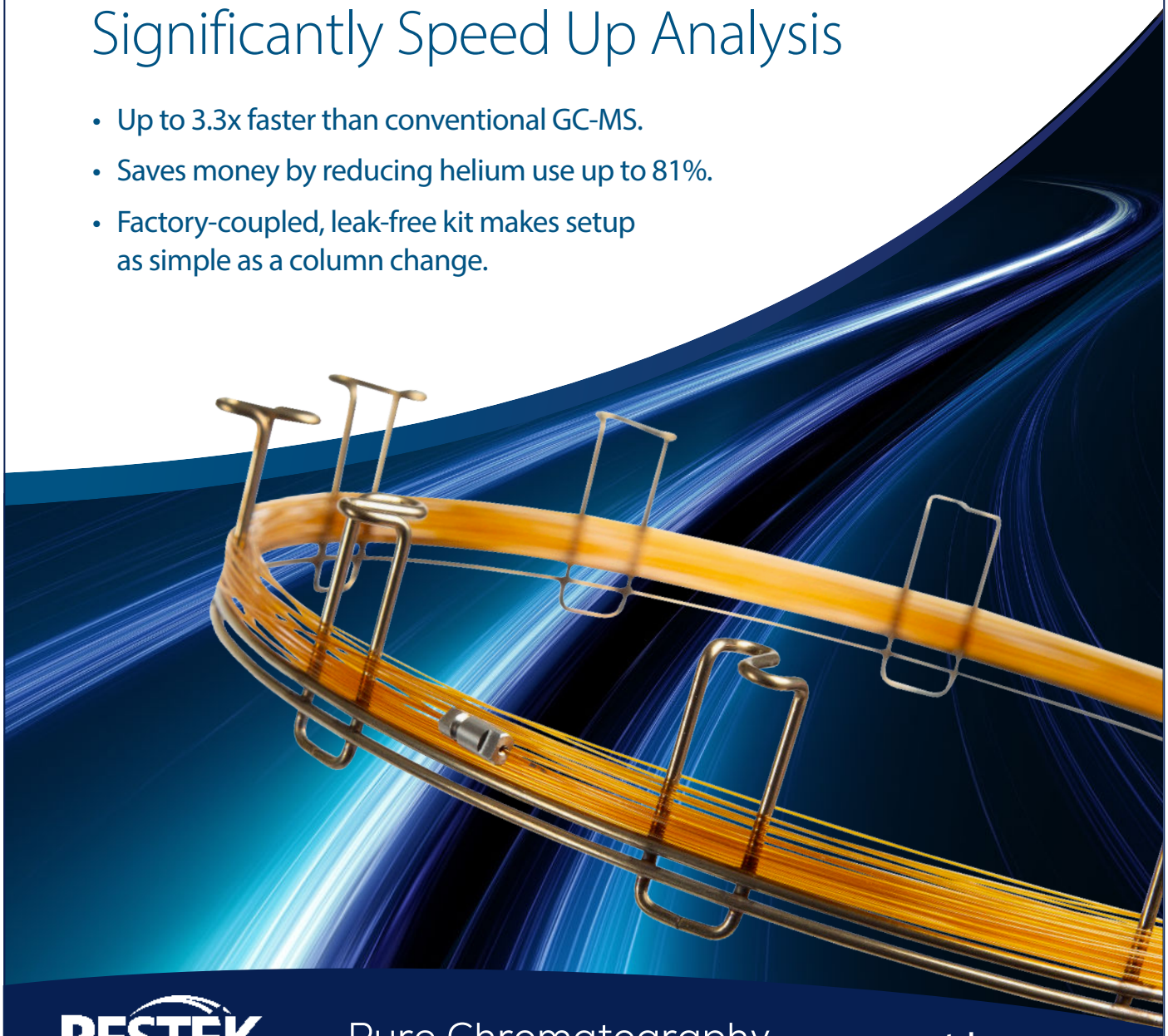
Restek GC

Increase Sample Throughput with Low-Pressure GC-MS

Leverage Your MS Vacuum to Significantly Speed Up Analysis

- Up to 3.3x faster than conventional GC-MS.
- Saves money by reducing helium use up to 81%.
- Factory-coupled, leak-free kit makes setup as simple as a column change.



RESTEK Pure Chromatography www.restek.com

Easy-Installation LPGC Column Kits Make Low-Pressure GC-MS Speeds Attainable

Simplified Setup Opens the Door to Significantly Faster Analyses

- Up to 3.3x faster than conventional GC-MS.
- Saves money by reducing helium use up to 81%.
- Factory-coupled, leak-free kit makes setup as simple as a column change.

Low-pressure GC-MS (LPGC-MS) provides significant speed gains using standard instrumentation, and it also dramatically decreases helium consumption. Multiresidue pesticides, for example, can be analyzed in a third of the time using 54% less helium compared to conventional methods (Figure 1 and Table I). While LPGC-MS is an effective way to increase sample throughput, historically, it has been difficult to implement because manual connections between different tubing diameters are prone to leaks.

Restek's preassembled low-pressure GC column kits—now stocked in an expanded range of unique phases and column dimensions and supported by predeveloped methods—make getting set up for LPGC-MS as simple as a column change. The robust, factory-coupled connection ensures reliable, leak-free performance. Ease of use and consistent results make these column kits an effective way to implement LPGC-MS, making the time- and cost-saving benefits of this advanced technique widely attainable for routine use in high-throughput labs.

What is LPGC-MS?

