Restek GC

Improve Your Linear Alpha Olefins (LAO) Impurity Analysis with Restek's New Rxi-LAO GC Columns

- Unique selectivity enables high resolution of impurities from peaks of interest.
- One-column method reduces instrument setup and analysis time.
- Application-specific column dimensions increase sample throughput.
- Pro *EZ*GC chromatogram modeler libraries simplify analysis optimization.

RESTEK Pure Chromatography www.restek.com

Improve Your Linear Alpha Olefins (LAO) Impurity Analysis with Restek's New Rxi-LAO GC Columns

Specifically applicated for linear alpha olefins (LAO) impurity analysis, Restek's new Rxi-LAO GC columns provide accurate analysis of LAO compounds including 1-butene, 1-hexene, and 1-octene. Combining a stationary phase with a unique selectivity and an optimal, one-column method, these new columns help labs improve their LAO analysis by increasing system uptime and sample throughput.

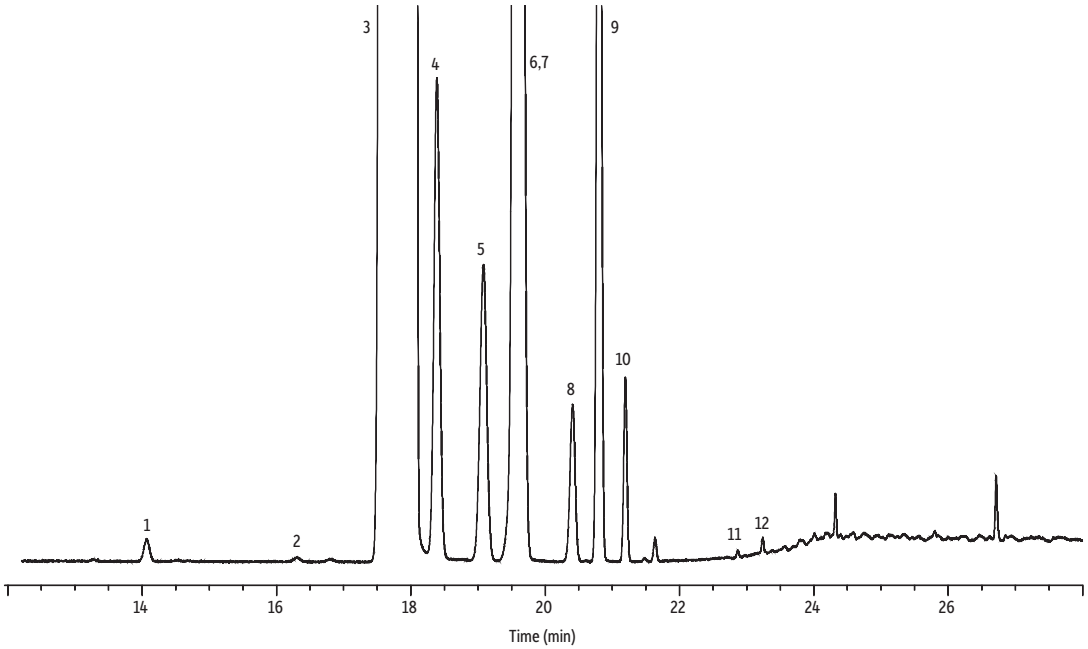
Rxi-LAO columns are defined by four key features:

- Unique selectivity enables high resolution of impurities from peaks of interest for excellent data quality.
- One-column method reduces instrument setup and analysis time, resulting in fast, accurate, and complete analysis.
- Application-specific column dimensions increase sample throughput.
- Pro *EZ*GC chromatogram modeler libraries simplify analysis optimization.

A GC Column Applicated for Linear Alpha Olefins Analysis

Restek's Rxi-LAO columns are the first GC columns specifically applicated for the impurity analysis of linear alpha olefins. Our unique selectivity achieves high resolution of impurities from peaks of interest, ensuring these new columns provide labs with the separation power needed for LAO impurity analysis (Figures 1 and 2).

