



Restek GC



# Increase Sample Throughput with Low-Pressure GC-MS

## Leverage Your MS Vacuum to Significantly Speed Up Analysis

- 3x faster multiresidue pesticides analysis in foods.
- Factory-coupled, leak-free kit makes setting up LPGC as simple as a column change.
- Integrated transfer line reduces background and stabilization time.



**RESTEK**

Pure Chromatography

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# Easy-Installation LPGC Column Kit Makes Low-Pressure GC-MS Speeds Attainable

## *Simplified Setup Opens the Door to Significantly Faster Analyses*

- 3x faster multiresidue pesticides analysis in foods.
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Low-pressure GC-MS (LPGC-MS) provides significant speed gains using standard instrumentation. Multiresidue pesticides, for example, can be analyzed in a third of the time required by conventional methods (Figure 1). 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 new preassembled low-pressure GC column kit makes getting set up for LPGC-MS as simple as a column change. The robust, factory-coupled connection and integrated transfer line ensure reliable, leak-free performance. Ease of use and consistent results make this column kit an effective way to implement LPGC-MS, making the benefits of this advanced technique widely attainable for routine use in high-throughput labs.

## What is LPGC-MS?

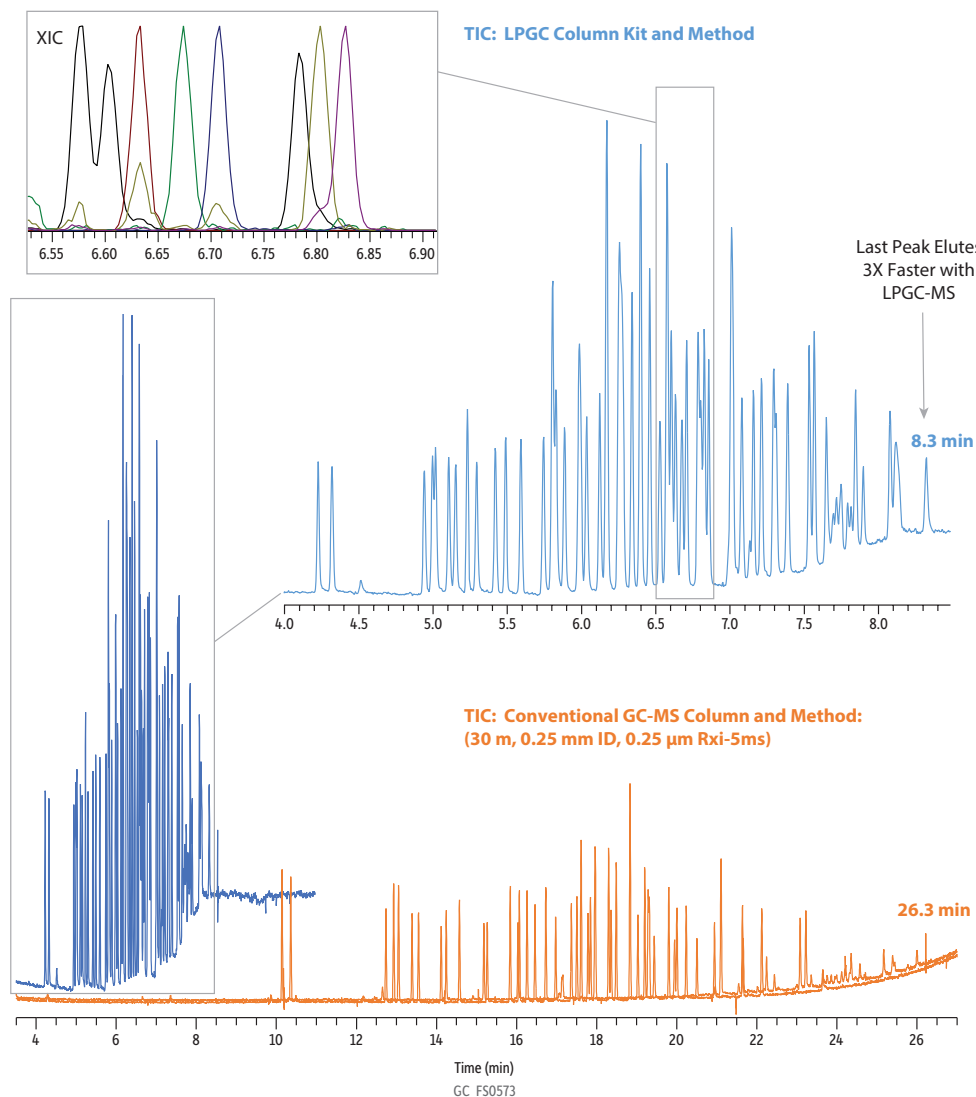
LPGC-MS is a technique that speeds up analysis times by using the MS vacuum to lower pressure in the analytical column while using an attached restrictor column to maintain head pressure. The primary benefit of LPGC-MS is the ability to significantly increase sample throughput, in some cases, speeding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



# Analyze Pesticides in Food 3x Faster

Taking advantage of the speed gains of LPGC-MS is a very effective way to increase sample throughput. In this multiresidue pesticides example, all compounds elute in 8 minutes, compared to 26 minutes for conventional analysis. 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 column kit.