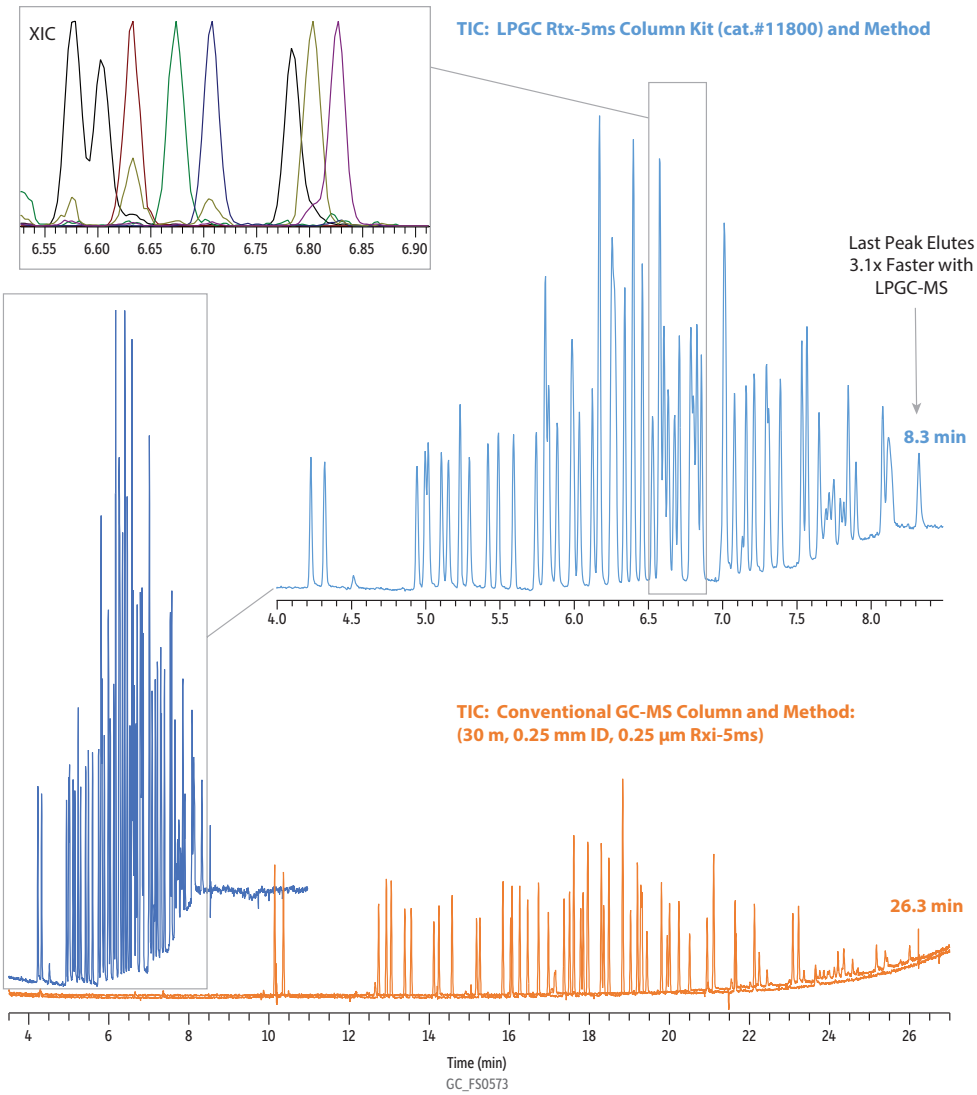
LPGC-MS is a technique that speeds up analysis times by using the MS vacuum to lower pressure in the analytical column while using an attached restrictor column to maintain head pressure. The primary benefit of LPGC-MS is the ability to significantly increase sample throughput, speeding up analyses by up to three or more times compared to conventional methods in some cases. LPGC-MS also reduces helium usage, and it can provide other benefits, too, such as increased sensitivity and less instrument maintenance, depending on sample type and level of use.

Visit www.restek.com for product details and more applications!

Analyze Pesticides in Food 3.1x Faster Using 54% Less Helium

Taking advantage of the speed gains of LPGC-MS is a very effective way to increase sample throughput and reduce helium use. In this multi-residue pesticides example, all compounds elute in eight minutes compared to 26 minutes for conventional analysis, and helium usage was reduced by 54%. Similar helium savings and speed gains are seen with other applications, as detailed in Table I and Table II. In addition, when using LPGC-MS, peak widths are narrower, creating taller peaks that may provide greater sensitivity (depending on matrix and cleanup procedures). Although care must be taken to ensure isobaric compounds are still chromatographically separated, even densely populated peaks can usually still be resolved spectrally as shown in the inset extracted-ion chromatogram.

Figure 1: Speed up multiresidue pesticides analysis with Restek's robust, preassembled LPGC Rtx-5ms column kit (cat.#11800).



Column	See notes
Sample	GC multiresidue pesticide standard #2 (cat.# 32564) GC multiresidue pesticide standard #6 (cat.# 32568)
Diluent:	Acetonitrile
Conc.:	2 µg/mL
Injection	
Inj. Vol.:	2 µL split (split ratio 10:1)
Liner:	Topaz 4.0 mm ID straight inlet liner w/ wool (cat.# 23444)
Inj. Temp.:	250 °C
Oven	
Carrier Gas	He
Detector	TSQ 8000
SIM Program:	35-550 m/z
Transfer Line Temp.:	290 °C
Analyzer Type:	Quadrupole
Source Temp.:	330 °C
Tune Type:	PFTBA
Ionization Mode:	EI

Instrument	Thermo Scientific TSQ 8000 Triple Quadrupole GC-MS
Notes	The reference standard is also available as part of Restek's 200+ compound GC multiresidue pesticide kit (cat.# 32562). **Conventional (30 m) Analysis:** Column: Rxi-5ms, 30 m, 0.25 mm ID, 0.25 µm (cat.# 13423) Temp. program: 90 °C (hold 1 min) to 330 °C at 8.5 °C/min (hold 5 min) Flow: 1.4 mL/min **LPGC-MS Analysis:** Column: LPGC Rtx-5ms, includes 15 m x 0.53 mm ID x 1.00 µm analytical column w/1 m x 0.53 mm ID integrated transfer line and 5 m x 0.18 mm ID Hydroguard restrictor factory connected via SilTite connector (cat.# 11800). Temp. program: 80 °C (hold 1 min) to 320 °C at 35 °C/min (hold 5 min) Flow: 2 mL/min

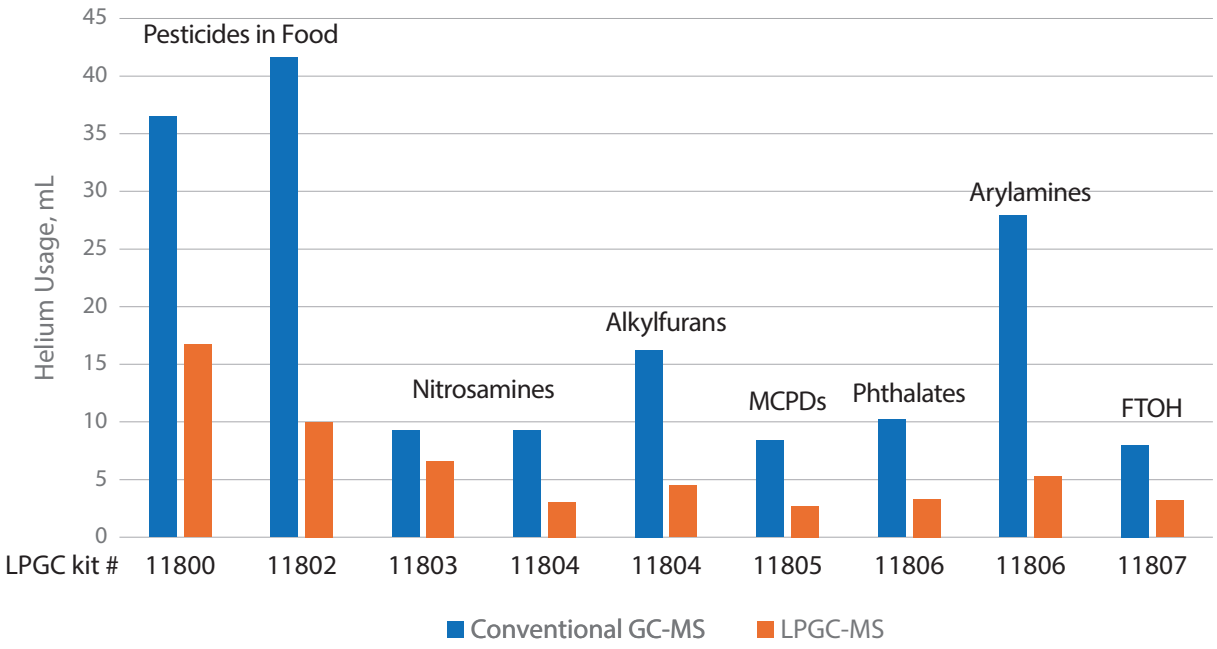
If using a 120V GC oven, an oven insert kit (e.g., GC Accelerator kit, cat.# 23849) will be needed to meet the aggressive ramp rates used in this analysis. For the full list of 63 analytes and their retention times under each method, visit www.restek.com and enter GC_FS0573 in the search.