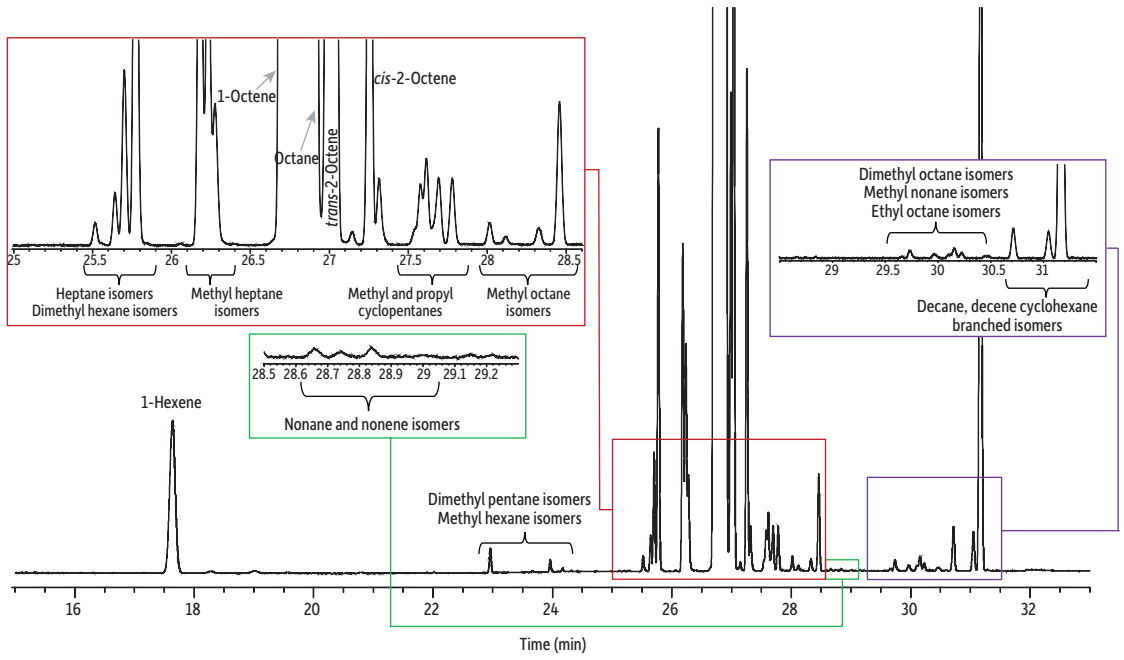
Figure 1: The unique selectivity of Rxi-LAO columns provides high resolution of impurities from peaks of interest in the analysis of 1-Hexene.



Peaks	t_R (min)
1. 3-Methyl-1-pentene	14.06
2. 3-Methylpentane	16.31
3. 1-Hexene	18.04
4. Hexane	18.39
5. 2-Ethyl-1-butene	19.08
6. *cis*-3-Hexene	19.61
7. *trans*-2-Hexene	19.61
8. *cis*-3-Methyl-2-pentene	20.41
9. *cis*-2-Hexene	20.81
10. *trans*-3-Methyl-2-pentene	21.19
11. Methyl-cyclopentene	22.87
12. Cyclohexene	23.24

Column	Rxi-LAO , 60 m, 0.25 mm ID, 1.4 µm (cat.# 13876)
Standard/Sample	1-Hexene
Conc.:	Neat solvent
Injection	
Inj. Vol.:	1 µL split (split ratio 100:1)
Liner:	Topaz 4.0 mm ID low pressure drop Precision inlet liner w/wool (cat.# 23309)
Inj. Temp.:	250 °C
Split Vent Flow Rate:	125 mL/min
Oven	
Oven Temp.:	35 °C (hold 20 min) to 160 °C at 30 °C/min (hold 20 min)
Carrier Gas	He, constant flow
Linear Velocity:	23 cm/sec @ 35 °C
Detector	FID @ 300 °C
Make-up Gas Flow Rate:	45 mL/min
Make-up Gas Type:	N_2
Hydrogen flow:	40 mL/min
Air flow:	450 mL/min
Data Rate:	20 Hz
Instrument	Agilent 7890B GC
Sample Preparation	The sample was pipetted into a 2 mL vial (cat.# 21142) and capped with a short screw cap (cat.# 24498).
Notes	• Compounds were tentatively identified using a mass spectrometer and method translation. • A 208V instrument was used. • Benzene is not present in the sample, but if it were, it would elute at 23.73 minutes under these conditions.

