RESTEK REFINED

innovative petrochemical solutions

New Solutions for Your Petro Analyses

Visit us at **www.restek.com/petro**

Get More Runs from Your SimDist Setup Using Stabilized MXT®-1HT Columns

- Stable up to 450°C—lowest bleed column, for longer lifetime.
- Meets all ASTM D6352 and D7500 specifications.
- 100% dimethyl polysiloxane phase allows easy comparisons to historical data.
- Unbreakable columns offer security when using hydrogen.

Accurate determination of the boiling range distribution of medium and heavy fractions using GC simulated distillation requires columns and phase polymers that are robust enough to withstand the high method temperatures without significant degradation. Metal columns are a much better alternative than fused silica, and the new MXT®-1HT SimDist columns, with stabilized dimethyl polysiloxane polymer, outperform other metal columns for critical method parameters, including bleed and C50/C52 resolution (Figures 1 and 2). Field testing of the MXT®-1HT SimDist column shows excellent performance, even under faster analytical conditions than those in the published method (Figure 3). Note that in both cases bleed is minimal, even at 430°C, which is essential for precise time-slices and accurate final boiling point determination. New MXT®-1HT SimDist columns are the lowest bleed column on the market, which translates directly into more analyses per calibration and longer column lifetimes.

Figure 1 Low bleed, high efficiency MXT®-1HT SimDist columns outperform competitors (ASTM D6352 conditions).

Lower bleed means:

- Longer column lifetime.
- More stable calibrations.
- Accurate boiling point determinations.

RESTEK ADVANTAGE:
Longer column lifetime and more accurate data!

Higher efficiency means:

- Greater resolution; analyze more samples before method criteria are reached.
- Assured method performance.

RESTEK ADVANTAGE:
Run more samples within method specifications!

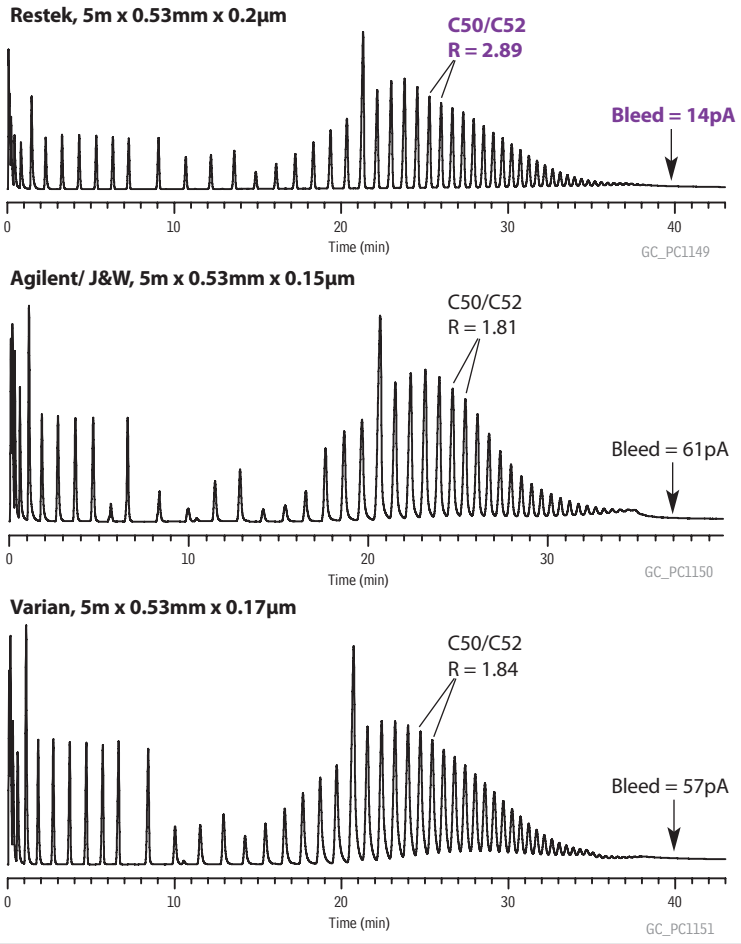
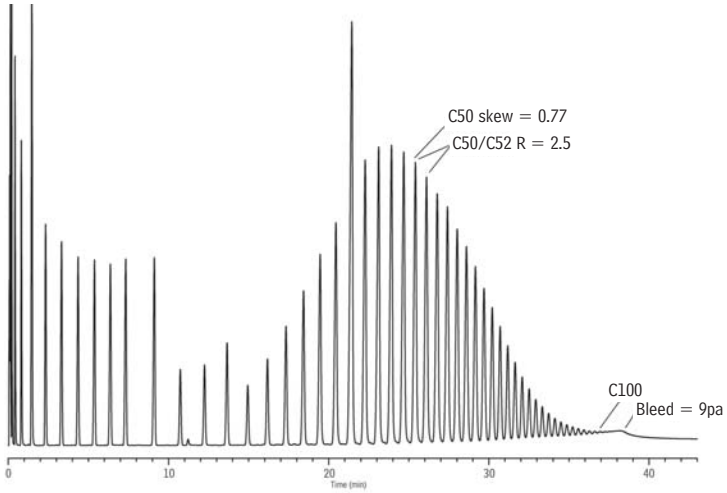


Figure 2 Superior resolution and peak shape on MXT®-1HT SimDist columns result in more accurate final boiling point determinations.



GC_PC01119

Column:	MXT®-1HT Sim Dist, 5m, 0.53mm ID, 0.20µm (cat.# 70115)
Sample:	C5-C100, 1% in carbon disulfide
Inj.:	1µL on-column (PTV)
Inj. temp.:	53°C to 430°C @ 10°C/min. (hold 5 min.)
Carrier gas:	helium, constant flow
Flow rate:	18mL/min.
Oven temp.:	50°C to 430°C @ 10°C/min. (hold 5 min.)
Det.:	FID @ 430°C
Instrument:	Shimadzu 2010

SimDist Products

Method Recommended Columns

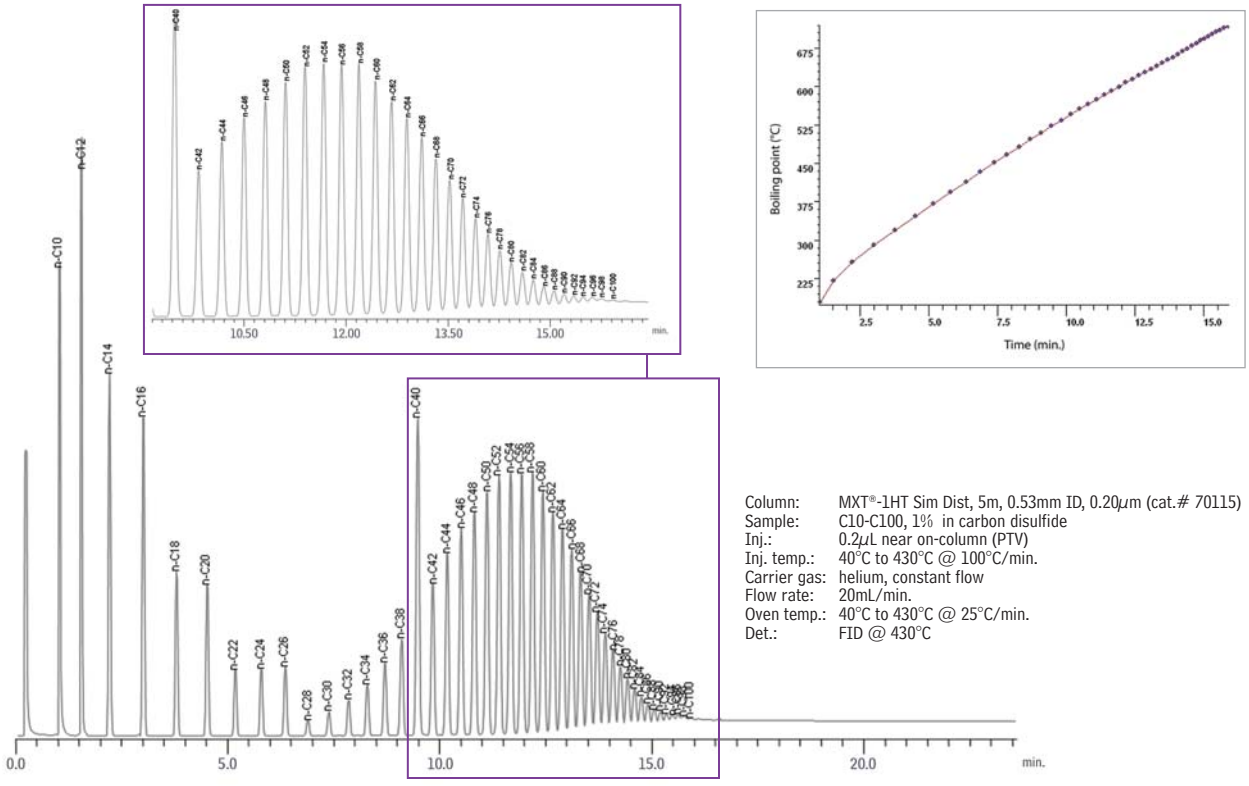
ASTM Method	Hydrocarbon Range	cat. #	Configuration
D2887	C5 - C44	70131	5m x 0.53mm, 0.88um
		70132	10m x 0.53mm, 2.65um
D7213 (2887-ext)	C5 - C60	70131	5m x 0.53mm, 0.88um
		70115	5m x 0.53mm, 0.20um
		70112	5m x 0.53mm, 0.10um
D3710	gasoline up to C14	70132	10m x 0.53mm, 2.65um
D5307	crude up to C42	70115	5m x 0.53mm, 0.20um
D6352	C10 - C90	70112	5m x 0.53mm, 0.10um
		70115	5m x 0.53mm, 0.20um
D7500	C7 - C110	70112	5m x 0.53mm, 0.10um
		70115	5m x 0.53mm, 0.20um
D7169	C5 - C100	70112	5m x 0.53mm, 0.10um
		70115	5m x 0.53mm, 0.20um