Table I: Compared to conventional GC-MS, LPGC-MS provides significant speed gains and cost savings from reduced helium use.

		Performance Improvement with LPGC-MS	
Application	**Column Kit**	**Increase in Analysis Speed**	**Reduction in Helium Use**
Alkylfurans	LPGC Rxi-624Sil MS, 10 m (cat. #11804)	2.3x faster	72% less
Arylamines	LPGC Rxi-35Sil MS, 10 m (cat.# 11806)	3.3x faster	81% less
MCPDs	LPGC Rxi-17Sil MS, 10 m (cat.# 11805)	2.0x faster	69% less
Nitrosamines	LPGC Rxi-624Sil MS, 15 m (cat.# 11803)	1.8x faster	29% less
	LPGC Rxi-624Sil MS, 10 m (cat.# 11804)	2.3x faster	67% less
Pesticides	LPGC Rtx-5ms, 15 m (cat.# 11800)	3.1x faster	54% less
	LPGC Rtx-5ms, 10 m (cat.#11802)	3.3x faster	76% less
Phthalates	LPGC Rxi-35Sil MS, 10 m (cat.# 11806)	1.4x faster	67% less
PFAS (Fluorotelomer alcohols)	LPGC Rtx-200, 10 m (cat.#11807)	1.9x faster	60% less

Explore our LPGC-MS applications in the Resource Hub at www.restek.com!

Figure 2: Reduction in Helium Consumption by Application



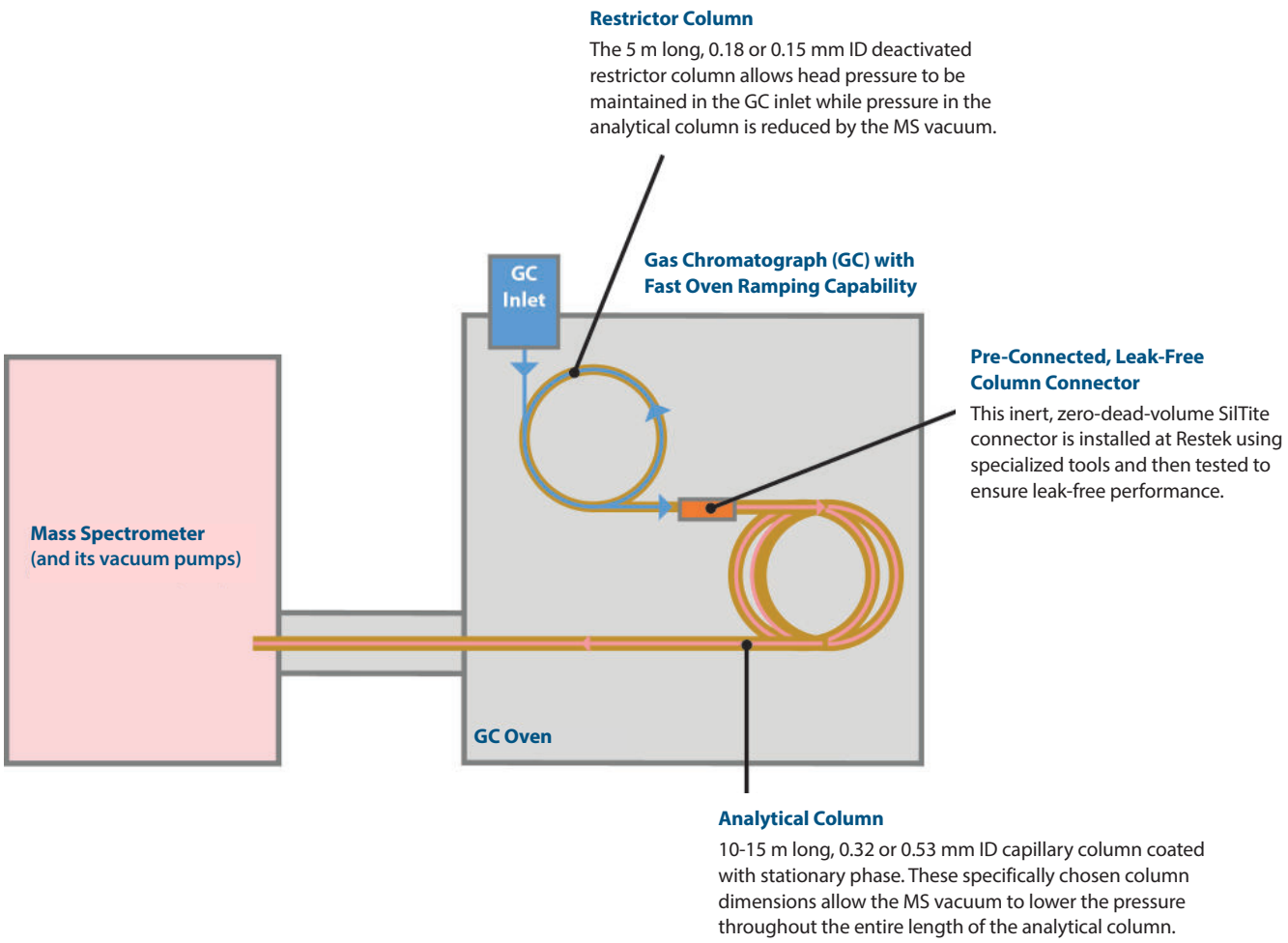
A Simple Solution to Historical Hurdles

The LPGC-MS approach has been described in the literature since the 1960s, but it has not seen widespread adoption. Why is that? Who wouldn't want similar results in less time? The barriers to LPGC-MS adoption traditionally have not been problems with chromatographic performance, indeed, the benefits of the technique are widely recognized. Rather, the obstacles to implementation have been due to challenges with the instrumental setup itself.