Figure 2: Rxi-LAO columns reliably separate 1-Octene from impurities.



Column	Rxi-LAO, 60 m, 0.25 mm ID, 1.4 µm (cat.# 13876)
Standard/Sample	1-Octene
Conc.:	Neat solvent
Injection	
Inj. Vol.:	1 µL split (split ratio 100:1)
Liner:	Topaz 4.0 mm ID low pressure drop Precision liner w/wool (cat.# 23309)
Inj. Temp.:	250 °C
Split Vent Flow Rate:	125 mL/min
Oven	
Oven Temp.:	35 °C (hold 20 min) to 160 °C at 30 °C/min (hold 20 min)
Carrier Gas	He, constant flow
Linear Velocity:	23 cm/sec @ 35 °C
Detector	FID @ 300 °C
Make-up Gas Flow Rate:	45 mL/min
Make-up Gas Type:	N_2
Hydrogen flow:	40 mL/min
Air flow:	450 mL/min
Data Rate:	20 Hz
Instrument	Agilent 7890B GC
Sample Preparation	The sample was pipetted into a 2 mL vial (cat.# 21142) and capped with a short screw cap (cat.# 24498).
Notes	Peaks are tentatively identified.

An LAO Workhorse: Increased Uptime and Increased Sample Throughput with a Single Column

As worldwide demand for polyethylene increases, so does the pressure on labs performing LAO impurity analysis. These labs need their GC columns to do more—accuracy isn't enough: their columns need to be dependable and fast.

Rxi-LAO columns achieve high selectivity for liner alpha olefins impurities while requiring only a one-column method, resulting in substantial benefits compared to two-column or even current one-column methods. To help meet the needs of different labs, Rxi-LAO columns are available in two dimensions (Table I).

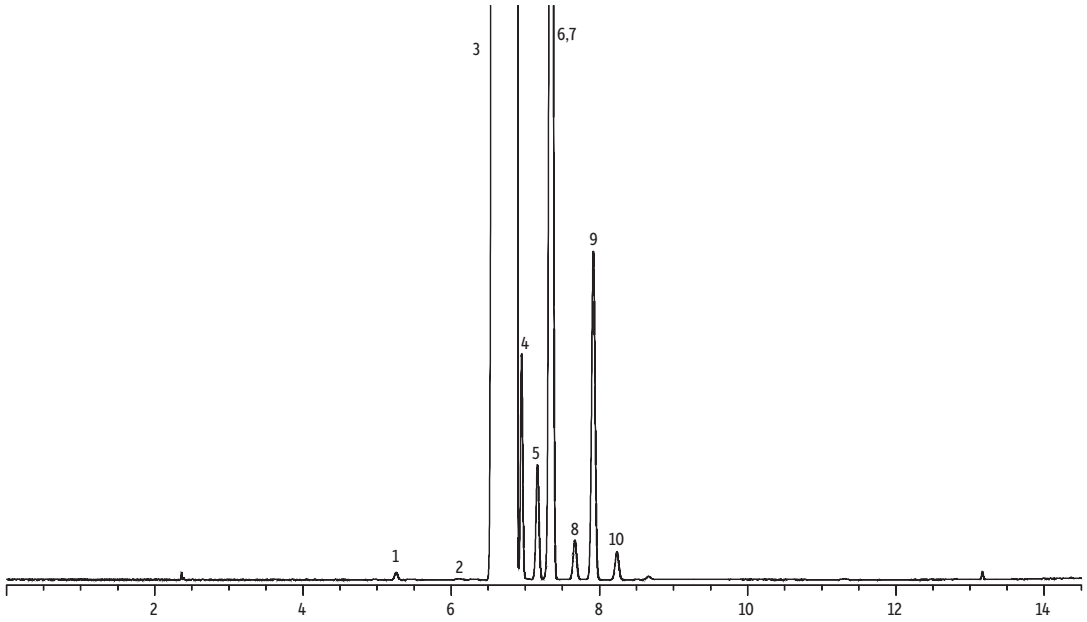
For labs using a two-column/two-GC method, we recommend our Rxi-LAO 60 m, 0.25 mm ID, 1.4 µm column (cat.# 13876). Compared to a two-column method, this single-column option halves the number of columns needed, resulting in reduced setup time, column costs, and analysis time while maintaining data quality (Figures 1 and 2).