MXT®-1HT Sim Dist Column

(Siltek® treated stainless steel)
(nonpolar phases)

ID	df (µm)	temp. limits	length	cat. #
0.53mm	0.10	-60 to 430/450°C	5-Meter	70112
0.53mm	0.20	-60 to 430/450°C	5-Meter	70115
0.53mm	0.21	-60 to 430/450°C	10-Meter	70118
0.53mm	0.88	-60 to 400/430°C	5-Meter	70131
0.53mm	1.0	-60 to 380/400°C	10-Meter	70130
0.53mm	1.2	-60 to 380/400°C	10-Meter	70119
0.53mm	2.65	-60 to 360/400°C	10-Meter	70132
0.53mm	5.0	-60 to 360/400°C	10-Meter	70133

Figure 3 Robust MXT®-1HT SimDist columns meet all ASTM D6352 requirements, even under accelerated conditions.



Column:	MXT®-1HT Sim Dist, 5m, 0.53mm ID, 0.20µm (cat.# 70115)
Sample:	C10-C100, 1% in carbon disulfide
Inj.:	0.2µL near on-column (PTV)
Inj. temp.:	40°C to 430°C @ 100°C/min.
Carrier gas:	helium, constant flow
Flow rate:	20mL/min.
Oven temp.:	40°C to 430°C @ 25°C/min.
Det.:	FID @ 430°C

Chromatograms courtesy of Joaquin Lubkowitz, Separation Systems, Gulf Breeze, FL.

GC_PC01120

Protect Equipment and Assure Predictable Retention Times Using Bonded PLOT Column Technology

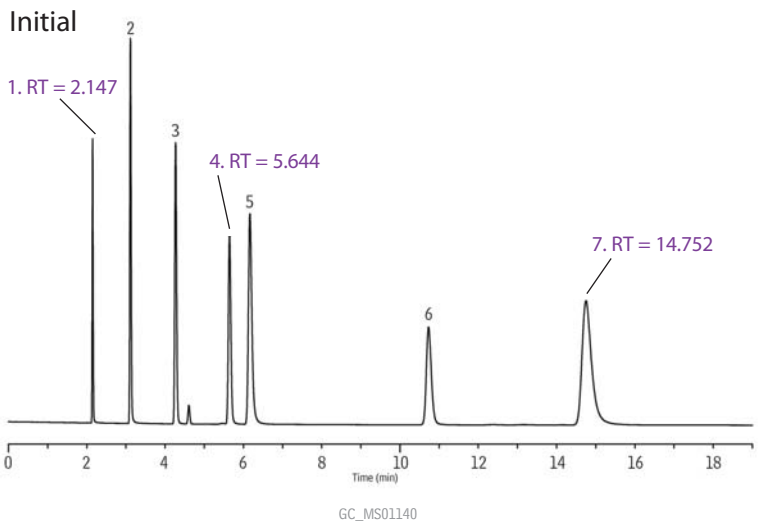
- New bonding process minimizes particle release, reducing column blockage and protecting instrument parts.
- More consistent flow means stable retention times; ideal for Deans and related flow switching techniques.
- Outstanding peak symmetry improves accuracy of impurity analysis for gases, solvents, and hydrocarbons.

PLOT columns are widely used in the petroleum industry because their retention and selectivity characteristics allow gases and volatiles to be separated with high resolution at above ambient temperatures. However, the utility of PLOT columns is significantly limited by the mechanical instability of the particle layers. Routine vibrations or changes in gas pressure can cause a release of particles that clog the column, resulting in highly variable flow behaviors over time and between columns.

Restek has developed a bonding process that establishes a new benchmark for PLOT column stabilization. This innovative process significantly reduces particle release and column blockage, resulting in highly stable flows and retention times, both run-to-run and column-to-column (Figure 4). By replacing conventional PLOT columns with bonded PLOT columns manufactured using this new technology, labs can increase the accuracy of impurities analysis and make better process decisions.

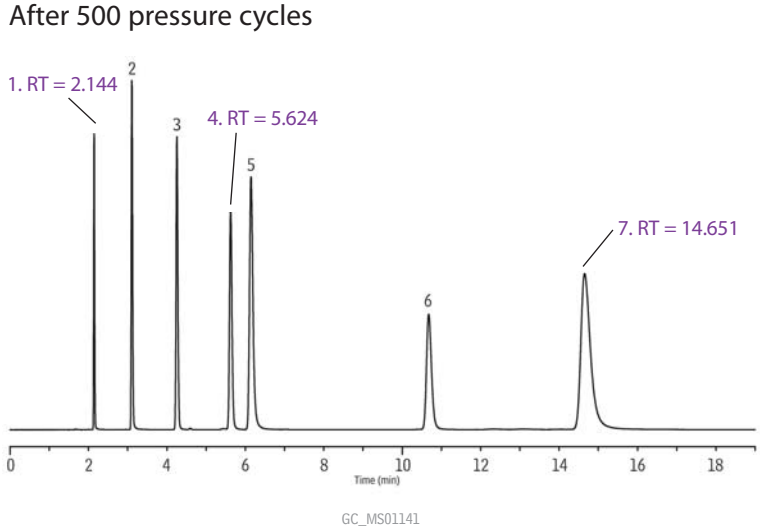
This new stabilization technology is especially beneficial to flow switching applications, and is available for porous polymer (4 selectivities), alumina (KCl and Na_2SO_4 deactivations), and molecular sieve PLOT columns.

Figure 4 New PLOT column technology assures stable retention times, even after 500 pressure cycles.



New Bonded PLOT columns

- ***Virtually no particle loss.***
- ***Constant retention times for flow switching.***



Peak List
1. methanol
2. ethanol
3. acetone
4. diethyl ether
5. *n*-pentane
6. ethyl acetate
7. *n*-hexane

Column:	Rt®-Q-BOND, 30m, 0.53mm ID, 20.0µm (cat.# 19742)
Sample:	QA test mix
Inj.:	1µL split, 16mL/min. split vent flow rate 4mm single gooseneck liner (cat.# 20798)
Inj. temp.:	250°C
Carrier gas:	hydrogen, constant pressure (3.0psi, 20.7kPa)
Linear velocity:	30cm/sec. @ 150°C
Oven temp.:	150°C
Det.:	FID @ 250°C
Instrument:	Agilent 6890

nonpolar

POLARITY

polar

Fused Silica PLOT Columns

Rt®-Q-BOND Columns (fused silica PLOT)

100% divinylbenzene

- Nonpolar PLOT column incorporating 100% divinyl benzene.
- Excellent for analysis of C1 to C3 isomers and alkanes up to C12.
- High retention for CO_2 simplifies gas analysis; CO_2 and methane separated from O_2/N_2/CO (Note: O_2/N_2/CO not separated at room temperature).
- Use for analysis of oxygenated compounds and solvents.
- Maximum temperature of 300°C.