In order to reduce pressure within the entire analytical column via the MS vacuum while still maintaining effective head pressure in the GC inlet, a narrow "restrictor" column must be coupled to the wider analytical column. Manual connections made between these different tubing diameters are prone to leaks, which historically has made LPGC-MS configurations difficult to install reliably.

Restek's preassembled LPGC column kits overcome these hurdles by using a robust, zero-dead-volume, factory coupling between the restrictor column and the analytical column (Figure 2). LPGC column kits have been specifically designed to install easily and are individually tested to ensure leak-free performance. With a low-pressure GC column kit, setting up for LPGC-MS is as simple as changing a column and updating the associated parameters in the instrument software.

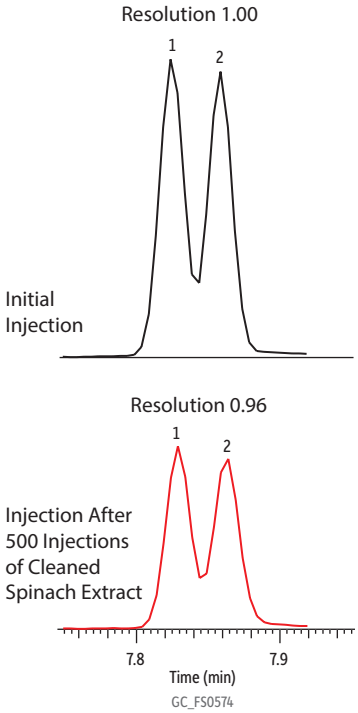
Figure 3: A preassembled LPGC column kit installs easily and ensures leak-free LPGC-MS performance.



A Reliable Solution to LPGC-MS Implementation

Implementing any new technique can be a risk, especially for a fast-paced lab with a constant supply of samples awaiting analysis. To make that risk pay off, it is essential to have confidence in the reliability of a new approach. An LPGC column kit will provide stable, leak-free performance over the course of hundreds of injections. With no loss of peak shape or significant variability in response, Figure 3 offers indirect evidence that no leak was formed during a 500-injection lifetime study. As direct evidence, Table II shows the mass spectrometer's evaluation of how well the GC-MS/MS system was sealed throughout the experiment.

Figure 4: Even after 500 injections of spinach extract under LPGC-MS, the resolution, peak shapes, and retention times of *cis/trans*-permethrin isomers remained nearly unchanged over the course of the lifetime study.



Peaks	t_R (min)	Conc. (ng/mL)	Parent Ion	Product Ion	Collision Energy
1. *cis*-Permethrin	7.82	90	183	153	12
2. *trans*-Permethrin	7.86	90	183	153	12

Column	LPGC Rtx-5ms, includes 15 m x 0.53 mm ID x 1.00 µm analytical column w/1 m x 0.53 mm ID integrated transfer line and 5 m x 0.18 mm ID Hydroguard restrictor factory connected via SilTite connector (cat.# 11800).
Sample	QuEChERS performance standards kit (cat.# 31152)
Diluent:	Acetonitrile
Conc.:	9 µg/mL
Injection	
Inj. Vol.:	1 µL split (split ratio 100:1)
Liner:	Topaz 4.0 mm ID single taper inlet liner w/ wool (cat.# 23447)
Inj. Temp.:	250 °C
Oven	
Oven Temp.:	70 °C (hold 1 min) to 320 °C at 35 °C/min (hold 5 min)
Carrier Gas	He, constant flow
Flow Rate:	2 mL/min
Detector	TSQ 8000
Transfer Line Temp.:	290 °C
Analyzer Type:	Quadrupole
Source Temp.:	325 °C
Solvent Delay Time:	2 min
Instrument	Thermo Scientific TSQ 8000 Triple Quadrupole GC-MS
Notes	The spinach matrix was prepared from 10 g of homogenized spinach extracted with QuEChERS EN salts (cat.# 25849) and cleaned up with dSPE containing magnesium sulfate, PSA, C18-EC, and GCB (cat.# 26219). The matrix extract was then spiked with 30 µL of each of the QuEChERS performance mixes for a final concentration of 9 ppm, and the internal standard triphenyl phosphate (TPP) was added at a final concentration of 10 ppm. Between the first and last run, 500 injections of spinach extract spiked with internal standard (TTP) were made.

Table II: MS leak-check data demonstrate that the system remained leak free throughout a 500-injection lifetime study.

# of Oven Cycles between 70-320 °C	% Leak Relative to Tuning Compound	Order of Magnitude of Tuning Compound (m/z 69) Intensity (10x)	Tuning Compound (m/z 69) Signal Full Width at Half Max (m/z)
0	5.03 % - Pass	10^7	0.70
100	4.69 % - Pass	10^7	0.71
200	4.08 % - Pass	10^7	0.71
300	3.85 % - Pass	10^7	0.71
400	3.40 % - Pass	10^7	0.71
500	4.59 % - Pass	10^7	0.72

Welcome to a Simple, Reliable Setup for Low-Pressure GC-MS

Taking advantage of your mass spectrometer's vacuum system to greatly accelerate GC analysis has never been easier. Restek's low-pressure GC column kits make transforming your instrument's productivity as easy as a quick column change and method update. Ease of use and reliable leak-free performance make these column kits an effective way to implement LPGC-MS and reap the rewards of much higher sample throughput and lower helium consumption.

Visit **www.restek.com/LPGC** for more applications and an in-depth look at this powerful technique.

Low-Pressure GC (LPGC) Column Kit

Leverage Your MS Vacuum to Significantly Speed Up Separations

Ideal for fast GC-MS and GC-MS/MS methods, Restek's low-pressure GC column kits are designed to install easily and reliably, making it simple to gain the speed boost and helium savings of LPGC.

- Up to 3.3x faster than conventional GC-MS.
- Saves money by reducing helium use up to 81%.
- Factory-coupled, leak-free kits make set up as simple as a column change.

LPGC kits are comprised of two factory-coupled columns: a 5 m narrow-bore restrictor column and a short, 0.53 or 0.32 mm ID analytical column in dimensions and phases optimized for LPGC-amenable analyses.

