

# Selection Guide for Polar WAX GC Column Phases.....



**Inside:**

**Information on  
Six Different PEG  
Columns**

**Polyethylene Glycol  
Stationary Phase  
Selection Guide**

**Applications for  
Each Polyethylene  
Glycol Column**



“Among the most widely used capillary columns today are the polar polyethylene glycol (PEG) columns. While PEG columns offer a unique selectivity for a wide variety of analyses, their uses have been limited because of short column lifetimes, restricted operating ranges, and poor inertness.

Restek Corporation has been providing chromatographers with superior capillary columns since 1985. And, our PEG columns are just another example of how we’ve improved on existing technology to solve customers’ problems. The columns in this guide are durable, function at a wide range of temperatures, and are highly inert.

We have designed six different PEG capillary GC column phases — Stabilwax<sup>®</sup>, Stabilwax<sup>®</sup>-DA, Stabilwax<sup>®</sup>-DB, FAMEWAX<sup>™</sup>, Rtx<sup>®</sup>-Wax, and MXT<sup>®</sup>-Wax columns — each an innovative improvement over existing, competitor PEG columns. In addition to the wide variety of PEG columns, we offer many custom column materials and configurations. We will try to match any column written into a method, or engineer a new custom PEG phase if your needs are special. If you cannot find what you are looking for, call our technical support at 800-356-1688, ext. 4.”

—— Rick Crago, Product Line Manager

#### Mark Lawrence & Tom Gurecki

Mark and Tom lead the manufacturing efforts for all of the phases included in this publication. Their goal is to bring you the most consistent columns, while continuing to expand the product offering.



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## Polyethylene Glycol Stationary Phase Selection Guide

Restek Phase	Temp. Limits	Cross-Reference	Typical Analyses	Benefits
Stabilwax <sup>®</sup> MXT <sup>®</sup> -WAX	40 to 260°C	Supelcowax <sup>™</sup> -10, HP-Innowax, Carbowax <sup>®</sup> , CP wax 52 CB	FAMEs, Flavors, Essential Oils, Solvents, BTEX	Resists oxidation, extended lifetimes, high thermal stability.
Stabilwax <sup>®</sup> -DA	40 to 260°C	Nukol <sup>™</sup> , SP <sup>™</sup> -1000, HP-FFAP, AT-1000, BP 21, CP Wax 58 CB, 007 FFAP, DB-HAP	Free Fatty Acids	Provides efficiency and inertness for acidic compounds.
Stabilwax <sup>®</sup> -DB	40 to 220°C	CAM, Carbowax <sup>®</sup> Amine, CP Wax 51	Amines	Provides efficiency and inertness for basic compounds.
Rtx <sup>®</sup> -Wax	20 to 250°C	DB-Wax, HP-Wax, AT-Wax, 007-Wax	Flavors, Essential Oils, Polar Solvents, BTEX	Increased efficiency and inertness over conventional wax columns, lower minimum operating temperature.
FAMEWAX <sup>™</sup>	20 to 250°C	Omegawax <sup>™</sup>	Fatty Acid Methy Esters	Specifically designed for fast, efficient analysis of FAMEs.

## Stabilwax® Columns for Solvents, FAMEs, Xylene Isomers, and Flavors

- Increased column lifetime.
- Remarkably low bleed.
- Solvent rinsable.

Stabilwax® columns are durable, all-purpose PEG columns. FAMEs, flavors, acids, essential oils, amines, solvents, xylene isomers, BTEX, and EPA Method 603 compounds (acrolein and acrylonitrile) are all easily analyzed on these rugged columns.

Restek's research chemists developed a polar-deactivated surface that tightly binds the Carbowax® polymer, thus increasing the polymer's thermal stability over competitive columns. Next, they incorporated antioxidant features into the polymer backbone to resist damage from an influx of trace oxygen, the most common cause of Carbowax® column failure. Finally, they fine-tuned the bonding mechanisms to result in a column that can be rejuvenated by solvent-washing.