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.32mm	10	to 280/300°C	19743	19744
0.53mm	20	to 280/300°C	19741	19742

Rt®-QS-BOND Columns (fused silica PLOT)

porous divinyl benzene homopolymer

- Intermediate polarity PLOT column incorporating low 4-vinyl pyridine.
- Separates ethane, ethylene and acetylene to baseline.

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.32mm	10	to 250°C	19739	19740
0.53mm	20	to 250°C	19737	19738

Rt®-S-BOND Columns (fused silica PLOT)

divinylbenzene 4-vinylpyridine

- Midpolarity PLOT column, incorporating high 4-vinyl pyridine.
- Use for the analysis of nonpolar and polar compounds.

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.32mm	10	to 250°C	19747	19748
0.53mm	20	to 250°C	19745	19746

Rt®-U-BOND Columns (fused silica PLOT)

divinylbenzene ethylene glycol/dimethylacrylate

- Polar PLOT column, incorporating divinylbenzene ethylene glycol/dimethylacrylate.
- Use for the analysis of polar and nonpolar compounds.

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.32mm	10	to 190°C	19751	19752
0.53mm	20	to 190°C	19749	19750

did you **know**?

Restek chemists have developed a new process for manufacturing PLOT columns. This process bonds the particles to the walls of the tubing, so there is virtually no particle generation. Reduced particle generation assures reproducible selectivity and flow on every run and every column.

Rt®-Alumina BOND/KCl Columns (fused silica PLOT)

(KCl deactivation)

ID	df (µm)	temp. limits	30-Meter	50-Meter
0.32mm	5	to 200°C	19761	19762
0.53mm	10	to 200°C	19759	19760

Rt®-Alumina BOND/Na_2SO_4 Columns (fused silica PLOT)

(Na_2SO_4 deactivation)

ID	df (µm)	temp. limits	30-Meter	50-Meter
0.32mm	5	to 200°C	19757	19758
0.53mm	10	to 200°C	19755	19756

Rt®-Msieve 5A Columns (fused silica PLOT)

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.32mm	30	to 300°C	19720	19722
0.53mm	50	to 300°C	19721	19723

Metal PLOT Columns

MXT®-Alumina BOND/Na_2SO_4 Columns

(Siltek®-treated stainless steel PLOT)

ID	df (µm)	temp. limits	3.5" coil 30-Meter	7" diameter 11-pin cage 30-Meter
0.53mm	10	to 200°C	79714-273	79714

MXT®-Msieve 5A Columns

(Siltek®-treated stainless steel PLOT)

ID	df (µm)	temp. limits	3.5" coil 30-Meter	7" diameter 11-pin cage 30-Meter
0.53mm	50	to 300°C	79723-273	79723

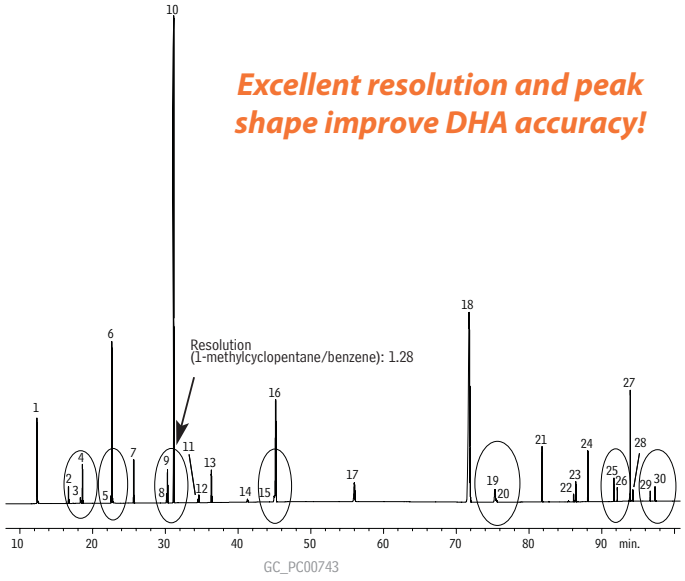
Visit **www.restek.com/petro** for more PLOT column applications.

Accurate DHA Analysis Including Alcohols using Rtx®-DHA Columns

- Columns designed for ASTM Methods D6729, D6730, D6733, and D5501.
- Columns meet or exceed all ASTM and CAN/CGSB method guidelines.
- Excellent responses and peak symmetry for polar oxygenates.
- Guaranteed column-to-column reproducibility for retention, efficiency, selectivity, peak skewness, resolution, and low bleed.

Gasolines are complex mixtures of hundreds of compounds. Information about concentrations of the individual components is important for evaluating raw materials and for controlling refinery processes. ASTM D6730-01 outlines a high-resolution GC method for detailed hydrocarbon analysis (DHA) of gasolines. Rtx®-DHA columns are ideal for DHA methods and easily meet or exceed both ASTM D6730-01 and Canadian General Standards Board CAN/CGSB 3.0 No. 14.3-99 requirements (Figure 5). Every Rtx®-DHA column is tested for retention, efficiency, stationary phase selectivity, and bleed—guaranteeing reproducible column-to-column performance.

Figure 5 Critical pairs of gasoline components resolved per ASTM specifications on an Rtx®-1PONA column.



1. ethanol
2. C5
3. *tert*-butanol
4. 2-methylbutene-2
5. 2,3-dimethylbutane
6. methyl *tert*-butyl ether (MTBE)
7. C6
8. 1-methylcyclopentene
9. benzene
10. cyclohexane
11. 3-ethylpentane
12. 1-*tert*-2-dimethylcyclopentane
13. C7
14. 2,2,3-trimethylpentane
15. 2,3,3-trimethylpentane
16. toluene
17. C8
18. ethylbenzene
19. *p*-xylene
20. 2,3-dimethylheptane
21. C9
22. 5-methylnonane
23. 1,2-methylethylbenzene
24. C10
25. C11 (undecane)
26. 1,2,3,5-tetramethylbenzene
27. naphthalene
28. C12 (dodecane)
29. 1-methylnaphthalene
30. C13 (tridecane)

Column:	Rtx®-DHA-100, 100m, 0.25mm ID, 0.5µm (cat.# 10148) plus Rtx®-5PONA tuning column, 2.62m, 0.25mm ID, 1.0µm, connected via Press-Tight® connector (cat.# 20446)
Sample:	custom detailed hydrocarbon analysis (DHA) mix, neat
Inj.:	0.01µL, split (split ratio 150:1), 4mm cup inlet liner (cat.# 20709)
Inj. temp.:	200ºC
Carrier gas:	helium, constant flow
Linear velocity:	28cm/sec. (2.3mL/min.)
Oven temp.:	5ºC (hold 15 min.) to 50ºC @ 5ºC/min. (hold 50 min.) to 200ºC @ 8ºC/min. (hold 10 min.)
Det.:	FID @ 250ºC

Circles indicate critical pairs that must be resolved.

DHA Products

did you **know**?