11800

Temp. Limits	Description	qty.	cat.#
-60 to 340/340 °C	LPGC Rtx-5ms column kit, includes 15 m x 0.53 mm ID x 1.00 µm Rtx-5ms analytical column w/1 m x 0.53 mm ID integrated transfer line and 5 m x 0.18 mm ID Hydroguard restrictor factory connected via SilTite connector	kit	11800
-60 to 325/350 °C	LPGC Rtx-5ms column kit, includes 10 m x 0.32 mm ID x 1.00 µm Rtx-5ms analytical column and 5 m x 0.15 mm ID Hydroguard restrictor factory connected via SilTite Connector	kit	11802
-20 to 280/310°C	LPGC Rxi-624Sil MS column kit, includes 15 m x 0.53 mm ID x 3.0 µm Rxi-624Sil MS analytical column and 5 m x 0.18 mm ID Rxi restrictor factory connected via SilTite connector	kit	11803
-20 to 300/320°C	LPGC Rxi-624Sil MS column kit, includes 10 m x 0.32 mm ID x 1.8 µm Rxi-624Sil MS analytical column and 5 m x 0.15 mm ID Rxi restrictor factory connected via SilTite connector	kit	11804
40 to 340/360 °C	LPGC Rxi-17Sil MS column kit, includes 10 m x 0.32 mm ID x 0.25 µm Rxi-17Sil MS analytical column and 5 m x 0.15 mm ID Rxi restrictor factory connected via SilTite connector	kit	11805
50 to 340/360 °C	LPGC Rxi-35Sil MS column kit, includes 10 m x 0.32 mm ID x 0.25 µm Rxi-35Sil MS analytical column and 5 m x 0.15 mm ID Rxi restrictor factory connected via SilTite connector	kit	11806
-20 to 290/310 °C	LPGC Rtx-200 column kit, includes 10 m x 0.32 mm ID x 1.00 µm Rtx-200 analytical column and 5 m x 0.15 mm ID Rxi restrictor factory connected via SilTite Connector	kit	11807

Vespel/Graphite Capillary Ferrules for $^1/_{16}$-Inch Compression-Type Fittings

Ferrule ID	Fits Column ID	Fitting Size	Material	qty.	cat.#
0.8 mm	0.45/0.53 mm (fused silica); 0.53 mm (MXT)	$^1/_{16}$"	VG2, 60% Vespel/40% Graphite	10-pk.	20213
0.5 mm	0.32 mm (fused silica); 0.25/0.32 mm (MXT)	$^1/_{16}$"	VG2, 60% Vespel/40% Graphite	50-pk.	20231
0.4 mm	0.025/0.05/0.075/0.10/0.15/ 0.18/0.20/0.25 mm (fused silica); 0.18 mm (MXT)	$^1/_{16}$"	VG2, 60% Vespel/40% Graphite	10-pk.	20211

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

Topaz 4.0 mm ID Single Taper Inlet Liner w/ Wool

for Thermo TRACE 1300/1310 and 1600/1610 GCs equipped with SSL inlets

ID x OD x Length	Packing	qty	Similar to Part #	cat.#
Single Taper, Premium Deactivation, Borosilicate Glass				
4.0 mm x 6.5 mm x 78.5 mm	Quartz Wool	5-pk.	Thermo Fisher Scientific 453A1925-UI	23447

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.

Product Name	Units	cat.#
Restek Electronic Leak Detector (includes carrying case, universal AC power adaptor [U.S., UK, Europe, Australia, Japan], 6-ft USB charging cable)	ea.	28500

GC Accelerator Oven Insert Kit

for Agilent 5890, 6890, 7890, and 8890 instruments

- GC Accelerator kit installs easily without damaging the GC column or interfering with the MS interface.

Designed with GC-MS users in mind, the GC Accelerator kit provides a simple way to speed up sample analysis. By reducing oven volume, these inserts allow faster ramp rates to be attained, which reduces oven cycle time and allows for increased sample throughput and more capacity to process rush samples.

Description	Instrument	qty.	cat.#
GC Accelerator Oven Insert Kit	for Agilent 5890, 6890, 7890, and 8890 instruments	kit	23849

If using a 120 V GC oven, a GC Accelerator oven insert kit (cat.# 23849) may be needed to meet aggressive ramp rates.

23849

Q-sep QuEChERS Extraction Salts

- Free-flowing salts transfer easily and completely.
- Easy-open packets eliminate the need for a second empty tube for salt transfer.
- Convenient slim packets fit perfectly into tubes to prevent spills.
- Ready-to-use tubes, no glassware required.
- Pre-weighed, ultra-pure extraction salts.
- Ideal for original unbuffered, AOAC (2007.01), and European (EN 15662) QuEChERS methods.

QuEChERS methods are fast, easy, and cost-effective, and Restek Q-sep products make QuEChERS procedures even easier. No specialized glassware is required when you're using Q-sep extraction packets and tubes. Free-flowing extraction salts and salt packets that fit easily into the extraction tubes make transferring the salts to your sample mess-free and easy.

Description	Material	Method	qty.	cat.#
Q-sep QuEChERS Extraction Kit	4 g $MgSO_4$, 1 g NaCl with 50 mL Centrifuge Tube	Original unbuffered	50 packets & 50 tubes	25848
Q-sep QuEChERS Extraction Salt Packets Only	4 g $MgSO_4$, 1 g NaCl	Original unbuffered	50 packets	25847
Q-sep QuEChERS Extraction Kit	4 g $MgSO_4$, 1 g NaCl, 1 g TSCD, 0.5 g DHS with 50 mL Centrifuge Tube	European EN 15662	50 packets & 50 tubes	25850
Q-sep QuEChERS Extraction Salt Packets Only	4 g $MgSO_4$, 1 g NaCl, 1 g TSCD, 0.5 g DHS	European EN 15662	50 packets	25849
Q-sep QuEChERS Extraction Kit	6 g $MgSO_4$, 1.5 g NaOAc with 50 mL Centrifuge Tube	AOAC 2007.01	50 packets & 50 tubes	25852
Q-sep QuEChERS Extraction Salt Packets Only	6 g $MgSO_4$, 1.5 g NaOAc	AOAC 2007.01	50 packets	25851

DHS – disodium hydrogen citrate sesquihydrate; $MgSO_4$ – magnesium sulfate; NaCl – sodium chloride; NaOAc – sodium acetate; TSCD – trisodium citrate dihydrate

25847

ordering notes

Certificates of analysis for this product are provided electronically. To view and download your certificate, simply visit www.restek.com/documentation

Q-sep QuEChERS dSPE Tubes for Extract Cleanup

Fast, Simple Sample Prep for Multiresidue Pesticide Analysis

- Packaged in foil subpacks of 10 for enhanced protection and storage stability.
- Ready-to-use tubes, no glassware required.
- Pre-weighed, ultra-pure sorbents.
- Support original unbuffered, AOAC (2007.01), European (EN 15662), and mini-multiresidue QuEChERS methods.

