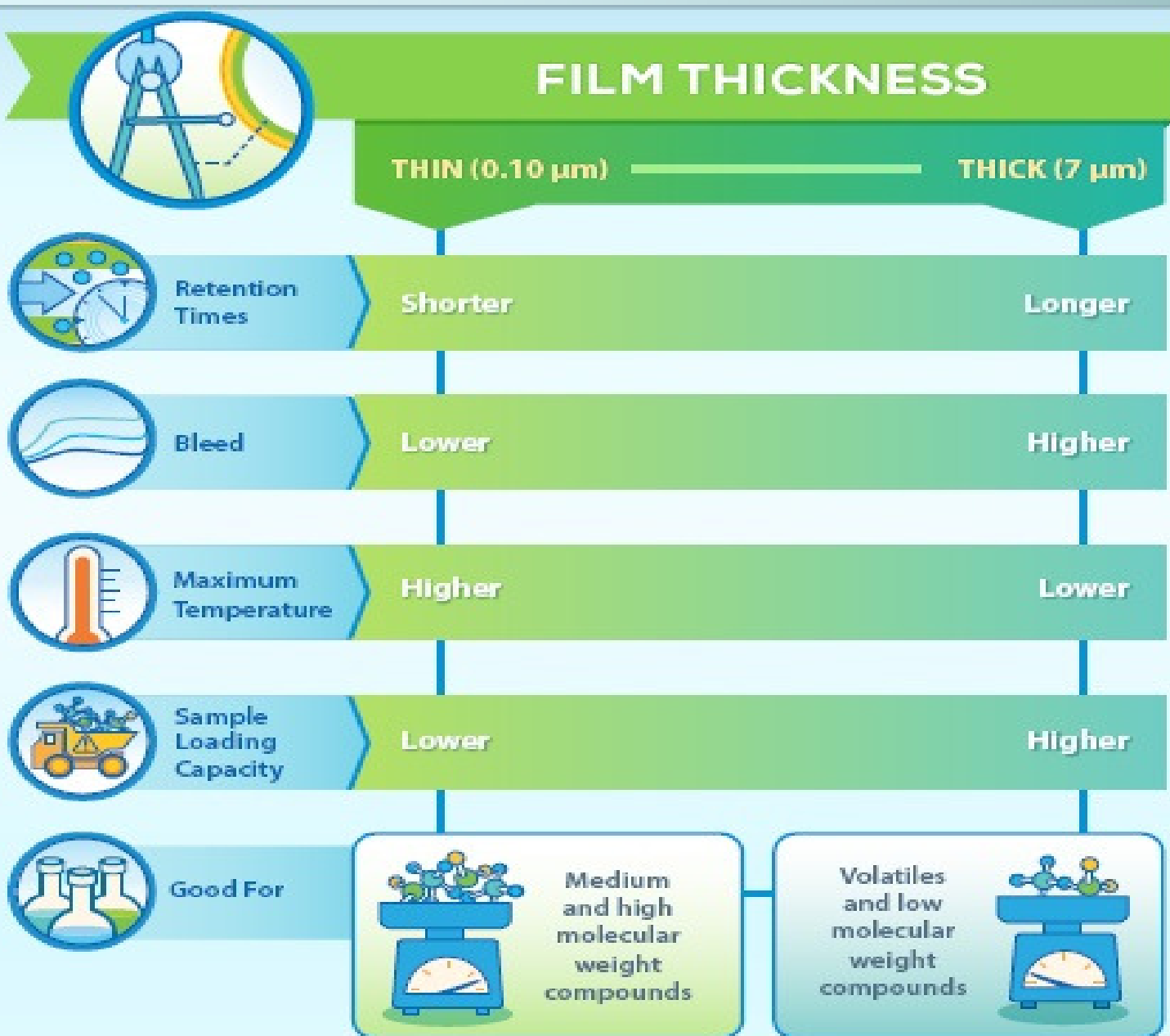
General-purpose columns work for a lot of analyses, but application-specific columns offer optimized selectivity and better separations of specific compounds. For example, an Rxi®-PAH column separates key PAHs that coelute on standard phases.



TECH TIP: SIL COLUMNS

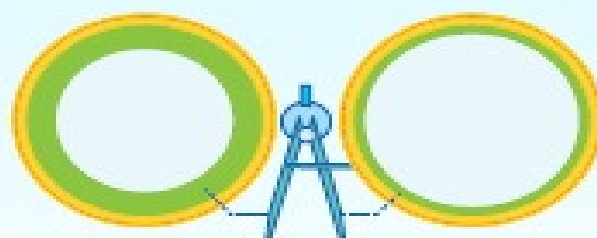
While polar phases generally have lower maximum temperatures than nonpolar, Restek offers "Sil MS" columns that have the similar polarity as their conventional counterparts with higher thermal stability. Lower bleed makes them ideal for MS!