Using hydrogen instead of helium can cut analysis time in half! Visit **www.restek.com/petro** for complete analytical details.

similar **phases**

Petrocol DH, DB-Petro, HP-PONA

Rtx®-DHA Columns (fused silica)

(Crossbond® 100% dimethyl polysiloxane—optimized for hydrocarbon analysis)

ID	df (µm)	temp. limits	length	cat. #
0.20mm	0.50	-60 to 300/340°C	50-Meter	10147
0.25mm	0.50	-60 to 300/340°C	100-Meter	10148
0.25mm	1.00	-60 to 300/340°C	150-Meter	10149

Rtx®-5 DHA Tuning Column (fused silica)

(Crossbond® 5% diphenyl/95% dimethyl polysiloxane—optimized for hydrocarbon analysis)

ID	df (µm)	temp. limits	length	cat. #
0.25mm	1.0	-60 to 340°C	5-Meter	10165

Method Recommended Columns

ASTM Method	Column	Dimensions	cat. #
D6729	Rtx-DHA-100	100m x 0.25mm, 0.50µm	10148
D6730	Rtx-DHA-100 & Rtx-5 DHA Tuning Column	100m x 0.25mm, 0.50µm w/ precolumn	10148 & 10165
D6733	Rtx-DHA-50	50m x 0.20mm, 0.50µm	10147
D5501	Rtx-DHA-150	150m x 0.25mm, 1.0µm	10149

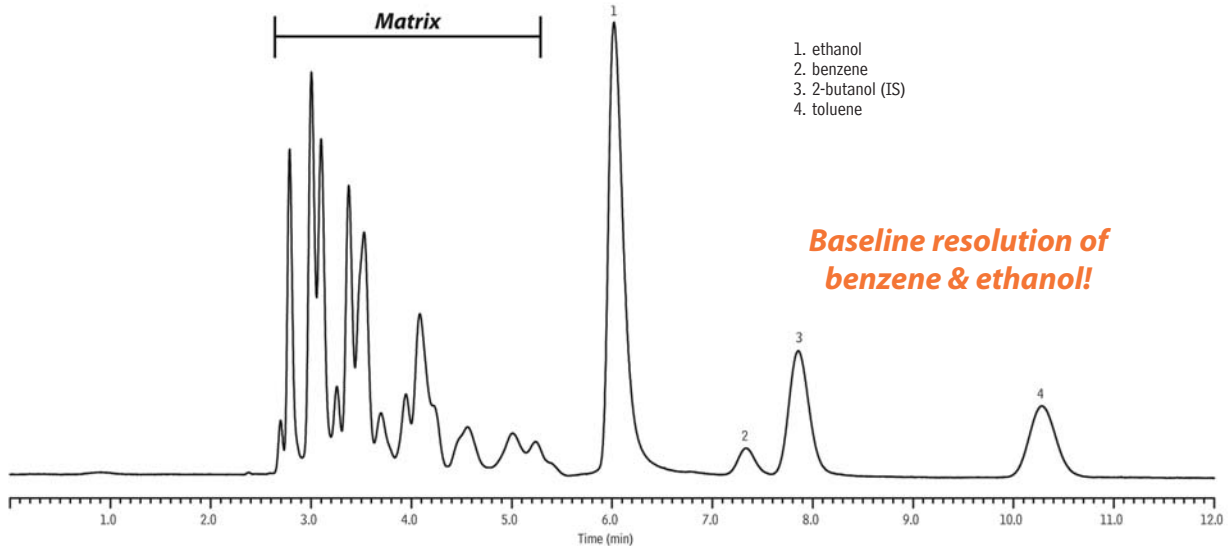
Note: Rtx®-1PONA columns have been renamed as Rtx®-DHA columns. There are no changes in manufacturing process or column performance.

Complete Resolution of Benzene from Ethanol in Spark Ignition Fuels Using the New D3606 Column Set

- Easy, accurate quantification of benzene and toluene.
- Fully conditioned, ready-to-use column set.
- Guaranteed performance: every set is tested for method application and includes chromatogram.

Laboratories analyzing reformulated spark ignition fuels that contain ethanol for the determination of benzene and toluene must use a modified ASTM D3606-06e1 method to prevent the coelution of ethanol and benzene. The primary challenge in this analysis is twofold: the tailing of the ethanol peak into benzene and the retention time shift of the aromatics, particularly benzene, toward the ethanol peak. Restek has solved these issues by developing a new D3606 column set, specifically for the modified ASTM D3606-06e1 application. Using this column set, the aromatic compounds are fully resolved, and can easily be quantified using the internal standard, 2-butanol (Figure 6). This column set is fully conditioned, and ready to use out of the box with only a 10 minute carrier gas purge at ambient temperature, followed by a 30 minute hold at 165°C.

Figure 6 Complete resolution of benzene from ethanol using a D3606 column set for ASTM D3606-06e1.



Column:	D3606 Application Column (2 column set, cat.# 83606-800) Column 1: nonpolar Rtx®-1, 6' (1.8m), 1/8" OD, 2.0mm ID Column 2: proprietary packing material, 16' (4.9m), 1/8" OD, 2.0mm ID
Sample:	commercial gasoline
Inj.:	1µL, direct
Inj. temp.:	200°C
Valve box temp.:	200°C
Backflush time:	3 min.
Carrier gas:	helium, constant flow
Flow rate:	20mL/min.
Oven temp.:	135°C, isothermal
Det.:	TCD @ 230°C
Instrument:	Agilent 6890

D3606 Products

D3606 Application Column (2 column set)

Description	cat.#*
D3606 Application Column (2 column set)**	
Column 1: 6' (1.8m), 1/8" OD, 2.0mm ID, nonpolar Rtx-1	
Column 2: 16' (4.9m), 1/8" OD, 2.0mm ID, proprietary packing material	83606-

*Please add column instrument configuration suffix number to cat.# when ordering. See chart on page 8.

**The column set is designed to accommodate both valve injection and/or syringe injection. Column 1 is configured with a 2" inlet void to facilitate on-column injection. The inlet is identified on both column 1 and column 2. Note: The inlet of column 2 is identified for proper orientation for connection to the valve.

ordering **note**

www.restek.com/petro for a complete list of D3606 standards.

Single Column Separation of CO and CO_2 in Presence of O_2/N_2 Using a ShinCarbon ST Packed/Micropacked Column

restek **innovation**!

ShinCarbon ST is an ideal packing material for permanent gases, low molecular weight hydrocarbons, sulfur dioxide, and Freon® gases.

a **plus 1** story

"Being one of the first labs to utilize the ShinCarbon column in a real working environment, I was pleased to find that I was able to do all my permanent gas analysis on one column instead of the customary two. The peaks were sharper than I had experienced in the past and run time was significantly reduced. We are extremely pleased with the performance of the ShinCarbon column and will continue to find even more applications for it."

Bruce Nasser,
Quality Control Chemist,
Oxygen Service Spec Lab

Packed Column Instrument Configurations

General Configuration
Suffix -800

Agilent 5880, 5890, 5987, 6890, 7890:
Suffix -810*

Varian 3700, Vista Series, FID:
Suffix -820

PE 900-3920, Sigma 1,2,3:
Suffix -830

PE Auto System 8300, 8400, 8700:
Suffix -840

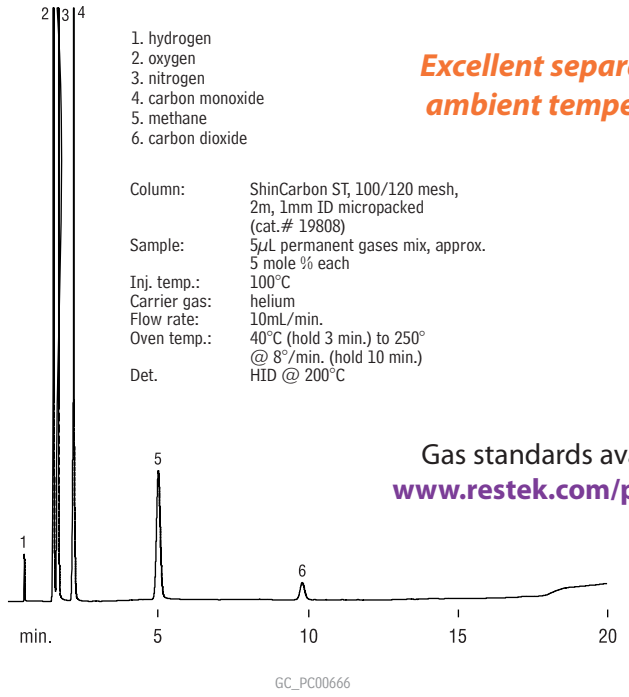
Visit www.restek.com for additional configurations.

Note: Initial 2" of column will be empty to accommodate a needle. For a completely filled column (not on-column) add suffix -901.
*-810 suffix also includes 1½" void on detector side.

- Separate permanent gases, including CO/CO_2, without cryogenic cooling.
- Excellent compatibility with most GC detectors—low bleed, minimal baseline rise.
- Preconditioned, less than 30 minutes to stabilize.