26215

Description	Material	Method	Type	Volume	qty.	Similar to Part #	cat.#
Foodstuffs with fats and waxes (e.g., cereals, avocado, nuts, seeds, and dairy)							
Q-sep QuEChERS dSPE Tubes	150 mg $MgSO_4$, 25 mg PSA, 25 mg C18-EC	Mini-multiresidue	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.	Agilent 5982-5121	26216
	150 mg $MgSO_4$, 50 mg C18-EC	—	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26242
	150 mg $MgSO_4$, 50 mg PSA, 50 mg C18-EC	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26125
	1200 mg $MgSO_4$, 400 mg PSA, 400 mg C18-EC	AOAC 2007.01	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.	Agilent 5982-5158	26221
	1200 mg $MgSO_4$, 400 mg C18-EC	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26244
	900 mg $MgSO_4$, 150 mg PSA, 150 mg C18-EC	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26226
General fruits and vegetables (e.g., celery, head lettuce, cucumber, melon)							
Q-sep QuEChERS dSPE Tubes	150 mg $MgSO_4$, 50 mg PSA	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26124
	150 mg $MgSO_4$, 25 mg PSA	Original unbuffered, EN 15662, mini-multiresidue	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.	Agilent 5982-5021	26215
	1200 mg $MgSO_4$, 400 mg PSA	AOAC 2007.01	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26220
	900 mg $MgSO_4$, 150 mg PSA	Original unbuffered, EN 15662	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.	Agilent 5982-5056	26223
General purpose (wide variety of sample types, including fatty and pigmented fruits and vegetables)							
Q-sep QuEChERS dSPE Tubes	150 mg $MgSO_4$, 50 mg PSA, 50 mg C18-EC, 7.5 mg GCB	—	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26243
	900 mg $MgSO_4$, 300 mg PSA, 300 mg C18-EC, 45 mg GCB	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26245
Highly pigmented fruits and vegetables (e.g., red peppers, spinach, blueberries)							
Q-sep QuEChERS dSPE Tubes	150 mg $MgSO_4$, 25 mg PSA, 7.5 mg GCB	Mini-multiresidue, EN 15662	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26218
	150 mg $MgSO_4$, 50 mg PSA, 50 mg C18-EC, 50 mg GCB	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26219
	900 mg $MgSO_4$, 150 mg PSA, 45 mg GCB	EN 15662	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26225
	900 mg $MgSO_4$, 300 mg PSA, 150 mg GCB	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26126
Pigmented fruits and vegetables (e.g., strawberries, sweet potatoes, and tomatoes)							
Q-sep QuEChERS dSPE Tubes	150 mg $MgSO_4$, 25 mg PSA, 2.5 mg GCB	Mini-multiresidue, EN 15662	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26217
	150 mg $MgSO_4$, 50 mg PSA, 50 mg GCB	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100-pk.		26123
	1200 mg $MgSO_4$, 400 mg PSA, 400 mg C18-EC, 400 mg GCB	AOAC 2007.01	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26222
	900 mg $MgSO_4$, 150 mg PSA, 15 mg GCB	EN 15662	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50-pk.		26224

Note: No entry in the Method column refers to dSPE formulations not specifically included in one of the cited references. These products can be used to accommodate the various needs of specific matrices not directly met by the cited references.

Multiple sorbents are used to extract different types of interferences.
$MgSO_4$—removes excess water.
PSA (primary and secondary amine)—removes sugars, fatty acids, organic acids, and anthocyanine pigments.
C18-EC (end-capped)—removes nonpolar interferences.
GCB (graphitized carbon black)—removes pigments, sterols, and nonpolar interferences.

GC Multiresidue Pesticide Kit

- Accurately identify and quantify pesticide residues by GC-MS/MS in fruits, vegetables, botanicals, and herbals such as tea, ginseng, ginger, echinacea, and dietary supplements.
- Comprehensive 203-compound kit covers food safety lists by the FDA, USDA, and other global governmental agencies; individual ampuls also sold separately.

32562

Cat.# 32563: GC Multiresidue Pesticide Standard #1 (16 components)
Organophosphorus Compounds
100 µg/mL each in toluene, 1 mL/ampul
Azinphos ethyl (2642-71-9)
Azinphos methyl (86-50-0)
Chlorpyrifos (2921-88-2)
Chlorpyrifos methyl (5598-13-0)
Diazinon (333-41-5)
EPN (2104-64-5)
Fenitrothion (122-14-5)
Isazophos (42509-80-8)
Phosalone (2310-17-0)
Phosmet (732-11-6)
Pirimiphos ethyl (23505-41-1)
Pirimiphos methyl (29232-93-7)
Pyraclofos (89784-60-1)
Pyrazophos (13457-18-6)
Pyridaphenthion (119-12-0)
Quinalphos (13593-03-8)

Cat.# 32564: GC Multiresidue Pesticide Standard #2 (40 components)
Organochlorine Compounds
100 µg/mL each in toluene, 1 mL/ampul
Aldrin (309-00-2)
α-BHC (319-84-6)
β-BHC (319-85-7)
δ-BHC (319-86-8)
γ-BHC (Lindane) (58-89-9)
Chlorbenside (103-17-3)
cis-Chlordane (5103-71-9)
trans-Chlordane (5103-74-2)
Chlorfenson (Ovex) (80-33-1)
Chloroneb (2675-77-6)
2,4'-DDD (53-19-0)
4,4'-DDD (72-54-8)
2,4'-DDE (3424-82-6)
4,4'-DDE (72-55-9)
2,4'-DDT (789-02-6)
4,4'-DDT (50-29-3)
4,4'-Dichlorobenzophenone (90-98-2)
Dieldrin (60-57-1)
Endosulfan I (959-98-8)
Endosulfan II (33213-65-9)
Endosulfan ether (3369-52-6)
Endosulfan sulfate (1031-07-8)
Endrin (72-20-8)
Endrin aldehyde (7421-93-4)
Endrin ketone (53494-70-5)
Ethylan (Perthane) (72-56-0)
Fenson (80-38-6)
Heptachlor (76-44-8)
Heptachlor epoxide (isomer B) (1024-57-3)
Hexachlorobenzene (118-74-1)
Isodrin (465-73-6)
2,4'-Methoxychlor (30667-99-3)
4,4'-Methoxychlor olefin (2132-70-9)
Mirex (2385-85-5)
cis-Nonachlor (5103-73-1)
trans-Nonachlor (39765-80-5)
Pentachloroanisole (1825-21-4)
Pentachlorobenzene (608-93-5)
Pentachlorothioanisole (1825-19-0)
Tetradifon (116-29-0)