For labs using a single-column method, we recommend our shorter, narrow-bore Rxi-LAO 40 m, 0.18 mm ID, 1.0 µm column (cat.# 40815). The smaller dimensions of this column enables fast analysis times while maintaining the separation power needed for LAO impurity analysis (Figures 3 and 4, Table II).

Table I: Switching to a one-column method using Rxi-LAO columns can offer labs substantial benefits over current methods.

Current Method	Rxi-LAO Column Dimension for One-Column Method	Rxi-LAO Column Advantage	Benefits vs. Current Method
2 GC/2 Column	60 m, 0.25 mm ID, 1.4 µm (cat.# 13876)	• One-column method reduces setup time. • Optimal stationary phase selectivity reduces analysis time and yields good resolution of impurities.	• Increased instrument uptime. • Increased sample throughput. • Accurate, complete results.
1 GC/1 Column	40 m, 0.18 mm ID, 1.0 µm (cat.# 40815)	• Shorter, small ID column produces faster analysis times while maintaining impurity resolutions.	• Increased sample throughput. • Good data quality.

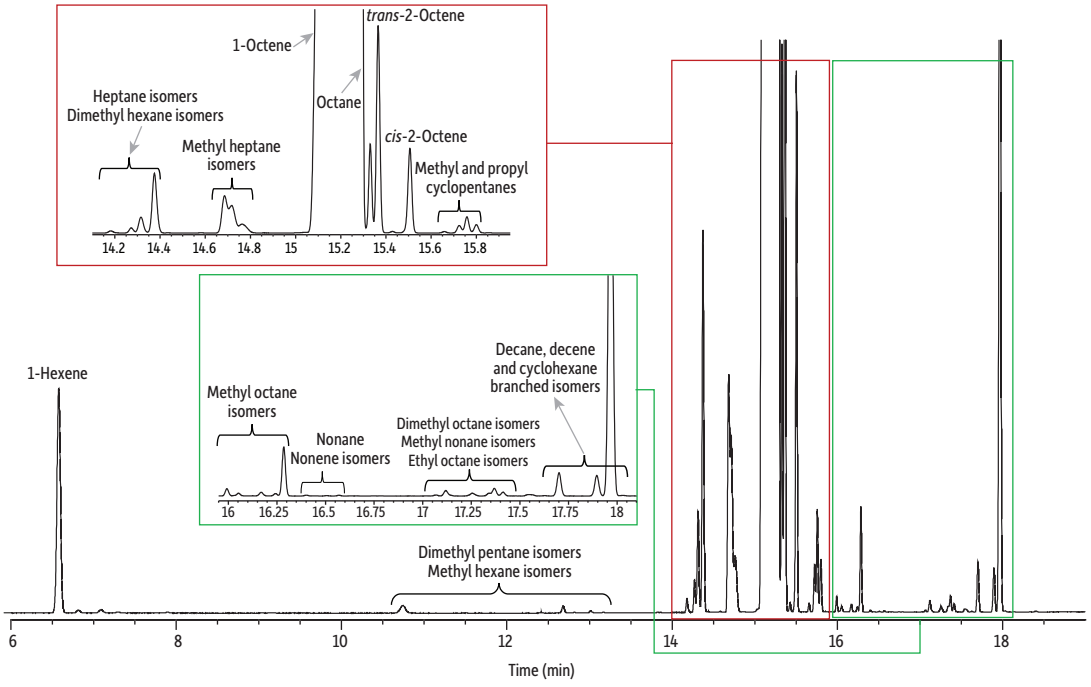
Figure 3: The optimal column dimensions of our 40 m, 0.18 mm ID, 1.0 µm Rxi-LAO column (cat.# 40815) allows even faster run times from a single column analysis while maintaining resolution of impurities from 1-Hexene.