### Benefits of Low Bleed

The low bleed at higher temperatures that is provided by a Stabilwax® column ensures accurate identification and quantitation of higher-boiling components, minimal detector contamination, and extended column lifetime. The Stabilwax® column is thermally stable to 250°C. Only a minimal bleed level is evident at this temperature. In fact, compared to similar PEGs from other manufacturers, the Stabilwax® exhibits the **lowest** bleed profile at 250°C (**Figure 1**).

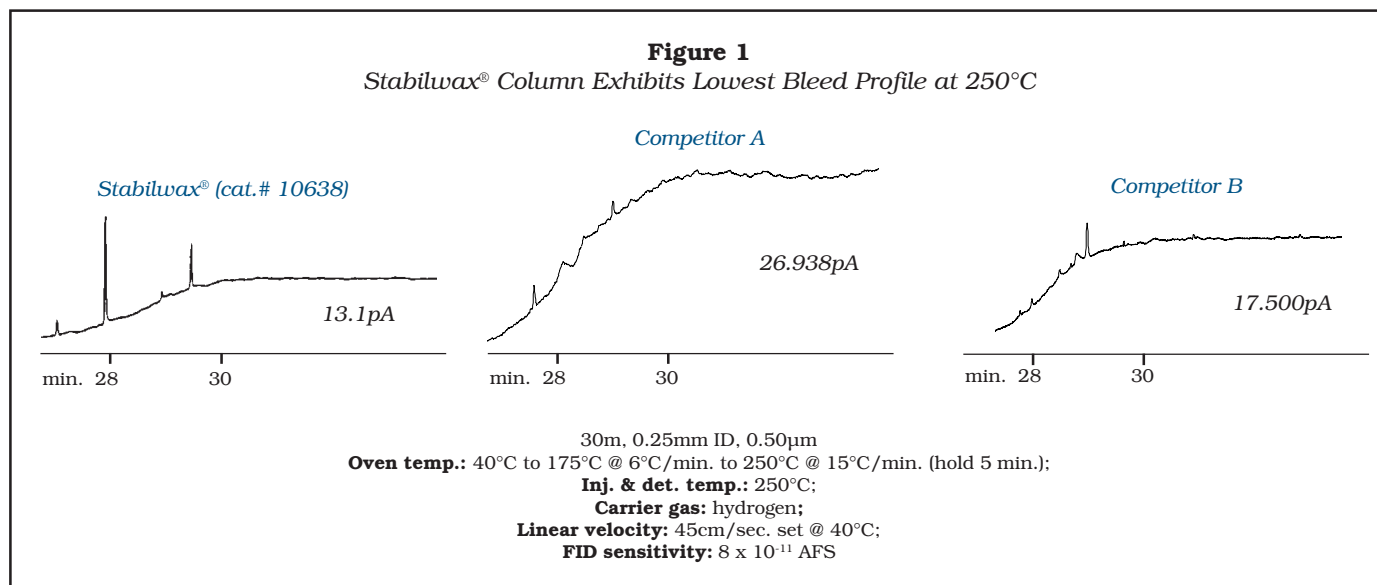


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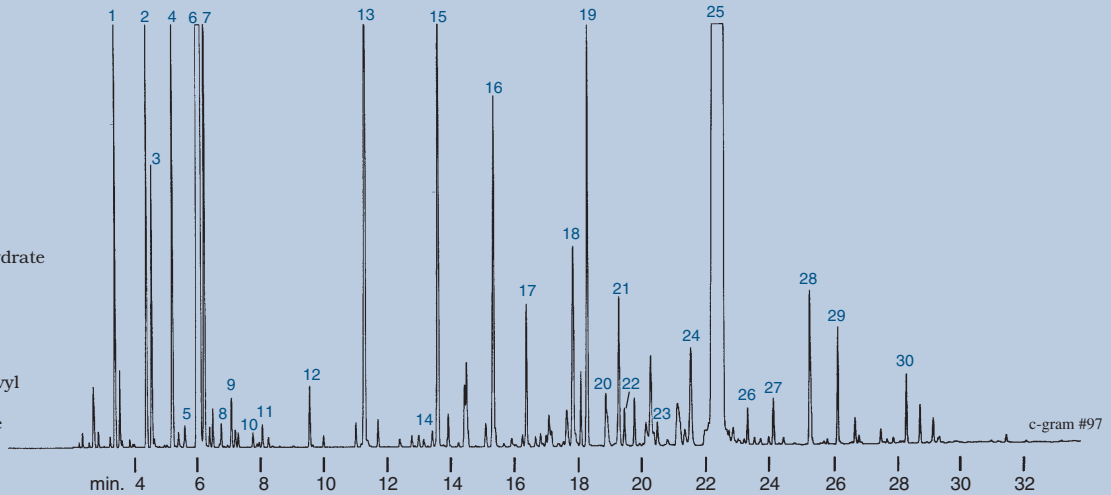
## Stabilwax® Columns for Complex Mixtures