Cat.# 32565: GC Multiresidue Pesticide Standard #3 (25 components)
Organonitrogen Compounds
100 µg/mL each in toluene:acetonitrile (99:1), 1 mL/ampul
Benfluralin (1861-40-1)
Biphenyl (92-52-4)
Chlorothalonil (1897-45-6)
Dichlofluanid (1085-98-9)
Dichloran (99-30-9)
3,4-Dichloroaniline (95-76-1)
2,6-Dichlorobenzonitrile (Dichlobenil) (1194-65-6)
Diphenylamine (122-39-4)
Ethalfluralin (55283-68-6)
Fluchloralin (33245-39-5)
Isopropalin (33820-53-0)
Nitralin (4726-14-1)
Nitrofen (1836-75-5)
Oxyfluorfen (42874-03-3)
Pendimethalin (40487-42-1)
Pentachloroaniline (527-20-8)
Pentachlorobenzonitrile (20925-85-3)
Pentachloronitrobenzene (Quintozene) (82-68-8)
Prodiamine (29091-21-2)
Profluralin (26399-36-0)
2,3,5,6-Tetrachloroaniline (3481-20-7)
Tetrachloronitrobenzene (Tecnazene) (117-18-0)
THPI (Tetrahydrophthalimide) (1469-48-3)
Tolylfluanid (731-27-1)
Trifluralin (1582-09-8)

Cat.# 32566: GC Multiresidue Pesticide Standard #4 (28 components)
Organonitrogen Compounds
100 µg/mL each in toluene, 1 mL/ampul
Acetochlor (34256-82-1)
Alachlor (15972-60-8)
Allidochlor (93-71-0)
Clomazone (Command) (81777-89-1)
Cycloate (1134-23-2)
Diallate (*cis* & *trans*) (2303-16-4)
Dimethachlor (50563-36-5)
Diphenamid (957-51-7)
Fenpropathrin (39515-41-8)
Fluquinconazole (136426-54-5)
Flutolanil (66332-96-5)
Linuron (330-55-2)
Metazachlor (67129-08-2)
Methoxychlor (72-43-5)
Metolachlor (51218-45-2)
N-(2,4-Dimethylphenyl)formamide (60397-77-5)
Norflurazon (27314-13-2)
Oxadiazon (19666-30-9)
Pebulate (1114-71-2)
Pretilachlor (51218-49-6)
Prochloraz (67747-09-5)
Propachlor (1918-16-7)
Propanil (709-98-8)
Propisochlor (86763-47-5)
Propyzamide (23950-58-5)
Pyridaben (96489-71-3)
Tebufenpyrad (119168-77-3)
Triallate (2303-17-5)

Cat.# 32567: GC Multiresidue Pesticide Standard #5 (34 components)
Organonitrogen Compounds
100 µg/mL each in toluene, 1 mL/ampul
Atrazine (1912-24-9)
Bupirimate (41483-43-6)
Captafol (2425-06-1)
Captan (133-06-2)
Chlorfenapyr (122453-73-0)
Cyprodinil (121552-61-2)
Etofenprox (80844-07-1)
Etridiazole (2593-15-9)
Fenarimol (60168-88-9)
Fipronil (120068-37-3)
Fludioxonil (131341-86-1)
Fluridone (Sonar) (59756-60-4)
Flusilazole (85509-19-9)
Flutriafol (76674-21-0)
Folpet (133-07-3)
Hexazinone (Velpar) (51235-04-2)
Iprodione (36734-19-7)
Lenacil (2164-08-1)
MGK-264 (113-48-4)
Myclobutanil (88671-89-0)
Paclobutrazol (76738-62-0)
Penconazole (66246-88-6)
Procymidone (32809-16-8)
Propargite (2312-35-8)
Pyrimethanil (53112-28-0)
Pyriproxyfen (95737-68-1)
Tebuconazole (107534-96-3)
Terbacil (5902-51-2)
Terbuthylazine (5915-41-3)
Triadimefon (43121-43-3)
Triadimenol (55219-65-3)
Tricyclazole (Beam) (41814-78-2)
Triflumizole (68694-11-1)
Vinclozolin (50471-44-8)

Cat.# 32568: GC Multiresidue Pesticide Standard #6 (18 components)
Synthetic Pyrethroid Compounds
100 µg/mL each in toluene, 1 mL/ampul
Acrinathrin (101007-06-1)
Anthraquinone (84-65-1)
Bifenthrin (82657-04-3)
Bioallethrin (584-79-2)
Cyfluthrin (68359-37-5)
lambda-Cyhalothrin (91465-08-6)
Cypermethrin (52315-07-8)
Deltamethrin (52918-63-5)
Fenvalerate (51630-58-1)
Flucythrinate (70124-77-5)
tau-Fluvalinate (102851-06-9)
cis-Permethrin (61949-76-6)
trans-Permethrin (61949-77-7)
Phenothrin (*cis* & *trans*) (26002-80-2)
Resmethrin (10453-86-8)
Tefluthrin (79538-32-2)
Tetramethrin (7696-12-0)
Transfluthrin (118712-89-3)

Cat.# 32569: GC Multiresidue Pesticide Standard #7 (10 components)
Herbicide Methyl Esters
100 µg/mL each in toluene, 1 mL/ampul
Acequinocyl (57960-19-7)
Bromopropylate (18181-80-1)
Carfentrazone ethyl (128639-02-1)
Chlorobenzilate (510-15-6)
Chlorpropham (101-21-3)
Chlozolinate (84332-86-5)
DCPA methyl ester (Chlorthal-dimethyl) (1861-32-1)
Fluazifop-*p*-butyl (79241-46-6)
Metalaxyl (57837-19-1)
2-Phenylphenol (90-43-7)

Cat.# 32570: GC Multiresidue Pesticide Standard #8 (24 components)
Organophosphorus Compounds
100 µg/mL each in toluene, 1 mL/ampul
Bromfenvinfos-methyl (13104-21-7)
Bromfenvinphos (33399-00-7)
Bromophos ethyl (4824-78-6)
Bromophos methyl (2104-96-3)
Carbophenothion (786-19-6)
Chlorfenvinphos (470-90-6)
Chlorthiophos (60238-56-4)
Coumaphos (56-72-4)
Edifenphos (17109-49-8)
Ethion (563-12-2)
Fenamiphos (22224-92-6)
Fenchlorphos (Ronnel) (299-84-3)
Fenthion (55-38-9)
Iodofenphos (18181-70-9)
Leptophos (21609-90-5)
Malathion (121-75-5)
Methacrifos (62610-77-9)
Profenofos (41198-08-7)
Prothiofos (34643-46-4)
Sulfotepp (3689-24-5)
Sulprofos (35400-43-2)
Terbufos (13071-79-9)
Tetrachlorvinphos (22248-79-9)
Tolclofos-methyl (57018-04-9)

Cat.# 32571: GC Multiresidue Pesticide Standard #9 (8 components)
Organophosphorus Compounds
100 µg/mL each in toluene, 1 mL/ampul
Disulfoton (298-04-4)
Fonofos (944-22-9)
Methyl parathion (298-00-0)
Mevinphos (7786-34-7)
Parathion (ethyl parathion) (56-38-2)
Phorate (298-02-2)
Piperonyl butoxide (51-03-6)
Triazophos (24017-47-8)

Description	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
GC Multiresidue Pesticide Kit	Contains 1 mL each of these mixtures.	Yes	6 months	Ambient	10 °C or colder	kit	32562

QuEChERS Performance Standards Kit

- Designed for use in all QuEChERS methods for pesticides in fruits and vegetables, including the original unbuffered method, AOAC 2007.01, and EN 15662.
- Kit contains organochlorine, organonitrogen, organophosphorus, and carbamate pesticides commonly used on fruits and vegetables.
- Volatile, polar, active, base-sensitive, and nonvolatile compounds are included to allow comprehensive evaluation of QuEChERS extraction and cleanup efficiencies, and optimization of GC and LC instrumental conditions.
- Ideal for initial method evaluations and ongoing method performance validations.
- Analytes are divided into three ampuls based on compatibility for maximum stability and shelf life.*
- Precise formulations improve data quality and operational efficiency; spend more time running samples and less time sourcing and preparing standards.
- Quantitatively analyzed to confirm the composition and stability of each mixture.