Peaks	t_R (min)
1. 3-Methyl-1-pentene	5.25
2. 3-Methylpentane	6.10
3. 1-Hexene	6.87
4. Hexane	6.94
5. 2-Ethyl-1-butene	7.16
6. *cis*-3-Hexene	7.34
7. *trans*-2-Hexene	7.35
8. *cis*-3-Methyl-2-pentene	7.66
9. *cis*-2-Hexene	7.91
10. *trans*-3-Methyl-2-pentene	8.23

Column	Rxi-LAO, 40 m, 0.18 mm ID, 1.0 µm (cat.# 40815)
Standard/Sample	1-Hexene
Conc.:	Neat solvent
Injection	
Inj. Vol.:	1 µL split (split ratio 100:1)
Liner:	Topaz 4.0 mm ID low pressure drop Precision inlet liner w/wool (cat.# 23309)
Inj. Temp.:	250 °C
Split Vent Flow Rate:	178 mL/min
Oven	
Oven Temp.:	35 °C (hold 11.85 min) to 160 °C at 50 °C/min (hold 12 min)
Carrier Gas	He, constant flow
Linear Velocity:	39.19 cm/sec @ 35 °C
Detector	FID @ 300 °C
Make-up Gas Flow Rate:	45 mL/min
Make-up Gas Type:	N_2
Hydrogen flow:	40 mL/min
Air flow:	400 mL/min
Data Rate:	20 Hz
Instrument	Agilent 7890B GC
Sample Preparation	The sample was pipetted into a 2 mL vial (cat.# 21142) and capped with a short screw cap (cat.# 24498).
Notes	• Compounds were tentatively identified using a mass spectrometer and method translation. • A 208V instrument was used. • Benzene is not present in the sample, but if it were, it would elute at 12.36 minutes under these conditions.

Figure 4: The narrow-bore Rxi-LAO column (cat.# 40815) accurately resolves 1-Octene within a fast, 18-minute run time.



Column	Rxi-LAO, 40 m, 0.18 mm ID, 1.0 µm (cat.# 40815)
Standard/Sample	1-Octene
Conc.:	Neat solvent
Injection	
Inj. Vol.:	1 µL split (split ratio 100:1)
Liner:	Topaz 4.0 mm ID low pressure drop Precision inlet liner w/wool (cat.# 23309)
Inj. Temp.:	250 °C
Split Vent Flow Rate:	178 mL/min
Oven	
Oven Temp.:	35 °C (hold 11.85 min) to 160 °C at 50 °C/min (hold 12 min)
Carrier Gas	He, constant flow
Linear Velocity:	39.19 cm/sec @ 35 °C
Detector	FID @ 300 °C
Make-up Gas Flow Rate:	45 mL/min
Make-up Gas Type:	N_2
Hydrogen flow:	40 mL/min
Air flow:	400 mL/min
Data Rate:	20 Hz
Instrument	Agilent 7890B GC
Sample Preparation	The sample was pipetted into a 2 mL vial (cat.# 21142) and capped with a short screw cap (cat.# 24498).
Notes	• Peaks are tentatively identified. • A 208V instrument was used.

Table II: The faster analysis times produced by the 40 m Rxi-LAO column (cat.# 40815) make it ideal for labs seeking a high throughput solution.

