



Restek® Refined

Detailed Hydrocarbon Analysis Featuring **Rtx-DHA Columns**

- Individually tested to meet DHA method criteria; guaranteed column-to-column reproducibility.
- Improved resolution between oxygenates and hydrocarbons for more accurate reporting.
- Use of hydrogen carrier gas yields **50% faster run times**.

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RESTEK

Pure Chromatography

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Accurate DHA Analysis, Including Alcohols, Using Rtx[®]-DHA Columns



- Columns designed for ASTM Methods D6729, D6730, D6733, D5134, 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 efficiency, peak skewness, and low bleed.

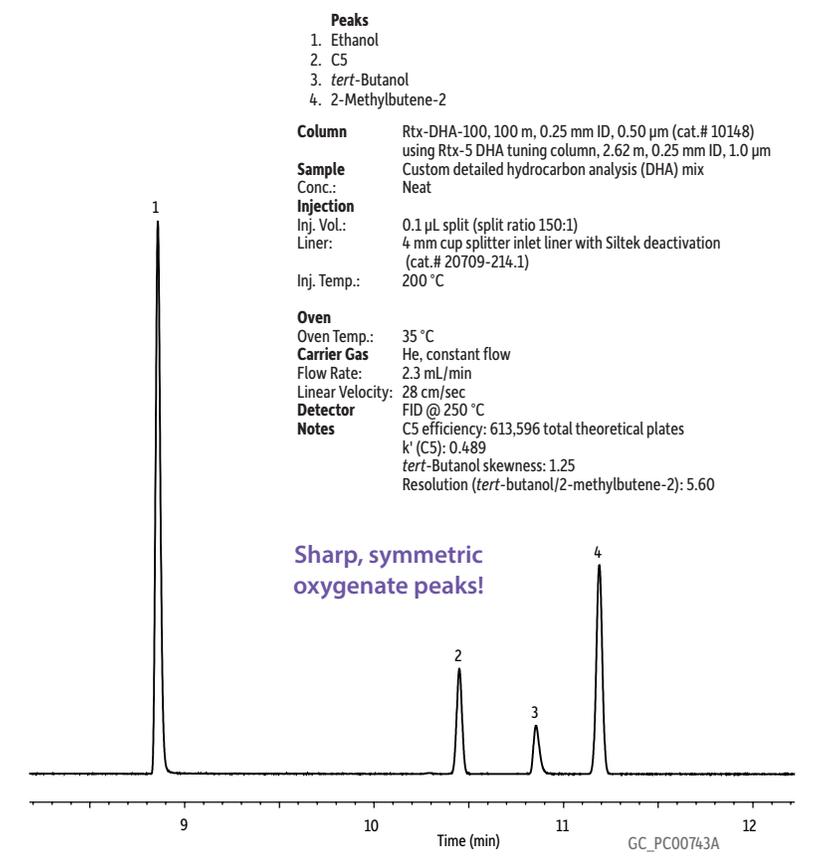
Gasolines are complex mixtures of hundreds of compounds. Information about concentrations of the individual components is important for evaluating raw materials and for controlling refinery processes. A high-resolution GC method for detailed hydrocarbon analysis (DHA) of gasolines is outlined in American Society of Testing and Materials (ASTM) Method D6730-01. ASTM D6730-01 is specific for the analysis of hydrocarbon components, plus oxygenated additives such as methanol, ethanol, *tert*-butanol, methyl *tert*-butyl ether (MTBE), and *tert*-amyl methyl ether (TAME) in spark-ignition engine fuels.

To maximize resolution of these complex mixtures, the ASTM method recommends a 100 m x 0.25 mm ID capillary column coated with 0.5 μ m of 100% dimethyl polysiloxane stationary phase and sets minimum resolution criteria for several critical pairs of closely eluting compounds. To retain the aromatics and accomplish the separations, a short tuning column, approximately 2–3 m long, coated with 5% diphenyl/95% dimethyl polysiloxane polymer, is connected to the inlet of the 100 m analytical column. Through a series of trial analyses, the length of the tuning column is adjusted to ensure the critical resolutions are achieved. Rtx-DHA-100 columns are ideal for DHA methods and easily meet or exceed performance requirements.