**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 Notes**

Thermo Scientific TSQ 8000 Triple Quadrupole GC-MS

**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: Low-pressure GC column kit (factory-coupled restrictor column [5 m x 0.18 mm ID] and Rtx-5ms analytical column [15 m, 0.53 mm ID, 1 µm plus 1 m integrated transfer line on the outlet end]; 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](http://www.restek.com) and enter GC\_FS0573 in the search.

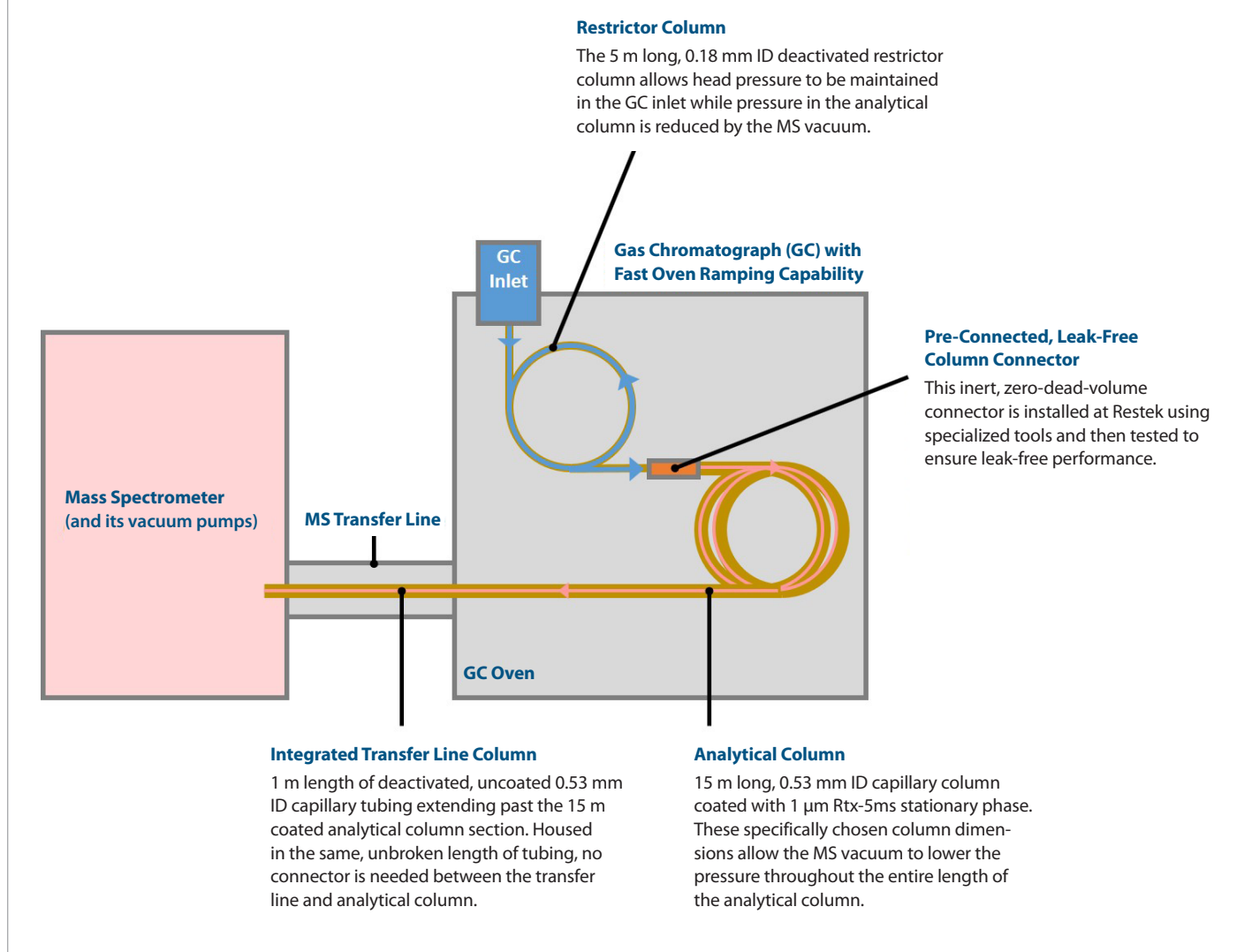
## A Simple Solution to Historical Hurdles

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 kit overcomes these hurdles by using a robust, zero-dead-volume, factory coupling between the restrictor column and the analytical column (Figure 2). It also features an integrated transfer line that reduces background and stabilization time. 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.