	Run time (min)	
Rxi-LAO Column Dimension	**1-Hexene Analysis**	**1-Octene Analysis**
60 m, 0.25 mm ID, 1.4 µm (cat.# 13876)	24	32
40 m, 0.18 mm ID, 1.0 µm (cat.# 40815)	**9**	**18**

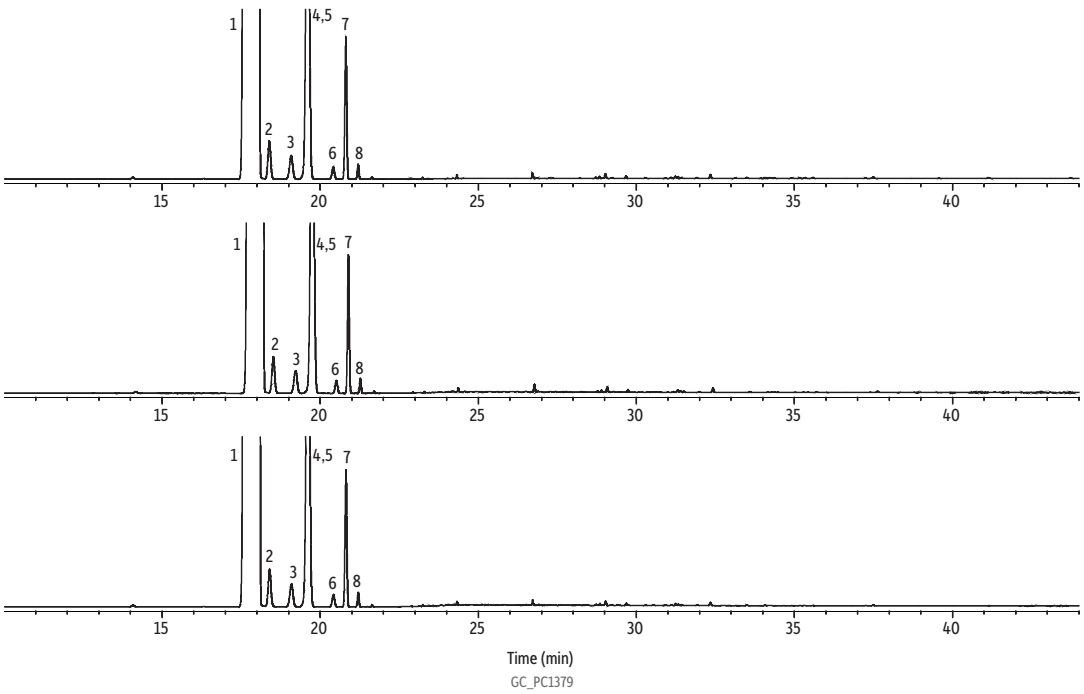
Renowned Rxi Column Technology as Standard

As part of the Rxi GC column family, Rxi-LAO columns benefit from the industry-leading GC column technology that is standard across our entire Rxi column line.

High Reproducibility

Our Rxi-LAO columns feature unmatched manufacturing precision and stringent quality control to deliver high column-to-column reproducibility. This ensures your Rxi-LAO column performs to the same high standard with every analysis, even after changing the column (Figure 5).

Figure 5: Rxi-LAO columns are engineered and QC tested to ensure column-to-column and lot-to-lot reproducibility.



Peaks	t_R (min)
1. 1-Hexene	18.04
2. Hexane	18.39
3. 2-Ethyl-1-butene	19.08
4. *cis*-3-Hexene	19.60
5. *trans*-2-Hexene	19.61
6. *cis*-3-Methyl-2-pentene	20.41
7. *cis*-2-Hexene	20.81
8. *trans*-3-Methyl-2-pentene	21.19

Column	Rxi-LAO, 60 m, 0.25 mm ID, 1.4 µm (cat.# 13876)
Standard/Sample	1-Hexene
Conc.:	Neat solvent
Injection	
Inj. Vol.:	1 µL split (split ratio 100:1)
Liner:	Topaz 4.0 mm ID low pressure drop Precision inlet liner w/wool (cat.# 23309)
Inj. Temp.:	250 °C
Split Vent Flow Rate:	125 mL/min
Oven	
Oven Temp.:	35 °C (hold 20 min) to 160 °C at 30 °C/min (hold 20 min)
Carrier Gas	He, constant flow
Linear Velocity:	23 cm/sec @ 35 °C
Detector	FID @ 300 °C
Make-up Gas Flow Rate:	45 mL/min
Make-up Gas Type:	N_2
Hydrogen flow:	40 mL/min
Air flow:	450 mL/min
Data Rate:	20 Hz
Instrument	Agilent 7890B GC
Sample Preparation	The sample was pipetted into a 2 mL vial (cat.# 21142) and capped with a short screw cap (cat.# 24498).