Quality & Consistency

Analytical columns used for DHA applications must exhibit high efficiency and exceptional inertness, especially for polar oxygenates in gasoline. Figure 1 illustrates a column efficiency of 613,600 total theoretical plates, measured on C5, and shows excellent peak symmetry for the oxygenated additives, including ethanol and *tert*-butanol (*tert*-butanol skewness = 1.25). We test every Rtx-DHA-100 column for retention (k'), efficiency (n), stationary phase selectivity (α), and bleed, according to ASTM D6730. Data are shown on each test report, assuring that your Rtx-DHA column will meet method specifications.

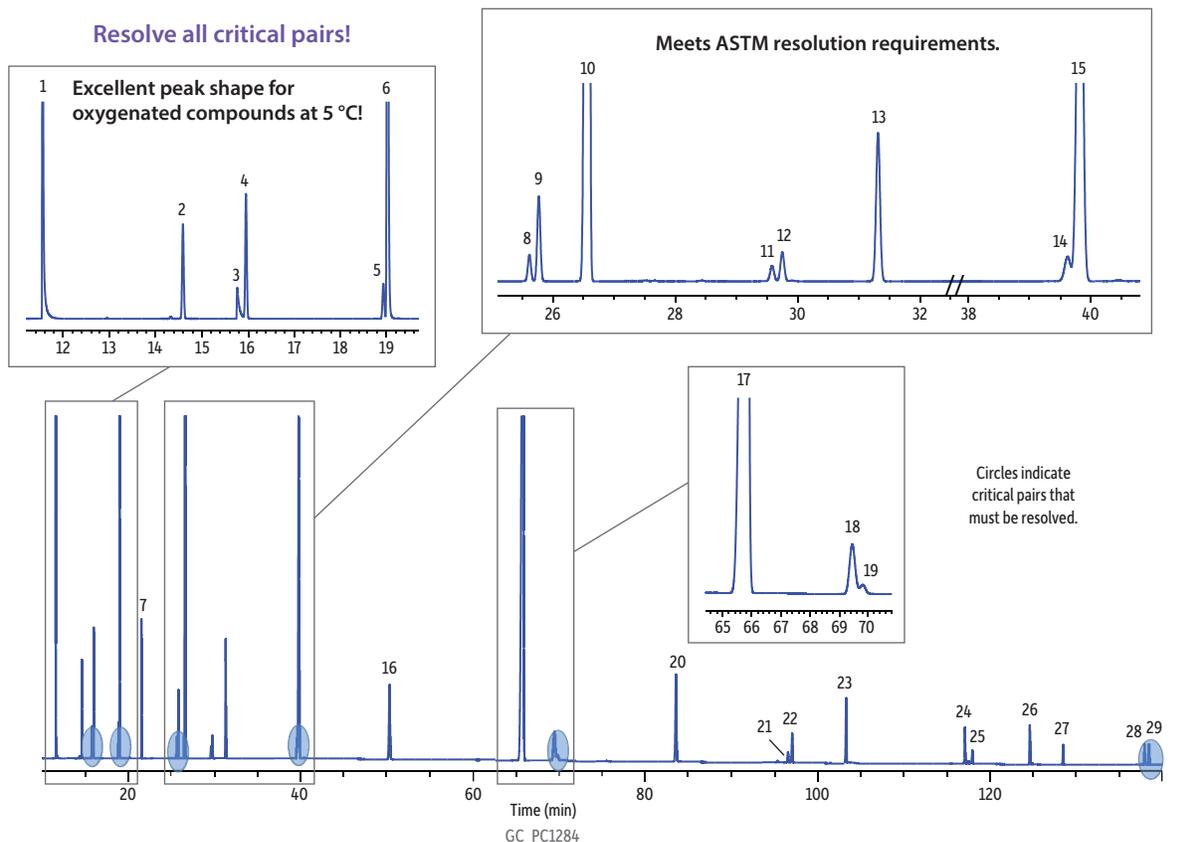
Figure 1: Rtx-DHA-100 columns meet or exceed ASTM D6730 specifications.