This PEG column also provides an affinity toward and separation of many polar compounds found in complex samples such as spearmint oil and industrial solvent mixtures. (**Figures 2 and 3**)

**Figure 2**

*Flavor Components of Native Spearmint Oil are Baseline Resolved on a Stabilwax® Column*

1.  $\alpha$ -pinene
2.  $\beta$ -pinene
3. sabinene
4. myrcene
5.  $\alpha$ -terpinene
6. L-limonene
7. 1,8-cineole
8. *cis*-ocimene
9.  $\gamma$ -terpinene
10. *p*-cymene
11. terpinolene
12. 3-octyl acetate
13. 3-octanol
14. L-menthone
15. *trans*-sabinenehydrate
16.  $\beta$ -bourbonene
17. linalool
18. terpinene-4-ol
19.  $\beta$ -caryophyllene
20. dihydrocarvone
21. *trans*-dihydrocarvyl acetate
22. *trans*- $\beta$ -farnesene
23.  $\alpha$ -terpineol
24. germacrene-D
25. carvone
26. *cis*-carvyl acetate
27. *trans*-carveol
28. *cis*-carveol
29. *cis*-jasmone
30. viridiflorol



60m, 0.25mm ID, 0.25 $\mu$ m Stabilwax® (cat.# 10626)

0.2 $\mu$ l split injection of a neat spearmint oil.

**Oven temp.:** 75°C (hold 4 min.) to 200°C @ 4°C/min. (hold 10 min.)

**Inj. & det. temp.:** 250°C; **Carrier gas:** hydrogen; **Linear velocity:** 40cm/sec. set @ 160°C;

**FID sensitivity:** 4 x 10<sup>-11</sup> AFS; **Split ratio:** 100:1

**Figure 3**

*Industrial Solvents Separated on a Stabilwax® Column in Under 10 minutes*

- |                          |                       |
|--------------------------|-----------------------|
| 1. pentane               | 11. chloroform        |
| 2. hexane                | 12. benzene           |
| 3. methyl formate        | 13. n-propyl alcohol  |
| 4. acetone               | 14. sec-butyl alcohol |
| 5. tetrahydrofuran       | 15. toluene           |
| 6. 1,1,1-trichloroethane | 16. n-butyl acetate   |
| 7. ethyl acetate         | 17. isobutyl alcohol  |
| 8. methanol              | 18. n-butyl alcohol   |
| 9. methylethyl ketone    | 19. o-xylene          |
| 10. methylene chloride   | 20. ethoxyethane      |

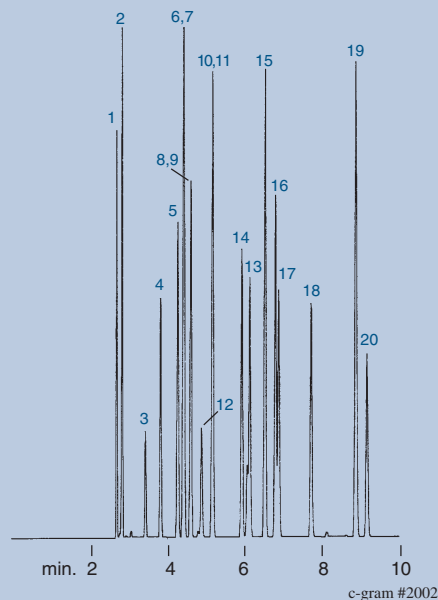
30m, 0.53mm ID, 1.0 $\mu$ m Stabilwax® (cat.# 10655)

Wet needle injection of neat solvents.