Low Bleed

The high stability of our Rxi columns means they generate less bleed and reduce background to further improve signal-to-noise ratios, enhance sensitivity, and lower detection limits. Together, these two advanced technologies help ensure your LAO data is highly accurate and that you get the right results fast.

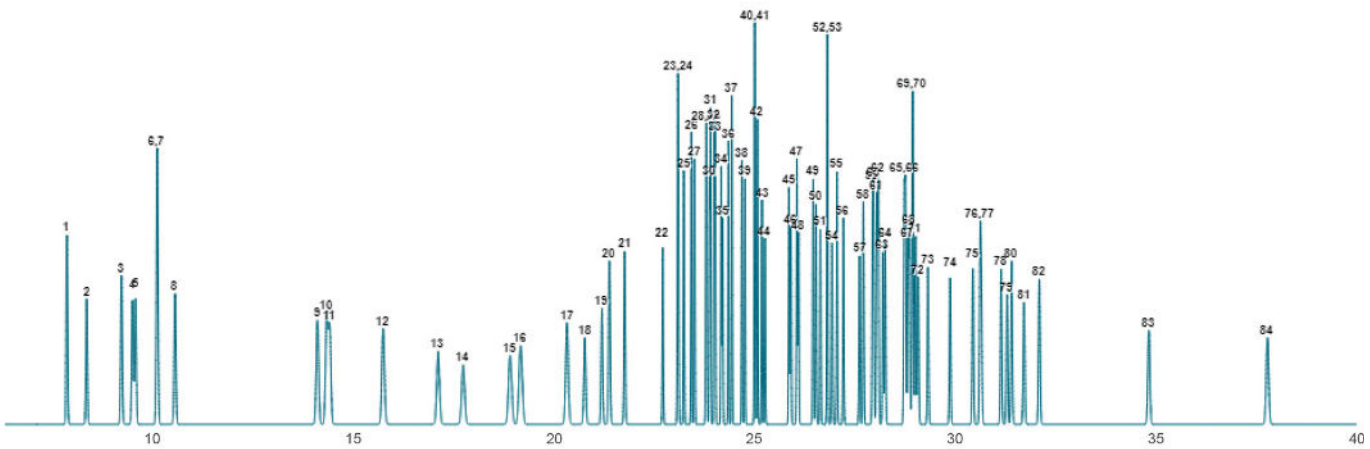
Learn more about the technology that goes into our Rxi GC columns at **www.restek.com/rxi**

Simplify Your Analysis Optimization with Pro *EZ*GC Software

Rxi-LAO columns are fully supported by our Pro *EZ*GC chromatogram modeler, allowing labs to simplify their analysis optimization. This free, easy-to-use software helps you perform GC method optimization and method development in minutes—without needing to use an instrument.

A powerful feature of Pro *EZ*GC software is its ability to model the performance of different column dimensions. If your LAO impurity application currently uses a single-column method, and you would like to see how changing to the shorter, 40 m Rxi-LAO column can speed up your analysis, Pro *EZ*GC software can be used to generate simulated results with exceptional accuracy.

Figure 6: Rxi-LAO GC columns are fully supported by Restek's Pro *EZ*GC chromatogram modeler, helping labs quickly and easily optimize their LAO analysis.