Resolution of Critical Pairs

There are a number of critical compound pairs that must be resolved as measured by an oxy setup blend mix. An Rtx-DHA-100 column meets all ASTM D6730-01 requirements for critical pair resolution, as demonstrated in Figure 2. A tuning column was used to achieve the highlighted resolutions based on retention of the aromatics (e.g., resolution for 1-methylcyclopentene/benzene = 1.5). In addition to qualifying for the ASTM D6730-01 analysis, Rtx-DHA-100 columns meet the similarly stringent Canadian General Standards Board CAN/CGSB 3.0 No. 14.3-99 requirements.

Figure 2: Critical pairs of gasoline components resolved per ASTM specifications, using an Rtx-DHA-100 column.



Column Rtx-DHA-100, 100 m, 0.25 mm ID, 0.50 μ m (cat.# 10148) using Rtx-5 DHA tuning column 2-5 m, 0.25 mm ID (cat.# 10165) with universal Press-Tight connectors (cat.# 20429) Oxy setup blend (cat.# 33034)

Sample

Injection 0.1 μ L split (split ratio 150:1)
 Inj. Vol.: Restek Premium 4 mm Precision liner w/wool (cat.# 23305.1)
 Inj. Temp.: 250 °C

Oven

Oven Temp.: 5 °C (hold 10 min) to 49 °C at 5 °C/min (hold 50 min) to 200 °C at 1.5 °C/min (hold 10 min)

Carrier Gas

He, constant flow

Flow Rate:

2.2 mL/min

Detector

FID @ 275 °C

Make-up Gas

30 mL/min

Type:

N₂

Hydrogen flow:

40 mL/min

Air flow:

368 mL/min

Instrument

Agilent 7890B GC

Notes

Restek's Rtx-DHA-100 column has the required selectivity to deliver adequate resolution between the critical pairs in ASTM Method D6730. Excellent column inertness provides peak shapes for oxygenated compounds that meet or exceed ASTM method criteria.

Chromatogram was obtained using 2.5 m of Rtx-5 DHA tuning column.