Analyze oxygen, nitrogen, methane, carbon monoxide, and carbon dioxide with one column and at room temperature. Restek's ShinCarbon ST material is a high surface area carbon molecular sieve (~1,500 m^2/g) that is ideal for separating gases and highly volatile compounds by GSC. ShinCarbon ST is an exceptionally stable material with good loadability. Its 330°C upper temperature limit minimizes bleed and baseline rise during temperature programming, making it compatible with most detection systems, including TCD or HID (Figure 7). All ShinCarbon ST columns are fully conditioned in an oxygen/moisture free environment to prevent contamination. This minimizes stabilization time (less than 30 minutes) when installing a new column which, in turn, minimizes downtime. Custom-made ShinCarbon ST columns are available on request.

Figure 7 Separate permanent gases in 10 minutes, without cryogenics.



ShinCarbon Products

ShinCarbon ST 80/100 Packed Columns (SilcoSmooth™ Stainless Steel)*

OD	ID	2-Meter
1/8" Silcosmooth	2.0mm	80486-

ShinCarbon ST 100/120 Micropacked Columns (SilcoSmooth™ Stainless Steel)**

OD	ID	1-Meter	2-Meter
1/16"	1.0mm	19809	19808
0.95mm	0.75mm	19810	—

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

**Does not include nuts and ferrules. Installation kits available—sold separately.

NOTE: ShinCarbon material is also available in 0.53mm MXT® tubing for use in any split/splitless injection port. Call 800-356-1688 for a custom quote.

ordering **note**

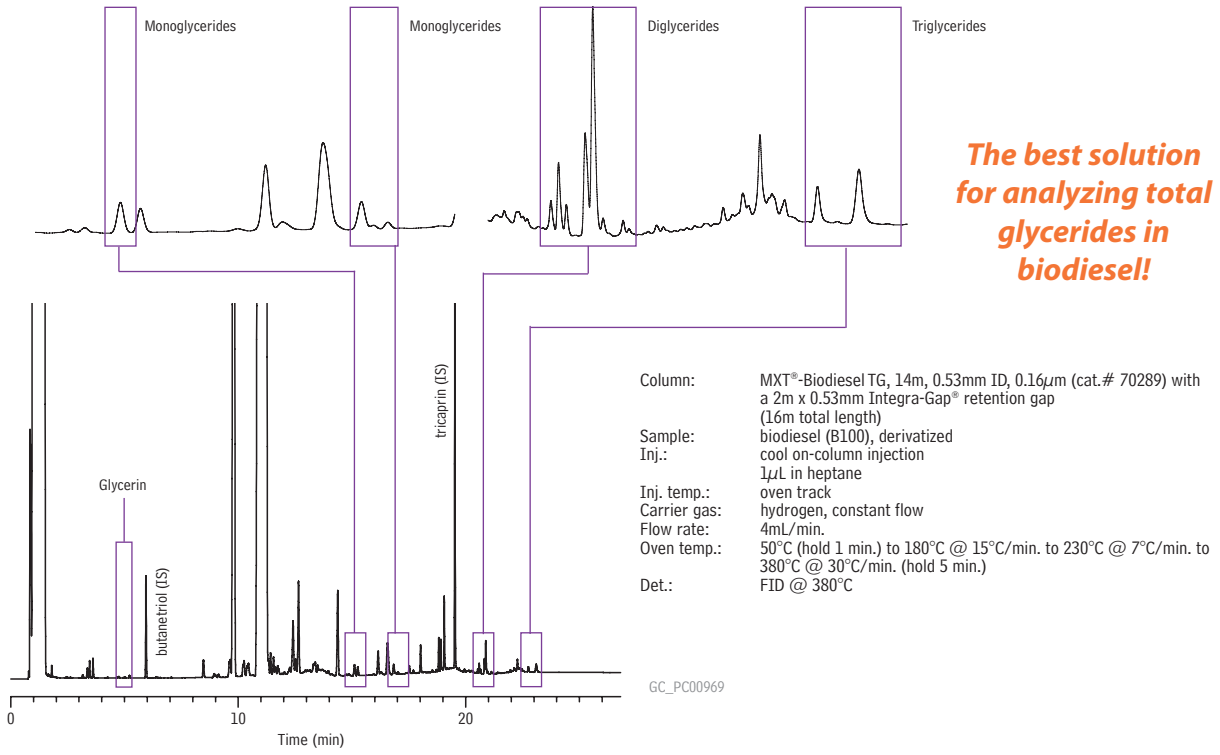
Installation kits available at **www.restek.com**

Accurate, Reliable Analysis of Glycerides in Biodiesel
Choose Metal or High Temperature Fused Silica Column Solutions

- Complete resolution of all compounds from interference peaks.
- Columns available in metal and fused silica.
  - Use Rtx®-Biodiesel TG fused silica columns up to 380°C—low bleed for accurate, reliable results.
  - Use MXT®-Biodiesel TG metal columns up to 430°C—same performance as fused silica with longer column lifetimes.

One of the biggest challenges in biodiesel analysis is the accurate determination of residual glyceride content. The high temperatures required to elute triglycerides cause most fused silica columns to deteriorate rapidly. Restek offers high-temperature fused silica columns that are stable up to 380°C, but the metal MXT®-Biodiesel TG column line is a better solution. MXT®-Biodiesel TG columns offer the same chromatographic performance as fused silica columns, but are designed for maximum heat tolerance, even up to 430°C. These columns provide good resolution and peak shape for all glycerides, as well as highly reproducible retention times (Figure 8). Additionally, metal MXT® columns are available with Integra Gap® technology, a built-in retention gap that eliminates connector-related leaks, reducing tailing and minimizing downtime for maintenance.

Figure 8 Robust metal MXT®-Biodiesel TG columns meet resolution criteria and show excellent response for determining glycerides in biodiesel.



The best solution for analyzing total glycerides in biodiesel!

Biodiesel Products

MXT®-Biodiesel TG Columns (Siltek® treated stainless steel)

Description	temp. limits	cat.#	
14m, 0.53mm ID, 0.16 w/ 2m Integra-Gap*	-60 to 380/430°C	70289	Restek Recommended
10m, 0.32mm ID, 0.10	-60 to 380/430°C	70292	
10m, 0.32mm ID, 0.10 w/ 2m x 0.53mm Retention Gap**	-60 to 380/430°C	70290	
15m, 0.32mm ID, 0.10	-60 to 380/430°C	70293	
15m, 0.32mm ID, 0.10 w/ 2m x 0.53mm Retention Gap**	-60 to 380/430°C	70291	
2m x 0.53mm MXT Biodiesel TG Retention Gap		70294	

Rtx®-Biodiesel TG Columns (fused silica)

Description	temp. limits	cat.#
10m, 0.32mm ID, 0.10	to 330/380°C	10292
10m, 0.32mm ID, 0.10 w/ 2m x 0.53mm retention gap**	to 330/380°C	10291
15m, 0.32mm ID, 0.10	to 330/380°C	10294
15m, 0.32mm ID, 0.10 w/ 2m x 0.53mm retention gap**	to 330/380°C	10293

**Connected with low-dead-volume MXT connector.

Visit **www.restek.com/biodiesel** for a complete list of biodiesel standards, products, and applications.

Petroleum Standards

These petroleum standards are gravimetrically prepared, NIST-traceable by weight, and verified by one or more analytical methods.

Ultra Low & Low Sulfur in Diesel Fuel Calibration Kits

EPA Section 80.580-80.585 Title 40, Chapter 1, Part 80

Cal Kit ULSD 1 - 20 — kit

Blank
1.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
2.5 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
5.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
10.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
15.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
20.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel

Set of seven 20mL bottles.

cat. # 33060 (kit)

Cal Kit ULSD 20 - 100 — kit

Blank
20.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
35.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
50.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
75.0 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
100 ppm total sulfur from di-*n*-butylsulfide in diesel fuel

Set of six 20mL bottles.

cat. # 33061 (kit)

Cal Kit LSD 100 - 500 — kit

Blank
100 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
200 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
300 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
400 ppm total sulfur from di-*n*-butylsulfide in diesel fuel
500 ppm total sulfur from di-*n*-butylsulfide in diesel fuel

Set of six 20mL bottles.

cat. # 33062 (kit)

Sulfur Simulated Distillation Standard

SSDS

30 ppm total sulfur by weight from ethanethiol
60 ppm total sulfur by weight from 1-propanethiol
30 ppm total sulfur by weight from 1-butanethiol
60 ppm total sulfur by weight from 1-pentanethiol
30 ppm total sulfur by weight from 1-hexanethiol
60 ppm total sulfur by weight from 1-heptanethiol
30 ppm total sulfur by weight from 3,5-dimethlybenzenethiol
60 ppm total sulfur by weight from 1-octanethiol
30 ppm total sulfur by weight from 1-nonanethiol
60 ppm total sulfur by weight from 1-decanethiol
30 ppm total sulfur by weight from 1-pentadecanethiolol
60 ppm total sulfur by weight from 1-hexadecanethiol
30 ppm total sulfur by weight from 1-octadecanethiol
Balance: toluene/isooctane 1/15

1mL pre-scored amber ampul.

cat. # 33049 (ea.)