Column:	**Rxi-LAO**, 60.00 m, 0.25 mm ID, 1.40 µm (cat.# 13876)
Carrier Gas:	Helium, Constant Flow @ 1.19 mL/min
Average Velocity:	23.00 cm/sec
Outlet Pressure (abs):	14.70 psi (Atmospheric Pressure)
Oven Temp.:	35 °C (hold 20 min) to 160 °C @ 30 °C/min (hold 15 min)

Rxi Capillary GC Columns

Rxi-LAO Columns (fused silica)
midpolarity Crossbond phase

- Specifically applicated for linear alpha olefin (LAO) impurity analysis.
- Unique selectivity enables high resolution of impurities from peaks of interest.
- One-column method reduces instrument setup and analysis time.
- Consistent column-to-column performance.
- Engineered to be a low-bleed column.

ID	df	Length	Temp. Limits	qty.	cat.#
0.25 mm	1.4 µm	60 m	-20 to 300/320 °C	ea.	13876
0.18 mm	1.0 µm	40 m	-20 to 300/320 °C	ea.	40815

Topaz GC Inlet Liners

Topaz GC inlet liners feature revolutionary technology and inertness to deliver you the next level of True Blue Performance:

- **Deactivation**—unbelievably low breakdown for accurate and precise low-level GC analyses.
- **Reproducibility**—unbeatable manufacturing controls and QC testing for superior reliability across compound classes.
- **Productivity**—unparalleled cleanliness for maximized GC uptime and lab throughput.
- **100% Satisfaction**—if a liner doesn't perform to your expectations, we will replace it or credit your account.*

Patented

* 100% SATISFACTION GUARANTEE: If your Topaz 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

Topaz 4.0 mm ID Low Pressure Drop Precision Inlet Liner w/ Wool

for Agilent GCs and Lucidity miniGCs equipped with split/splitless inlets

ID x OD x Length	Deactivation	Material	Packing	qty	Similar to Part #	cat.#
4.0 mm x 6.3 mm x 78.5 mm	Premium	Borosilicate Glass	Quartz Wool	5-pk.	Agilent 5190-3165 (5-pk.), 5190-3169 (25-pk.), 5183-4701 (5-pk.), 5183-4702 (25-pk.)	23309

2.0 mL, 9 mm Short-Cap, Screw-Thread Vials (vial only)

Fit all 2.0 mL, 12 x 32 mm, screw-thread 9 mm/425 vial-based autosamplers.

Description	Type	Volume	Color	Size	qty.	Similar to Part #	cat.#
Short-Cap Vial w/White Graduated Marking Spot	9-425 Screw-Thread	2.0 mL	Amber	12 x 32 mm	100-pk.	Agilent 5182-0716	21142

2.0 mL, 9 mm Short-Cap, Screw-Vial Closures (Polypropylene, preassembled)

Type	Cap Size	Color	Septa Material	qty.	cat.#
Screw-Thread	9-425	Blue	PTFE/Silicone/PTFE	1000-pk.	24498

Choose preslit caps (available for some vials) to reduce the risk of needle bending, release vacuum from high-volume injections, and improve injection reproducibility when greater than 20% of vial volume is withdrawn.

Restek Electronic Leak Detector

New and improved! Prevent small leaks from causing big problems with a Restek leak detector.

- Detects a broad range of gases and indicates leak severity with both an LED display and audible tone.
- No more waiting for a full charge—can be operated during charging or used up to 12 hours between charges.
- Charging kit includes both universal AC power adaptor and USB charging cable, so you can charge anywhere, anytime.
- Pinpoint very small gas leaks quickly and accurately before they cause damage and downtime.
- Compact, handheld unit is easy to operate and convenient to use anywhere you need to check for leaks.

28500

Description	Includes	qty.	cat.#
Restek Electronic Leak Detector	carrying case, universal AC power adaptor [U.S., UK, Europe, Australia, Japan], 6-ft USB charging cable	ea.	28500

Avoid using liquid leak detectors on a GC! Liquids can be drawn into the system and/or into the leak detector.

*Caution: The Restek electronic leak detector should only be used 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.

RESTEK
Pure Chromatography

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

www.restek.com

QUALITY ISO 9001 • 17025 • 17034

Lit. Cat.# PCSS3860-UNV