Peaks

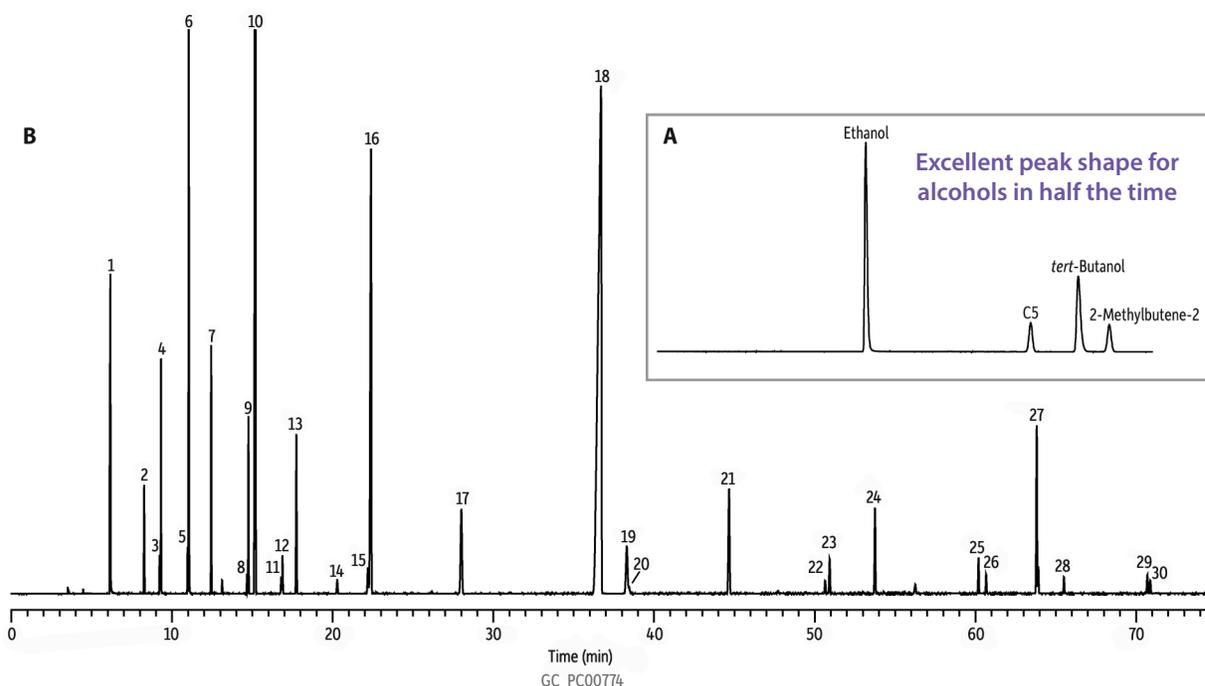
1. Ethanol
2. C5 (*n*-pentane)
3. *tert*-Butanol
4. 2-Methylbutene-2
5. 2,3-Dimethylbutane
6. Methyl *tert*-butyl ether (MTBE)
7. C6 (*n*-hexane)
8. 1-Methylcyclopentene
9. Benzene
10. Cyclohexane
11. 3-Ethylpentane
12. *trans*-1,2-Dimethylcyclopentane
13. C7 (*n*-heptane)
14. 2,3,3-Trimethylpentane
15. Toluene
16. C8 (*n*-octane)
17. Ethylbenzene
18. *p*-Xylene
19. 2,3-Dimethylheptane
20. C9 (*n*-nonane)
21. 5-Methylnonane
22. 1-Methyl-2-ethylbenzene
23. C10 (*n*-decane)
24. C11 (undecane)
25. 1,2,3,5-Tetramethylbenzene
26. Naphthalene
27. C12 (dodecane)
28. 1-Methylnaphthalene
29. C13 (tridecane)

Speed Up Analysis Time Using Hydrogen

Rtx-DHA-100 columns easily meet all ASTM and CGSB method requirements when using helium as the carrier gas. However analysis times can be improved significantly—with no loss in chromatographic performance—by switching to hydrogen as the carrier gas. Rtx-DHA-100 columns meet or exceed all criteria in these standardized methods in up to 50% less time when using hydrogen (Figure 3).

Figure 3: Achieve up to 50% faster analysis times using hydrogen instead of helium.

	Optimized D6730 with hydrogen	Optimized D6730 with helium	Standard D6730 conditions
Approximate analysis time	72 min	98 min	146 min
% Time savings (relative to standard method conditions)	51% faster	33% faster	—



Column Rtx-DHA-100, 100 m, 0.25 mm ID, 0.50 μ m (cat.# 10148)
using Rtx-5 DHA tuning column 5 m, 0.25 mm ID,
DHA/oxygenates setup blend

Sample Injection
Inj. Vol.: 0.1 μ L split (split ratio 150:1)
Liner: 4 mm cup splitter inlet liner with Siltek deactivation
Inj. Temp.: 250 °C

Oven
Carrier Gas H₂, constant flow
Flow Rate: 3.62 mL/min

Linear Velocity: 55 cm/sec

Detector FID @ 300 °C

Notes
Oven Temp.:
A: 35 °C
B: 5 °C (hold 8.32 min) (elute C5) to 48 °C at 22 °C/min (hold 26.32 min)
(elute ethylbenzene) to 141 °C at 3.20 °C/min (elute C12) to 300 °C at
1 °C/min

Acknowledgement Chromatogram courtesy of Neil Johansen, Inc., Aztec, New Mexico, in
association with Envantage Analytical Software, Inc., Cleveland, Ohio.