SimDist Standards

D2887 Calibration Mix (17 components)

Compound	Conc. (% w/w)	Compound	Conc. (% w/w)
n-hexane (C6)	6	*n*-octadecane (C18)	5
n-heptane (C7)	6	*n*-eicosane (C20)	2
n-octane (C8)	8	*n*-tetracosane (C24)	2
n-nonane (C9)	8	*n*-octacosane (C28)	1
n-decane (C10)	12	*n*-dotriacontane (C32)	1
n-undecane (C11)	12	*n*-hexatriacontane (C36)	1
n-dodecane (C12)	12	*n*-tetracontane (C40)	1
n-tetradecane (C14)	12	*n*-tetratetracontane (C44)	1
n-hexadecane (C16)	10		

Packaged 1mL/ampul

cat. # 31222 (ea.)

No data pack available.

ASTM D2887-01 Calibration Mix (20 components)

n-pentane (C5)
n-hexane (C6)
n-heptane (C7)
n-octane (C8)
n-nonane (C9)
n-decane (C10)
n-undecane (C11)
n-dodecane (C12)
n-tetradecane (C14)
n-pentadecane (C15)
n-hexadecane (C16)
n-heptadecane (C17)
n-octadecane (C18)
n-eicosane (C20)
n-tetracosane (C24)
n-octacosane (C28)
n-dotriacontane (C32)
n-hexatriacontane (C36)
n-tetracontane (C40)
n-tetratetracontane (C44)

1% w/w in carbon disulfide, 1g solution/ampul*

cat. # 31674 (ea.)

5% w/w, Neat, 1g /ampul**

cat. # 31675 (ea.)

No data pack available.
*This standard may only be shipped by FedEx ground, and only within the US.
**The 5% w/w blend of neat hydrocarbons can be shipped in the US (overnight) and to our international customers.

Polywax Standards

These high molecular weight hydrocarbon waxes are useful for simulated distillation and other high-temperature GC work.

Compound	Solvent	Conc.	cat.# (ea.)
Polywax 500	Neat	1g	36224
Polywax 655	Neat	1g	36225
Polywax 850	Neat	1g	36226
Polywax 1000	Neat	1g	36227

No data pack available.

DHA Standards

DHA PONA VI Mix (426 components)

PONA-VI (PONA 6) is a qualitative mixture of various gasoline and refinery materials prepared to provide nearly every component that may be encountered in feedstock and finished gasolines. Some oxygenates have been added to allow this blend to be used for DHA method setup.

Visit **www.restek.com/petromixes** for a component list.

Neat, 0.1mL in Autosampler Vial

cat. # 30723 (ea.)

Neat, 0.1mL in Vial with Miniert Valve

cat. # 30724 (ea.)

DHA Standards *cont'd*

Visit **www.restek.com/petromixes** for a component list.

Oxy Set-Up Blend (30 components)
2mL prescored ampul
cat. # 33034 (ea.)

PIANO Blends

The PIANO blends are standards used for calibrating complex hydrocarbon analyses and provide the greatest number of gravimetrically determined values for quantitative calibration.

DHA PIANO Blend (136 components)
Neat, 0.1mL in Autosampler Vial
cat. # 30712 (ea.)
Neat, 0.1mL in Vial with Miniert Valve
cat. # 30709 (ea.)

DHA Paraffins Mix (11 components)
Neat, 0.1mL in Autosampler Vial
cat. # 30713 (ea.)
Neat, 0.1mL in Vial with Miniert Valve
cat. # 30714 (ea.)

DHA Isoparaffins Mix (34 components)
Neat, 0.1mL in Autosampler Vial
cat. # 30715 (ea.)
Neat, 0.1mL in Vial with Miniert Valve
cat. # 30716 (ea.)

DHA Aromatics Mix (38 components)
Neat, 0.1mL in Autosampler Vial
cat. # 30717 (ea.)
Neat, 0.1mL in Vial with Miniert Valve
cat. # 30718 (ea.)

DHA Naphthenes Mix (27 components)
Neat, 0.1mL in Autosampler Vial
cat. # 30719 (ea.)
Neat, 0.1mL in Vial with Miniert Valve
cat. # 30720 (ea.)

DHA Olefins Mix (26 components)
Neat, 0.1mL in Autosampler Vial
cat. # 30721 (ea.)
Neat, 0.1mL in Vial with Miniert Valve
cat. # 30722 (ea.)

D3606 Standards

ASTM D3606 Calibration Kit without Internal Standard

30647: ASTM D3606 Calibration Standard #1 without Internal Standard
30648: ASTM D3606 Calibration Standard #2 without Internal Standard
30649: ASTM D3606 Calibration Standard #3 without Internal Standard
30650: ASTM D3606 Calibration Standard #4 without Internal Standard
30651: ASTM D3606 Calibration Standard #5 without Internal Standard
30652: ASTM D3606 Calibration Standard #6 without Internal Standard
30653: ASTM D3606 Calibration Standard #7 without Internal Standard

kit

Contains 25mL each of these mixtures.
cat. # 30672 (kit)

ASTM D3606 Calibration Kit with MEK Internal Standard

30654: ASTM D3606 Calibration Standard #1 with MEK Internal Standard
30655: ASTM D3606 Calibration Standard #2 with MEK Internal Standard
30656: ASTM D3606 Calibration Standard #3 with MEK Internal Standard
30657: ASTM D3606 Calibration Standard #4 with MEK Internal Standard
30658: ASTM D3606 Calibration Standard #5 with MEK Internal Standard
30659: ASTM D3606 Calibration Standard #6 with MEK Internal Standard
30660: ASTM D3606 Calibration Standard #7 with MEK Internal Standard

kit

Contains 1mL each of these mixtures.
cat. # 30673 (kit)

ASTM D3606 Calibration Kit with *sec*-Butanol Internal Standard

30661: ASTM D3606 Calibration Standard #1 with *sec*-Butanol Internal Standard
30662: ASTM D3606 Calibration Standard #2 with *sec*-Butanol Internal Standard
30663: ASTM D3606 Calibration Standard #3 with *sec*-Butanol Internal Standard
30664: ASTM D3606 Calibration Standard #4 with *sec*-Butanol Internal Standard
30665: ASTM D3606 Calibration Standard #5 with *sec*-Butanol Internal Standard
30666: ASTM D3606 Calibration Standard #6 with *sec*-Butanol Internal Standard
30667: ASTM D3606 Calibration Standard #7 with *sec*-Butanol Internal Standard

kit

Contains 1mL each of these mixtures.
cat. # 30674 (kit)

ASTM D3606 Backflush Standard

2,2,4-trimethylpentane (isooctane)
5% vol/vol in nonane, 1mL/ampul
cat. # 30671 (ea.)

ASTM D3606 Quality Control Standard without Internal Standard

benzene	0.67% vol/vol
toluene	5

In isooctane, 25mL/ampul
cat. # 30668 (ea.)

ASTM D3606 Quality Control Standard with MEK Internal Standard

benzene	0.6432% vol/vol
2-butanone (MEK)	4
toluene	4.8

In isooctane, 25mL/ampul
cat. # 30669 (ea.)

ASTM D3606 Quality Control Standard with *sec*-Butanol Internal Standard

benzene	0.6432% vol/vol
2-butanol (*sec*-butyl alcohol)	4
toluene	4.8

In isooctane, 25mL/ampul
cat. # 30670 (ea.)

Visit **www.restek.com/petromixes** for our complete line of petrochemical reference standards.

Reference Standards

cylinder
design

DCG Partnership Cylinders:

Size: 7.6 x 24 cm.
CGA-170/110 connection.
US DOT Specs:
DOT-4B-240ET

Please note: This cylinder is not approved for use in Canada.

More gas standards available at **www.restek.com/petromixes**

Natural Gas and Refinery Gas Standards

- Each available in three varying concentrations.
- Mini-regulator designed specifically for these standards.