**Oven temp.:** 50°C to 220°C @ 10°C/min.;

**Inj. & det. temp.:** 250°C; **Carrier gas:** helium;

**Linear velocity:** 20cm/sec.; **FID sensitivity:** 5.12 x 10<sup>-10</sup> AFS



## Stabilwax®-DA Columns for Acidic Compounds

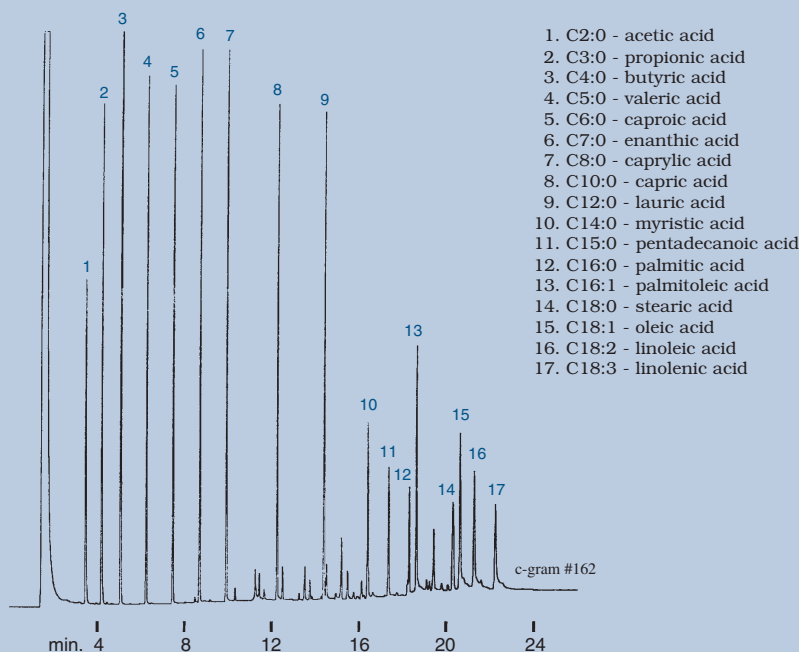
- Ideal for free fatty acids analysis.
- Thermally stable to 250°C.
- Solvent rinsable.
- Resolves saturated and unsaturated free fatty acids.
- No derivatization needed of free fatty acids.
- Inertness increases sample capacity.
- Achieves good peak shapes.

The analysis of volatile free fatty acids has been difficult on common siloxane stationary phases because of analyte adsorption and low sample capacity. Although PEG stationary phases exhibit improved capacity and better selectivity for many free acids, peak tailing still can occur. Stabilwax®-DA is a bonded PEG stationary phase that has been specially deactivated to analyze acidic compounds. The resulting inertness significantly reduces adsorption and increases sample capacity of volatile-free acids, thereby improving peak shape (**Figure 4**). It also eliminates the need to derivatize free fatty acids from C1 to C20, which simplifies sample preparation. Restek's deactivation and innovative Crossbond® procedure produces columns that last longer and give better peak shapes with high molecular weight acids than our competitors.

**Restek's Crossbond® Procedure produces columns with lower bleed, longer lifetime, solvent rinsability, and you can use direct aqueous injections.**

**Figure 4**

*Stabilwax®-DA Column Gives Good Peak Shapes for Free Fatty Acids*



30m, 0.53mm ID, 0.25µm Stabilwax®-DA (cat.# 11025)  
0.5µl direct injection of a 5mg/ml standard.

**Oven temp.:** 100°C (hold 2 min.) to 250°C @ 8°C/min.;

**Inj. & det. temp.:** 280°C; **Carrier gas:** helium;

**Linear velocity:** 40cm/sec. (flow rate: 5.2cc/min.); **FID sensitivity:** 8 x 10<sup>-11</sup> AFS

**Special deactivation improves separations and simplifies sample preparation.**

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at [www.restekcorp.com](http://www.restekcorp.com)  
for detailed product  
information and to  
order free literature.