A: Front end of DHA/oxygenates setup blend

C5 Efficiency: 586,825 plates
C5 k': 0.476
tert-Butanol skew: 2.10
Resolution: tert-butanol/2-methylbutene-2: 5.39

B: DHA/oxygenates setup blend

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. 1,2-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
26. 1,2,3,5-Tetramethylbenzene
27. Naphthalene
28. C12
29. 1-Methylnaphthalene
30. C13

Superior Performance for DHA Analysis

A comparison of DHA columns (also referred to as PIANO, PIONA, or PONA columns by other manufacturers) shows that the Rtx-DHA-100 column is the best overall DHA column for peak shape, theoretical plates, and required resolution. Figure 4 shows that, at 35 °C, as specified in the ASTM methods, the Competitor A and Competitor B PONA columns did not meet ASTM D6730 method specifications. The Competitor C and Competitor D PONA columns performed within specifications, but column efficiency was less than ideal. In contrast, the performance of the Rtx-DHA-100 column at 35 °C was well within ASTM D6730 method specifications, and column efficiency exceeded the specification. The column also performed well at subambient temperature.

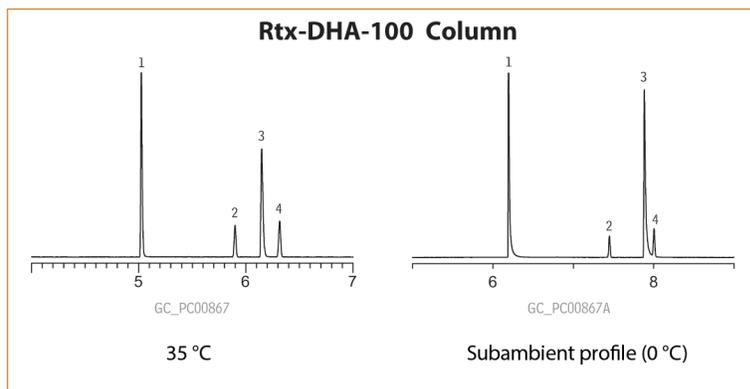
Figure 4: Rtx-DHA-100 columns outperform competitor columns for detailed hydrocarbon analysis.

PONA Test Mix

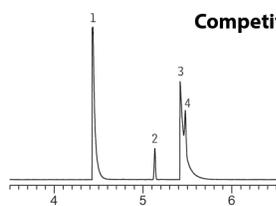
	ASTM D6730 guidelines	Rtx-DHA-100	Competitor A	Competitor B	Competitor C	Competitor D
Minimum C5 Efficiency*	400,000-550,000 plates	613,596	522,974	466,089	489,991	483,449
k' (C5)	0.45-0.50	0.49	0.46	0.51**	0.47	0.46
tert-butanol skewness	>1.00-<5.00	1.25	>5.00**	3.60	1.71	1.59
Resolution (tert-butanol/2-methylbutene-2)*	3.25-5.25	5.60	1.00**	4.32	5.01	5.07

* Minimum values; criteria may be exceeded for these parameters.

** Fails method criteria (results based on analyses at 35 °C).

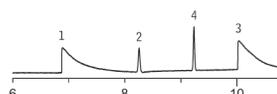


Superior performance for ASTM D6730 method specifications!

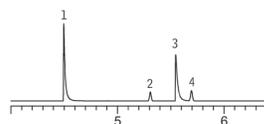


Competitor A Column

35 °C

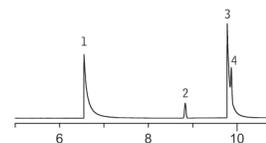


Subambient profile (0 °C)

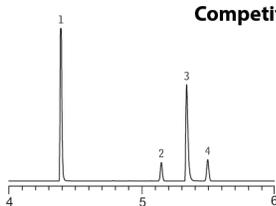


Competitor B Column

35 °C

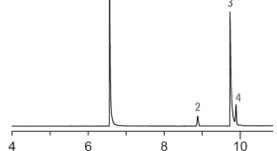


Subambient profile (0 °C)