Natural Gas Standards

Available in three mixes, from lean to rich. Each has an extended list of C6+ components.

	Natural Gas Standard #1 cat.# 34438, ea. % each compound**	Natural Gas Standard #2 cat.# 34439, ea. % each compound**	Natural Gas Standard #3 cat.# 34440, ea. % each compound**
nitrogen	1.000	2.500	5.000
carbon dioxide	0.500	1.000	1.500
methane UHP	94.750	85.250	70.000
ethane UHP	2.000	5.000	9.000
propane	0.750	3.000	6.000
isobutane	0.300	1.000	3.000
n-butane	0.300	1.000	3.000
isopentane	0.150	0.500	1.000
n-pentane	0.150	0.500	1.000
hexanes plus*	0.100	0.250	0.500
Concentration	mole	mole	mole
Volume	13.16L @ 200psig	13.16L @ 200psig	5.5L @ 75psig
Ideal Heating Value (Dry BTU/SCF @ 14.696psia & 60°F)	1048 gross	1142 gross	1317 gross

Refinery Gas Standards

Available in three mixes with varying C5 unsaturates or extended C6+ components.

	Refinery Gas Standard #1 cat.# 34441, ea. % each compound**	Refinery Gas Standard #2 cat.# 34442, ea. % each compound**	Refinery Gas Standard #5 cat.# 34443, ea. % each compound**
hydrogen	40.750	12.500	12.500
argon	0.500	1.000	1.000
nitrogen	4.000	37.200	37.200
carbon monoxide	1.000	1.000	1.000
carbon dioxide	3.000	3.000	3.000
methane	8.500	5.000	5.000
ethane	6.000	4.000	4.000
ethylene	2.000	2.000	2.000
acetylene	—	1.000	1.000
propane	7.000	6.000	6.000
propylene	3.000	3.000	3.000
propadiene	0.850	1.000	1.000
cyclopropane	—	0.040	—
isobutane	6.000	5.000	5.000
n-butane	4.000	4.000	4.000
isobutylene	2.000	1.000	1.000
1,3 butadiene	3.000	3.000	3.000
cis-2-butene	2.000	2.000	2.000
trans-2-butene	2.000	3.000	3.000
butene-1	2.000	2.000	2.000
2-methyl-2-butene	—	0.200	0.200
isopentane	1.000	1.000	1.000
n-pentane	1.000	1.000	1.000
cis-2-pentene	—	0.400	0.400
trans-2-pentene	—	0.160	0.200
pentene-1	—	0.400	0.400
n-hexane	0.500	0.100	—
hexanes plus	—	—	0.100
Concentration	mole	mole	mole
Volume	5.2L @ 70psig	4.9L @ 60psig	4.6L @ 60psig

*Contact Restek or your Restek representative for a complete list of hexanes plus.
**Precise concentrations are provided on the data sheet included with each cylinder and may vary slightly from those listed here.

Visit **www.restek.com/petromixes** for our complete line of petrochemical reference standards.

Sample Cylinders & Valves

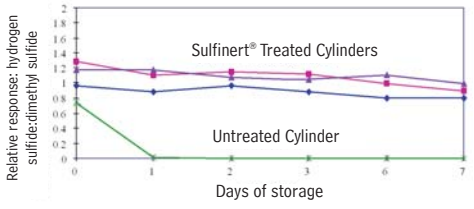
Sulfinert® Treated High Pressure Sample Cylinders

- Sulfinert® coating provides stable storage of sulfur and mercury at ppb levels in petroleum samples.
- Inert coating doesn't flake; more durable than Teflon®.
- TPED compliant cylinders now available for shipping into EU countries.
- All cylinders have 1/4" female NPT threads on both ends.

Refinery and natural gas samples often contain trace amounts of sulfur-containing compounds which can interfere with reactions or poison catalysts in petrochemical processes. Because sulfur compounds react quickly with stainless steel surfaces, accurate determination of these compounds is impossible when samples are collected and stored in untreated sample cylinders. Restek's Sulfinert® passivation technique bonds an inert silica layer into the surface of stainless steel, preventing active compounds from reacting with or adsorbing to the steel. These Swagelok® high pressure sample cylinders are Sulfinert® treated for greater stability of sulfur compounds and mercury. DOT rating to 1,800 and 5,000psig allows sampling at gas wellheads as well as in the refinery. Use of high pressure sample cylinders is cited in ASTM D1265, Standard Practice for Sampling Liquefied Petroleum (LP) Gases, Manual Method.

Sulfur compounds are stable in Sulfinert® treated stainless steel systems.

17ppbv hydrogen sulfide in 500mL cylinders



also **available**

Certificates are available upon request.

304L Stainless Steel

		1,800psig		TPED, 1,450psig	
Size	qty.	Swagelok part #	cat.#	Swagelok part #	cat.#
75cc	ea.	304L-HDF4-75	24130		
150cc	ea.	304L-HDF4-150	24131	304L-HDF4-150-PD	24131-PI
300cc	ea.	304L-HDF4-300	24132	304L-HDF4-300-PD	24132-PI
500cc	ea.	304L-HDF4-500	24133	304L-HDF4-500-PD	24133-PI
1000cc	ea.	304L-HDF4-1000	24134	304L-HDF4-1000-PD	24134-PI
2250cc	ea.	304L-HDF4-2250	21394	304L-HDF4-2250-PD	21394-PI

316L Stainless Steel

		5,000psig		TPED, 4,350psig	
Size	qty.	Swagelok part #	cat.#	Swagelok part #	cat.#
150cc	ea.	316L-50DF4-150	22111	316L-50DF4-150-PD	22111-PI
300cc	ea.	316L-50DF4-300	22112	316L-50DF4-300-PD	22112-PI
500cc	ea.	316L-50DF4-500	22113	316L-50DF4-500-PD	22113-PI

Sulfinert® Treated Alta-Robbins Sample Cylinder Valves

- All wetted parts are Sulfinert® treated for inertness.
- Compatible with Sulfinert® treated Swagelok® sample cylinders.
- Large, durable, Kel-F® seat ensures leak-free operation; temperature range: -40°C to 120°C.
- All valves have 1/4" male NPT inlet fittings.

Description	DOT Pressure Rating	qty.	cat.#
1/4" Male NPT Outlet	3,500psig	ea.	21400
1/4" Male Compression Outlet	3,500psig	ea.	21401
1/4" Male NPT with Dip Tube*	3,500psig	ea.	21402
1/4" Male NPT with 2,850psi Rupture Disc	3,500psig	ea.	21403
1/4" Female NPT Outlet with 2,850psi Rupture Disc	3,500psig	ea.	21404
1/4" Male NPT Outlet	6,000psig	ea.	22109
1/4" Female NPT Outlet	6,000psig	ea.	22110

*To order catalog #21402 (Sulfinert Alta-Robbins Sample Cylinder Valve, 1/4" NPT with Dip Tube), please call Customer Service at 800-356-1688, ext. 3, or contact your Restek representative. Specify dip tube length or % outage when ordering (maximum length = 5.25"/ 13.3cm). Note: End of part will not be treated after cutting tube to length.

BTO® Septa

- Usable to 400°C inlet temperature.
- Precision molding assures consistent, accurate fit.
- Partial predrilled CenterGuide design.
- Preconditioned and ready to use.
- Do not adhere to hot metal surfaces.
- Packaged in precleaned glass jars.
- Each batch GC/FID tested.
- Bleed and temperature optimized; ideal for demanding GC and GC/MS applications.

Septum Diameter	50-pk.	100-pk.
5mm CenterGuide	27100	27101
6mm (1/4")	27102	27103
9mm CenterGuide	27104	27105
9.5mm (3/8")	27106	27107
10mm	27108	27109
11mm (7/16") CenterGuide	27110	27111
11.5mm CenterGuide	27112	27113
12.5mm (1/2") CenterGuide	27114	27115
17mm CenterGuide	27116	27117
Shimadzu Plug	27118	27119

Note: Due to the injection port temperatures, Restek recommends using only BTO septa in Thermo Scientific instruments.

Restek Thermolite® Septa

- Usable to 340°C inlet temperature.
- Precision molding assures consistent, accurate fit.
- Excellent puncturability.
- Preconditioned and ready to use.
- Do not adhere to hot metal surfaces.
- Packaged in precleaned glass jars.