**When combining compounds with different functionalities, chemical stability can be an issue. The analytes in this kit are separated into three mixes to ensure maximum long-term storage stability. For analysis, a fresh working standard should be prepared by combining the three kit mixes in a 1:1:1 ratio to prepare a 100 µg/mL working standard solution. Once blended, Restek does not recommend storing working standards or subsequent dilutions for future use.*

Contains 1 mL each of these mixtures: 31153, QuEChERS Performance Standard A; 31154, QuEChERS Performance Standard B; 31155, QuEChERS Performance Standard C.

Cat.# 31153: QuEChERS Performance Standard A (16 components)
Acephate (30560-19-1)
Azinphos methyl (86-50-0)
Chlorpyrifos (2921-88-2)
Coumaphos (56-72-4)
Diazinon (333-41-5)
Dichlofluanid (1085-98-9)
Dichlorvos (DDVP) (62-73-7)
Dimethoate (60-51-5)
Fenthion (55-38-9)
Malathion (121-75-5)
Methamidophos (10265-92-6)
Mevinphos (7786-34-7)
Omethoate (1113-02-6)
Phosalone (2310-17-0)
Pirimiphos methyl (29232-93-7)
Propargite (2312-35-8)

Cat.# 31154: QuEChERS Performance Standard B (7 components)
gamma-BHC (Lindane) (58-89-9)
Chlorothalonil (1897-45-6)
4,4'-DDT (50-29-3)
Dicofol (Kelthane) (115-32-2)
Endosulfan sulfate (1031-07-8)
Endrin (72-20-8)
2-Phenylphenol (90-43-7)

Cat.# 31155: QuEChERS Performance Standard C (17 components)
Bifenthrin (82657-04-3)
Captan (133-06-2)
Carbaryl (Sevin) (63-25-2)
Cyprodinil (121552-61-2)
Deltamethrin (52918-63-5)
Fenhexamid (126833-17-8)
Fenpropathrin (39515-41-8)
Folpet (133-07-3)
Imazalil (35554-44-0)
Iprodione (36734-19-7)
Metalaxyl (57837-19-1)
Methiocarb (2032-65-7)
Myclobutanil (88671-89-0)
cis-Permethrin (61949-76-6)
trans-Permethrin (61949-77-7)
Thiabendazole (148-79-8)
Vinclozolin (50471-44-8)

Description	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
QuEChERS Performance Standards Kit	300 µg/mL each in acetonitrile/acetic acid (99.9:0.1), 1 mL/ampul. Blend equal volumes of all three ampuls for a 100 µg/mL final solution.	Yes	3 months	Ambient	10 °C or colder	kit	31152

QuEChERS Standards for AOAC Official Method 2007.01

- Ready to use for generating test mixes, calibration standards, and spiking experiments.
- Reliable standards produced according to specifications defined in AOAC Official Method 2007.01.
- Cost-effective QuEChERS standards can be used without dilutions for greater lab efficiency.

Following QuEChERS methods is even quicker and easier when you use Restek method-specific chemical standards for AOAC Official Method 2007.01 (Pesticide Residues in Foods by Acetonitrile Extraction and Partitioning with Magnesium Sulfate). Our suite of AOAC QuEChERS standards includes internal standards mix, triphenylphosphate (TPP) solution, and QC spike mix. Each standard can be used directly without dilutions because they are formulated to the exact concentrations prescribed by AOAC Method 2007.01.

AOAC QuEChERS IS Solution

(2 components)

α-BHC-d6 (α-HCH-d6) (86194-41-4)

Parathion-d10 (350820-04-1)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
AOAC QuEChERS IS Solution							
40 µg/mL each in acetonitrile, 5 mL/ampul	Yes	6 months	18 months	Ambient	10 °C or colder	ea.	31963

QuEChERS Reference Standards

Ready to use for QuEChERS extractions—no dilutions necessary.

Pesticide analysis is fast and simple using QuEChERS methods. Use these cost-effective QuEChERS standards for even greater lab efficiency. Standards are compatible with all major methods, including mini-multiresidue, AOAC, and European procedures. Save time with convenient mixes or make your own blend using our full line of single-component solutions.

QuEChERS Internal Standard Mix for GC-MS Analysis

(6 components)

PCB 18 (37680-65-2), 50 µg/mL
PCB 28 (7012-37-5), 50 µg/mL
PCB 52 (35693-99-3), 50 µg/mL
Triphenylmethane (519-73-3), 10 µg/mL
Triphenylphosphate (115-86-6), 20 µg/mL
Tris(1,3-dichloroisopropyl)phosphate (13674-87-8), 50 µg/mL

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
QuEChERS Internal Standard Mix for GC/MS Analysis							
In acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33267

Linuron-d6 Standard

Isotopically labeled to provide the best approach for pesticide residue quantification.

Linuron-d6 (1219804-76-8)

CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
1219804-76-8	100 µg/mL in acetonitrile, 1 mL/ampul	Yes	6 months	31 months	Ambient	10 °C or colder	ea.	31990

Diazinon-d10 Standard

Isotopically labeled to provide the best approach for pesticide residue quantification.

Diazinon-d10 (diethyl-d10) (100155-47-3)

CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
100155-47-3	100 µg/mL in acetonitrile, 1 mL/ampul	Yes	6 months	36 months	Ambient	10 °C or colder	ea.	31986

Atrazine-d5 Standard

Isotopically labeled to provide the best approach for pesticide residue quantification.

Atrazine-d5 (163165-75-1)

CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
163165-75-1	100 µg/mL in acetonitrile, 1 mL/ampul	Yes	6 months	36 months	Ambient	10 °C or colder	ea.	31984

Triphenylphosphate

Triphenylphosphate (115-86-6)

CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
115-86-6	20 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	71 months	Ambient	10 °C or colder	ea.	33258
115-86-6	1000 µg/mL in acetone, 1 mL/ampul	Yes	6 months	71 months	Ambient	10 °C or colder	ea.	32281

Notes

Learn more at **www.restek.com/LPGC**

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