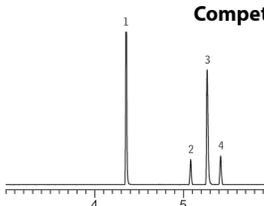


Competitor C Column

35 °C

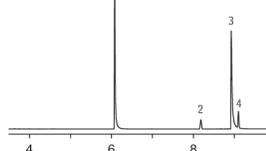


Subambient profile (0 °C)



Competitor D Column

35 °C



Subambient profile (0 °C)

Column 100 m, 0.25 mm ID, 0.50 µm
Sample DHA Oxy-Setup mix (Transition Labs #94100)
Injection
 Inj. Vol.: 0.01 µL split (split ratio 150:1)
 Inj. temp.: 275 °C
Oven
 Oven temp.: 35 °C and Method D 6730 temperature profile
Carrier gas Hydrogen
 Linear velocity: 48 cm/sec
Detector FID @ 300 °C

Notes
 Column A: 5 °C > 8.23 min > 22 °C/min > 48 min
 Column B: 5 °C > 8.84 min > 22 °C/min > 48 min
 Column C: 5 °C > 8.87 min > 22 °C/min > 48 min
 Column D: 5 °C > 8.19 min > 22 °C/min > 48 min
 Rtx-DHA-100: 5 °C > 8.20 min > 22 °C/min > 48 min

Temperature Profile
 5 °C > 8.23 min > 22 °C/min > 48 min
 5 °C > 8.84 min > 22 °C/min > 48 min
 5 °C > 8.87 min > 22 °C/min > 48 min
 5 °C > 8.19 min > 22 °C/min > 48 min
 5 °C > 8.20 min > 22 °C/min > 48 min

Peaks
 1. Ethanol
 2. Pentane (C5)
 3. tert-Butanol
 4. 2-Methylbutene-2

Conclusion

Rtx-DHA-100 columns offer the best overall value and performance for detailed hydrocarbon analysis. These columns meet or exceed all ASTM D6730-01 and Canadian General Standards Board method requirements and outperform other commercially available columns. Make your next DHA column an Rtx-DHA-100 column—individually tested to meet DHA method criteria, assuring outstanding performance and column-to-column reproducibility.

Product Listing

Columns

similar phases

HP-PONA, DB-Petro,
CP-Sil PONA C8,
Petrocol DH, BP1PONA

Rtx-DHA Columns (fused silica)

Crossbond 100% dimethyl polysiloxane—optimized for hydrocarbon analysis

Description	temp. limits	qty.	cat.#
50 m, 0.20 mm ID, 0.50 μ m	-60 to 300/340 °C	ea.	10147
100 m, 0.25 mm ID, 0.50 μ m	-60 to 300/340 °C	ea.	10148
150 m, 0.25 mm ID, 1.00 μ m	-60 to 280/340 °C	ea.	10149

Method Recommended Columns

ASTM Method	Column	Dimensions	cat.#
D6729	Rtx-DHA-100	100m x 0.25mm, 0.50 μ m	10148
D6730	Rtx-DHA-100 & Rtx-5 DHA Tuning Column	100m x 0.25mm, 0.50 μ m w/ precolumn	10148 & 10165
D6733	Rtx-DHA-50	50m x 0.20mm, 0.50 μ m	10147
D5134	Rtx-DHA-50	50m x 0.20mm, 0.50 μ m	10147
D5501	Rtx-DHA-150	150m x 0.25mm, 1.0 μ m	10149

Rtx-5 DHA Tuning Column (fused silica)

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

Description	temp. limits	qty.	cat.#
5 m, 0.25 mm ID, 1.00 μ m	-60 to 325/350 °C	ea.	10165

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

Press-Tight Connectors

- Universal fit: use with 0.1–0.53 mm ID Restek columns (0.33–0.74 mm OD).
- Optional deactivated fused quartz helps eliminate activity for complete inertness along the GC flow path.
- Optional Siltek deactivation is ideal for organochlorine pesticides analysis.



Universal Press-Tight Connectors

- Connect a guard column to an analytical column.
- Repair a broken column.
- Connect a column outlet to a transfer line.