Septum Diameter	25-pk.	50-pk.	100-pk.
5mm (3/16")	27120	27121	27122
6mm (1/4")	27123	27124	27125
7mm	27126	27127	27128
8mm	27129	27130	27131
9mm	27132	27133	27134
9.5mm (3/8")	27135	27136	27137
10mm	27138	27139	27140
11mm (7/16")	27141	27142	27143
11.5mm	27144	27145	27146
12.5mm (1/2")	27147	27148	27149
17mm	27150	27151	27152
Shimadzu Plug	27153	27154	27155

Restek Tubing Scorer for MXT® Columns

- Makes perfect cuts every time.
- Easy to use.
- Leaves column entrance perfectly round.

Metal MXT® columns are easy to cut. Scoring wafers can be used, but may leave the column end irregularly shaped. The Restek tubing scorer is designed to make a square cut every time, leaving the column entrance perfectly round.

The Restek tubing scorer is designed to make a perfect cut every time.

Description	qty.	cat.#
Restek Tubing Scorer for MXT Columns (0.25-0.53mm ID & 0.5-0.8mm OD)	ea.	20523
Replacement Scoring Wheel	ea.	20522

Restek Filter Base Plates

- Standard base plate fittings are 1/8". To adapt to 1/4", order 1/8" to 1/4" tube-end unions.
- Base plates fit all Super-Clean gas filters listed.

22025

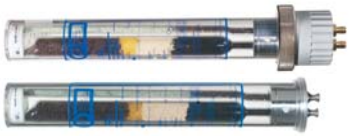
22026

22027

	Brass		Stainless Steel	
Description	qty.	cat.#	qty.	cat.#
Single-Position Filter Base Plate	ea.	22025	ea.	22344
2-Position Filter Base Plate	ea.	22026	ea.	22345
3-Position Filter Base Plate	ea.	22027	ea.	22346

Restek Super-Clean Gas Filter Kits and Replacements

- High-purity output ensures 99.9999% pure gas (at max. flow of 2L/min.).
- "Quick connect" fittings for easy, leak-tight cartridge changes.
- Glass inside to prevent diffusion; polycarbonate housing outside for safety.
- All traps measure 10 5/8" x 1 3/4" (27 x 4.4 cm).
- Each base plate unit measures 4" x 4" x 1 7/8" (10.2 x 10.2 x 4.8 cm).



21982

22020

Description	qty.	cat.#
Carrier Gas Cleaning Kit (includes mounting base plate, 1/8" inlet/outlet fittings, and oxygen/moisture/hydrocarbon Triple Gas Filter)	kit	22019
Fuel Gas Purification Kit (includes mounting base plate, 1/8" inlet/outlet fittings, and hydrocarbon/moisture Fuel Gas Filter)	kit	22021
Ultra-High Capacity Hydrocarbon Filter	ea.	22030
Ultra-High Capacity Moisture Filter	ea.	22028
Ultra-High Capacity Oxygen Filter	ea.	22029
Replacement Triple Gas Filter (removes oxygen, moisture and hydrocarbons)	ea.	22020
Replacement Fuel Gas Filter (removes moisture and hydrocarbons)	ea.	22022
Helium-Specific Carrier Gas Cleaning Kit (includes mounting base plate, 1/8" inlet/outlet fittings, and oxygen/moisture/hydrocarbon Helium-Specific Filter)	kit	21983
Replacement Helium-Specific Gas Filter (removes oxygen, moisture and hydrocarbons)	ea.	21982
Gas Filter Bundle Kit (includes one Triple Gas Filter, cat.#22020 and two Fuel Gas Filters, cat.# 22022)	kit	22031

NEW Restek ProFLOW 6000 Electronic Flowmeter

Flow meters that can measure flammable gases are becoming mandatory, due to the increased use of hydrogen in chromatography. With its Ex rating, the Restek ProFLOW 6000 Flowmeter is designed specifically with explosive and flammable gases in mind. With a wide range of capabilities, the new Restek ProFLOW 6000 is the only flowmeter you need for any type of chromatography gas measurement.

- Measures bidirectional volumetric flow for all gases across a range of 0.5-500 mL/min.
- NIST traceable calibration.
- Explosion-proof rating for flammable and explosive gases.
- Accuracy of ± 2% of flow or ± 0.05 mL/min., whichever is greater.
- Over range indicator and auto-shutoff feature.
- Use as a bench-top or hand-held unit.
- Measures most gas types.
- Convenient storage case included.
- Data output via USB port.
- Recalibration service available.

Flowmeter Facts:

Type of flow meter:	volumetric
Battery:	2 AA
Operating Temp. Range:	32-120°F (0-48°C)
Humidity Range:	0-97% (non-condensing)
Warranty:	one year
Certifications:	CE, Ex
Compliance:	WEEE, RoHS

Backed by a 1-year warranty, the Restek ProFLOW 6000 flowmeter will set a new industry standard for flowmeters.

Description	qty.	cat.#
Restek ProFLOW 6000 Electronic Flowmeter (hard-sided storage case included)	ea.	22656

Restek Electronic Leak Detector

Why have a small leak turn into a costly repair?
Protect your data and column by using a Restek Leak Detector.

Features and benefits include:

- Optimized sample flow path.
- New ergonomic, hand-held design.
- Rugged side grips for added durability.
- Handy probe storage for cleanliness and convenience.
- Longer lasting battery, up to 6 hours of continuous use.
- Automatic shut-off.
- A convenient carrying and storage case.
- Easy to clean probe assembly.
- A universal charger set (US, European, UK, and Australian plugs included).
- One year warranty.

i tech tip

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

22839

Leak Detector Facts

Detectable gases:	helium, nitrogen, argon, carbon dioxide, hydrogen
Battery:	Rechargeable Ni-MH internal battery pack (6 hours normal operation)
Operating Temperature Range:	32°-120°F (0°-48°C)
Humidity Range:	0-97%
Warranty:	one year
Certifications:	CE, Ex, Japan
Compliance:	WEEE, RoHS

Description	qty.	cat.#
Leak Detector with Universal Charger Set (hard-sided storage case included)	ea.	22839
Small Probe Adaptor	ea.	22658

22839

Hard-sided storage case included with purchase of unit.

*Caution: The Restek Electronic Leak Detector is designed to detect trace amounts of hydrogen in a noncombustible environment. It is NOT designed for determining leaks in a combustible environment. A combustible gas detector should be used for determining combustible gas leaks under any condition. The Restek Electronic Leak Detector may be used for determining trace amounts of hydrogen in a GC environment only.

Restek Corporation
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Bellefonte, PA 16823-8497

Industry Experts at Your Service

At Restek, we have invested in highly focused product development and a world-class team of industry professionals. We are dedicated to bringing you the innovative chromatography tools you need to make better process control decisions.

Jan Pijpelink
Petrochemical Market Development Manager

Jan is a 28-year veteran of the petrochemical industry with extensive international experience in petro laboratories and with process applications throughout North America, Europe, and Asia. Jan leads our scientific collaborations and key industry partnerships.

E-mail: jan.pijpelink@restek.com

Jaap de Zeeuw
International GC Specialist

Jaap is a renowned chromatographer with over 30 years of petrochemical experience, including 27 years with Varian/Chrompack where he focused primarily on industrial analysis issues. Jaap is widely published and travels extensively for seminars and international workshops.

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Barry Burger
Innovations Chemist

Barry has more than 30 years of chromatography experience and has been a voting member of the ASTM D2 committee for 12 years. He specializes in petrochemical applications and the development of capillary, packed, and micropacked GC columns.

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Rick Morehead
Innovations Chemist

Rick has over 28 years of experience in analytical chemistry and product development. He has had a fundamental role in many new product initiatives at Restek, and currently is focused on developing petrochemical applications. His previous experience has included managing the New Product Development and Fused Silica Manufacturing departments.

E-mail: rick.morehead@restek.com

Gary Stidsen
GC Columns Product Manager

Gary has 30 years of experience as an applications chemist, lab manager, and product developer. He currently manages the development of a wide range of column lines, including fused silica, metal, packed/micropacked, and PLOT column products.

E-mail: gary.stidsen@restek.com

RESTEK

Lit. Cat.# PCFL1195A

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ISO 9001:2000 cert.# FM80397