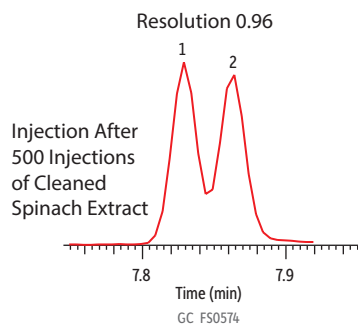
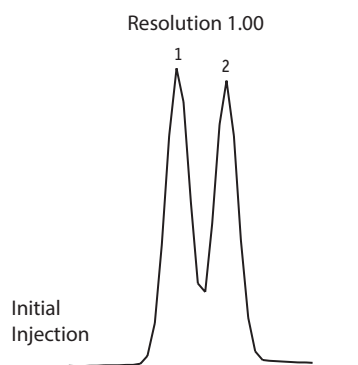
**Figure 2:** A preassembled LPGC column kit installs easily and ensures leak-free LPGC-MS performance.



## 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 I shows the mass spectrometer's evaluation of how well the GC-MS/MS system was sealed throughout the experiment.

**Figure 3:** 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. <i>cis</i> -Permethrin	7.82	90	183	153	12
2. <i>trans</i> -Permethrin	7.86	90	183	153	12

**Column** Low-pressure GC column kit (factory-coupled restrictor column [5 m x 0.18 mm ID] and Rtx-5ms analytical column [15 m, 0.53 mm ID, 1  $\mu$ m plus 1 m integrated transfer line on the outlet end]; cat.# 11800)

**Sample** QuEChERS performance standards kit (cat.# 31152)

**Diluent:** Acetonitrile

**Conc.:** 9  $\mu$ g/mL

**Injection**

**Inj. Vol.:** 1  $\mu$ L 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 Notes** Thermo Scientific TSQ 8000 Triple Quadrupole GC-MS  
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  $\mu$ L 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 I:** 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 <sup>7</sup>	0.70
100	4.69 % - Pass	10 <sup>7</sup>	0.71
200	4.08 % - Pass	10 <sup>7</sup>	0.71
300	3.85 % - Pass	10 <sup>7</sup>	0.71
400	3.40 % - Pass	10 <sup>7</sup>	0.71
500	4.59 % - Pass	10 <sup>7</sup>	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 kit makes transforming your instrument's productivity as easy as a quick column change and method update. Ease of use and reliable leak-free performance make this column kit an effective way to implement LPGC-MS and reap the rewards of much higher sample throughput.



11800

## Low-Pressure GC (LPGC) Column Kit

Leverage Your MS Vacuum to Significantly Speed Up Separations

- 3x faster multiresidue pesticides analysis in foods.
- Factory-coupled, leak-free kit makes setting up LPGC as simple as a column change.
- Ideal for speeding up GC-MS and GC-MS/MS methods.
- Integrated transfer line reduces background and stabilization time.

Restek's low-pressure GC column kit has been specifically designed to easily install into your GC-MS or GC-MS/MS system, making it simpler to take advantage of the speed boost that is possible with low-pressure GC-MS (LPGC-MS). This kit is comprised of two factory-coupled columns:

- Restrictor column: 5 m length of 0.18 mm ID Hydroguard tubing.
- Analytical column with integrated transfer line: 15 m, 0.53 mm ID, 1  $\mu$ m Rtx-5ms analytical column plus 1 m integrated transfer lines on the outlet end (16 m total length of 0.53 mm ID tubing).

These two lengths of tubing (0.18 mm ID restrictor column and 0.53 mm ID analytical column with integrated transfer line) are pre-connected by Restek using a robust, inert, zero-dead-volume connector and then individually tested to ensure leak-free performance for LPGC-MS applications.