Description	5-pk.	25-pk.	100-pk.
Universal Press-Tight Connectors	20400	20401	20402
Universal Press-Tight Connectors, Deactivated	20429	20430	—
Universal Press-Tight Connectors, Siltek Deactivated	20480	20449	—

SilTite μ -Union Connectors



- Reliably create permanent connections between fused silica analytical columns, guard columns, and retention gaps.
- SilTite FingerTite technology provides easy installation and a permanent leak-tight connection.
- Deactivated metal and zero-dead-volume design ensure optimal peak shapes.
- Robust connection is stable through extreme temperature and pressure cycling, making it ideal for use with mass spectrometers.
- Kits contain two SilTite μ -Union connectors, five double-taper ferrules, and installation tools.



Description	Fits Column ID	qty.	cat.#
SilTite μ -Union Connector Kit	0.32 mm to 0.32 mm	kit	23882
SilTite μ -Union Connector Kit	0.32 mm to 0.53 mm	kit	23883
SilTite μ -Union Connector Kit	0.53 mm to 0.53 mm	kit	23884
SilTite μ -Union Connector Kit	0.18/0.25 mm to 0.18/0.25 mm	kit	23885
SilTite μ -Union Connector Kit	0.18/0.25 mm to 0.32 mm	kit	23886
SilTite μ -Union Connector Kit	0.18/0.25 mm to 0.53 mm	kit	23887

Inlet Liners

4.0 mm ID Cup Inlet Liner

for Agilent GCs equipped with split/splitless inlets



ID x OD x Length	qty.	cat.#
Cup, Intermediate Polarity (IP), Borosilicate Glass 4.0 mm x 6.3 mm x 78.5 mm	ea.	20709
Cup, Intermediate Polarity (IP), Borosilicate Glass 4.0 mm x 6.3 mm x 78.5 mm	5-pk.	20710
Cup, Siltek, Borosilicate Glass 4.0 mm x 6.3 mm x 78.5 mm	5-pk.	20710-214.5

Restek Premium Inlet Liners

Exceptionally inert, Restek Premium inlet liners with state-of-the-art deactivation improve trace-level analysis.

- Increase accuracy and precision by preventing loss of sensitive analytes—even when using wool.
- Achieve lower detection limits for a wide range of active compounds.
- Ensure liner-to-liner reproducibility through consistent manufacturing and extensive testing.
- 100% customer satisfaction—if a liner doesn't perform to expectations, we will replace it or credit your account.

Restek Premium 4.0 mm ID Precision Inlet Liner w/ Wool

for Agilent GCs equipped with split/splitless inlets



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

Thermolite Plus Septa

- Usable to 350 °C inlet temperature.*
- Ultra-low bleed minimizes background signal.
- Septa have a CenterGuide design to minimize coring.
(Not available on 6 mm, 7 mm, 8 mm, 9.5 mm, 10 mm and Shimadzu plug.)
- 5 mm septa are partially predrilled for improved puncturability.



Septum Diameter	48-pk.	50-pk.	100-pk.
	cat.#	cat.#	cat.#
5 mm (3/16"), predrilled and with CenterGuide		23860	23861
6 mm (1/4")		23874	
7 mm		23875	
8 mm		23876	
9 mm, with CenterGuide		23862	23863
9.5 mm (3/8")		23877	
10 mm		23878	
11 mm (7/16"), with CenterGuide		23864	23865
11.5 mm, with CenterGuide		23866	23867
12.7 mm (1/2"), with CenterGuide	23868		
17 mm, with CenterGuide	23870		
Shimadzu Plug		23872	23873

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

*For 17 mm inlets, the maximum temperature for Thermolite Plus septa is 300 °C.



Restek Electronic Leak Detector

Features & benefits include:

- Audible tone indicates the severity of a leak.
- Redesigned circuitry offers 12 hours of operation between charges.
- Detects a broad range of gases; Ex rated for use with hydrogen and other explosive gases.*
- Ergonomic, handheld design.
- Rugged side grips for added durability.
- Handy probe storage for cleanliness and convenience.
- Long-lasting battery; up to 12 hours of continuous use.
- Automatic shutoff.
- A convenient carrying and storage case.
- Easy-to-clean probe assembly.
- A universal charger set (U.S., European, UK, and Australian plugs included).