RESTEK *Rxi-Columns* 2016



TECH TIP: CONFIRM YOUR PEAKS

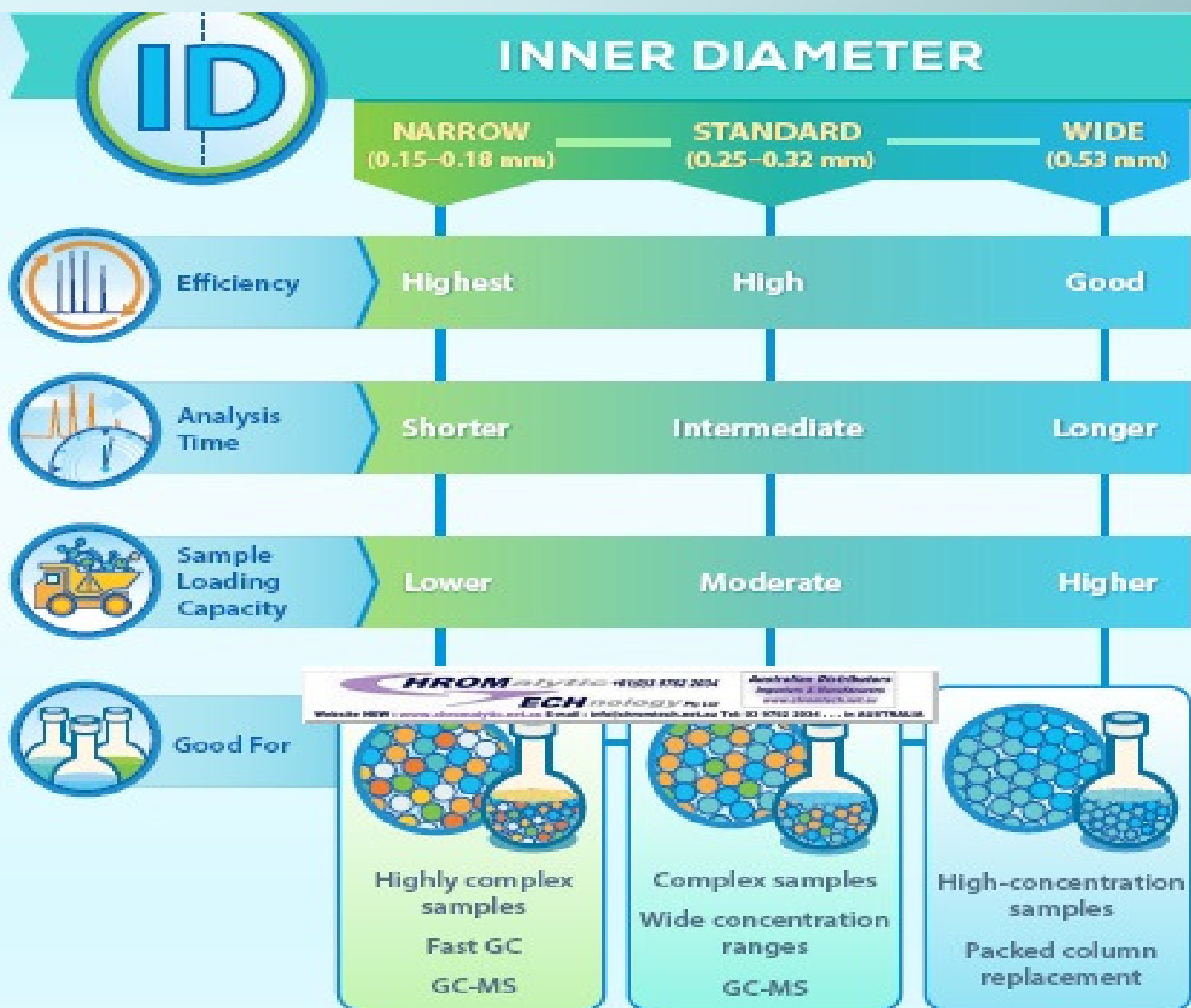
When changing either the film thickness or the temperature program, don't forget to confirm your peak identifications as elution order changes can occur.



TECH TIP: THICK VS. THIN

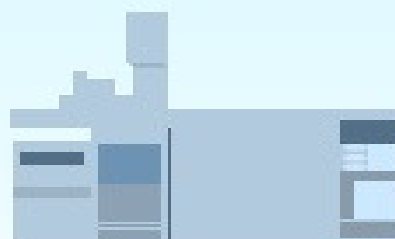
Thin films are great for fast analyses, but it's easy to overload them. Thick films offer more sample loading capacity and are recommended for high-concentration samples.

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TECH TIP: SAMPLE CAPACITY

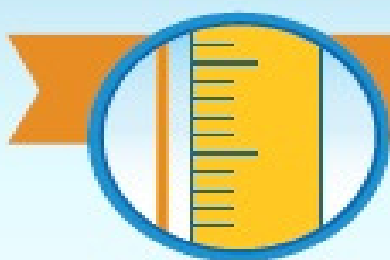
Exceeding your column's sample loading capacity can cause poor peak shape and a loss of resolution. Inject less or choose a larger ID column with thicker film for high-concentration samples (e.g., purity testing).



TECH TIP: DETECTOR FLOW RATES

Always consider your detector's flow rate requirements when selecting column ID. Wide bore columns are generally not suitable for MS as they require higher flow rates than MS detectors can tolerate.

RESTEK *Rxi-COLUMNS* 2016



LENGTH

SHORT (5 m)

LONG (150 m)



Efficiency

Good

Best



Analysis Time

Short

Long



Sample Complexity/
Number of
Compounds

Low

High



TECH TIP: EZGC® METHOD TRANSLATOR

When changing carrier gases or column dimensions, make sure to adjust your method to ensure consistent chromatography. Restek's free, online EZGC® method translator is a great way to translate your method easily and accurately. www.restek.com/ezgc

Get the Right Results with Rxi® Columns



Now that you've got the basics down, visit www.restek.com/rxi to find the best Rxi® column for your application. Highly inert Rxi® columns give you the right results fast and their low bleed means less maintenance and maximum instrument uptime!