ID	Temp. Limits	Includes	qty.	cat.#
<b>Low-Pressure GC (LPGC) Column Kit</b>				
	-60 to 340/340 °C	Factory-coupled restrictor column (5 m x 0.18 mm ID) and Rtx-5ms analytical column (15 m, 0.53 mm ID, 1 $\mu$ m plus 1 m integrated transfer line on the outlet end)	kit	11800

## 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 GCs equipped with SSL inlets

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

\* 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](http://www.restek.com/warranty)

## Vespel/Graphite Capillary Ferrules for 1/16-Inch Compression-Type Fittings

Description	Ferrule ID	Fits Column ID	Fitting Size	Material	qty.	Similar to Part #	cat.#
Ferrules	0.8 mm	0.45/0.53 mm	1/16"	VG2, 60% Vespel/40% Graphite	10-pk.	Grace 5124716, 100/0.8-VG2	20213



## GC Accelerator Oven Insert Kit

for Agilent 5890, 6890, 7890, and 8890 instruments

- Get the same GC separation in less time—use a GC Accelerator kit and the EZGC method translator to accurately convert methods to a scaled-down column format.
- Scaled-down methods let you speed up analysis time and increase sample throughput without capital investment.
- 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. When faster ramp rates are used, existing methods can be accurately scaled down to smaller, high-efficiency, narrow-bore columns using Restek's EZGC method translator. With a scaled-down column, a properly translated method, and a GC Accelerator kit, you can obtain the same chromatographic separation—often with greater sensitivity—in a fraction of the time without making a capital investment.



23849

Description	Instrument	qty.	cat.#
GC Accelerator Oven Insert Kit	for Agilent 5890, 6890, 7890, and 8890 instruments	kit	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 <sub>4</sub> , 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 <sub>4</sub> , 1 g NaCl	Original unbuffered	50 packets	25847
Q-sep QuEChERS Extraction Kit	4 g MgSO <sub>4</sub> , 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 <sub>4</sub> , 1 g NaCl, 1 g TSCD, 0.5 g DHS	European EN 15662	50 packets	25849
Q-sep QuEChERS Extraction Kit	6 g MgSO <sub>4</sub> , 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 <sub>4</sub> , 1.5 g NaOAc	AOAC 2007.01	50 packets	25851

DHS – disodium hydrogen citrate sesquihydrate; MgSO<sub>4</sub> – magnesium sulfate; NaCl – sodium chloride; NaOAc – sodium acetate; TSCD – trisodium citrate dihydrate



25847



258479

## ordering notes

Certificates of analysis for this product are provided electronically. To view and download your certificate, simply visit [www.restek.com/documentation](http://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.#
<b>Foodstuffs with fats and waxes (e.g., cereals, avocado, nuts, seeds, and dairy)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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
<b>General fruits and vegetables (e.g., celery, head lettuce, cucumber, melon)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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
<b>General purpose (wide variety of sample types, including fatty and pigmented fruits and vegetables)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 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 <sub>4</sub> , 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
<b>Highly pigmented fruits and vegetables (e.g., red peppers, spinach, blueberries)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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
<b>Pigmented fruits and vegetables (e.g., strawberries, sweet potatoes, and tomatoes)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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 <sub>4</sub> , 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<sub>4</sub>—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)  
Pyrizophos (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)  
Tetraflon (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)  
Chlorothalonil (1897-45-6)  
Ethalfuralin (55283-68-6)  
Fluchloralin (33245-39-5)  
Isopropalin (33820-53-0)  
Nitalin (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)  
Tolyfluanid (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)  
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)  
Triadimefon (43121-43-3)  
Terbacil (5902-51-2)  
Terbutylazine (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)  
Chlzolinate (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  
Bromfeninfos-methyl (13104-21-7)  
Bromfeninfos (33399-00-7)  
Bromophos ethyl (4824-78-6)  
Bromophos methyl (2104-96-3)  
Carbophenothion (786-19-6)  
Chlorfeninfos (470-90-6)  
Chlorthiophos (60238-56-4)  
Coumaphos (56-72-4)  
Edifenfos (17109-49-8)  
Ethion (563-12-2)  
Fenamiphos (22224-92-6)  
Fenchlorfos (Ronnell) (299-84-3)  
Fenthothion (55-38-9)  
Iodofenfos (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)  
Tetrachlorinfos (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)

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)

### Cat. # 31154: QuEChERS Performance Standard B (7 components)

gamma-BHC (Lindane) (58-89-9)  
 Chlorothalonil (1897-45-6)  
 4,4'-DDT (50-29-3)

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)

$\alpha$ -BHC-d6 ( $\alpha$ -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.#
<b>AOAC QuEChERS IS Solution</b>							
40 $\mu$ g/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  $\mu$ g/mL

PCB 28 (7012-37-5), 50  $\mu$ g/mL

PCB 52 (35693-99-3), 50  $\mu$ g/mL

Triphenylmethane (519-73-3), 10  $\mu$ g/mL

Triphenylphosphate (115-86-6), 20  $\mu$ g/mL

Tris(1,3-dichloroisopropyl)phosphate (13674-87-8), 50  $\mu$ g/mL

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
<b>QuEChERS Internal Standard Mix for GC/MS Analysis</b>							
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

Learn more at [www.restek.com/LPGC](http://www.restek.com/LPGC)

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