Learn more at
www.restek.com/leakdetector

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

Product Listing

Reference Standards

Widest variety of standards available!

Visit www.restek.com/petro for our most current list.

DHA Standards

ASTM Methods D6729, D6730, and D6733 are designed for the determination of the individual hydrocarbons present in spark ignition engine fuels, as well as fuel blends containing oxygenates such as methyl *tert*-butyl ether, ethyl *tert*-butyl ether, *tert*-butanol, ethanol, etc.

These standards are produced for refineries performing detailed hydrocarbon analysis (DHA) of crude oil feedstocks and fuels. They help with calibrating complex hydrocarbon analyses and provide the greatest number of gravimetrically determined values for qualitative calibration to help our customers optimize production and maximize profitability—while fulfilling requirements such as ASTM Methods D6729, D6730, and D6733.

Oxy SetUp Blend (29 components)

ASTM Method D6730-01 is specifically designed for the determination of the individual hydrocarbons present in spark ignition fuels, as well as fuel blends containing oxygenates such as methyl *tert*-butyl ether, ethyl *tert*-butyl ether, *tert*-butanol, ethanol, etc.

Gravimetrically prepared and NIST-traceable.

Benzene, 1.00%	1-Methylcyclopentene, 0.50%
<i>tert</i> -Butanol, 0.50%	1-Methyl-2-ethylbenzene, 0.50%
Cyclohexane, 28.9%	1-Methylnaphthalene, 0.25%
<i>n</i> -Decane, 1.00%	5-Methylnonane, 0.20%
2,3-Dimethylbutane, 0.50%	Naphthalene, 0.50%
<i>trans</i> -1,2-Dimethylcyclopentane, 0.50%	<i>n</i> -Nonane, 2.00%
2,3-Dimethylheptane, 0.20%	<i>n</i> -Octane, 2.00%
Dodecane, 0.25%	<i>n</i> -Pentane, 2.00%
Ethanol, 8.00%	1,2,3,5-Tetramethylbenzene, 0.25%
Ethylbenzene, 25.0%	Toluene, 7.00%
3-Ethylpentane, 0.20%	Tridecane, 0.25%
<i>n</i> -Heptane, 2.00%	2,3,3-Trimethylpentane, 0.50%
<i>n</i> -Hexane, 2.00%	Undecane, 0.50%
2-Methylbutene-2, 2.50%	<i>p</i> -Xylene, 1.00%
Methyl <i>tert</i> -butyl ether, 10.0%	

2 mL prescored ampul cat.# 33034 (ea.)

DHA PONA Standard (188 components)

This standard 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 by refineries for detailed hydrocarbon analysis (DHA) method setup and to fulfill requirements such as ASTM Methods D6729, D6730, and D6733.

Neat, 0.15 mL in Autosampler Vial cat.# 30731 (ea.)

Quantity discounts not available.

No data pack available.

For a full component list, visit www.restek.com and search for "30731."

DHA PiONA Standard (133 components)

Neat, 0.15 mL in Autosampler Vial cat.# 30730 (ea.)

DHA Paraffins Standard (11 components)

Neat, 0.15 mL in Autosampler Vial cat.# 30725 (ea.)

DHA Isoparaffins Standard (33 components)

Neat, 0.15 mL in Autosampler Vial cat.# 30726 (ea.)

DHA Olefins Standard (26 components)

Neat, 0.15 mL in Autosampler Vial cat.# 30727 (ea.)

DHA Naphthenes Standard (26 components)

Neat, 0.15 mL in Autosampler Vial cat.# 30728 (ea.)

DHA Aromatics Standard (37 components)

Neat, 0.15 mL in Autosampler Vial cat.# 30729 (ea.)

Quantity discounts not available.



RESTEK
Pure Chromatography

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

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Lit. Cat.# PCSS1007D-UNV