### Unbreakable Metal Capillary Columns



For harsh environments or special applications where fused silica tubing may not be the ideal material, Restek offers MXT® capillary columns. MXT® columns are made from unbreakable, thin-wall stainless steel that has been treated with our Silcosteel® process. This process deposits a sub-micron layer of flexible fused silica on the inside of the tubing, giving it the same inertness as an Rtx® column, but with the ruggedness of stainless steel. MXT® columns are caged in small diameter coils that are ideal for portable or process GCs.

MXT®-Wax columns combine the unique selectivity of the PEG stationary phases with the rugged durability of stainless steel tubing. These columns are ideal for use in the process and portable GC industries, where column breakage is a significant problem.

See page 12 for  
ordering information.

## Stabilwax®-DB Columns for Basic Compounds

- Bonded phase reduces column bleed.
- Thermally stable to 220°C.
- Eliminates need for derivatization.
- No column priming required.
- Reproducible amine analyses.
- Stringently tested for analysis of difficult basic compounds.

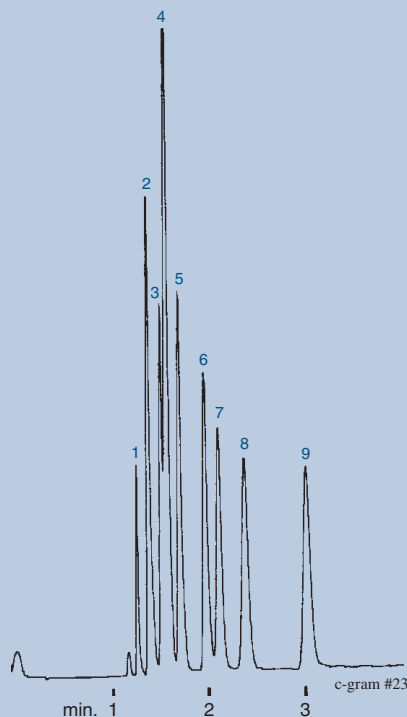
This column was developed to reduce adsorption and improve response of basic compounds without the need for column priming. Analyses that previously required derivatization, or another analytical technique such as HPLC, can now be performed on the Stabilwax®-DB column. In addition to the stringent Grob test for efficiency, bleed, and inertness (excluding oxygenated compounds), the Stabilwax®-DB column must also analyze a mixture that contains triamine, diamine, and propylamine. This additional test ensures that every Stabilwax®-DB column is basic enough to analyze these difficult amine compounds.

Some basic compounds, such as amines, are prone to adsorption in the GC system, including the analytical column. The Stabilwax®-DB column is specially treated for better recovery and quantitation of amines (**Figure 5**).

**Figure 5**

*Improved Recovery and Quantitation of Primary Amines  
(low MW) on a Stabilwax®-DB Column*

1. trimethylamine
2. dimethylamine
3. ethylamine
4. methylamine
5. isopropylamine
6. n-propylamine
7. tert-butylamine
8. diethylamine
9. sec-butylamine



30m, 0.53mm ID, 1.0µm Stabilwax®-DB (cat.# 10855)  
1.0µl direct injection of low molecular weight amines in water.  
**Oven temp.:** 45°C isothermal; **Inj. & det. temp.:** 250°C; **Carrier gas:** hydrogen;  
**Linear velocity:** 40cm/sec. (flow rate: 5cc/min.); **FID sensitivity:** 1 x 10<sup>-11</sup> AFS

## Rtx<sup>®</sup>-Wax Columns for Difficult Active Compounds

- Minimum temperature of 20°C for analysis of volatiles.
- Excellent efficiency and inertness for aldehydes.
- Fast BTEX analyses.
- Thermally stable to 250°C.

The Rtx<sup>®</sup>-Wax column features a bonded, highly inert PEG stationary phase that provides excellent selectivity for compounds ranging in volatility, molecular weight, and polarity, and can even resolve aromatic isomers. It has a low minimum operating temperature (20°C) for analysis of volatile compounds. Crossbond<sup>®</sup> cross-linking, or bonding of the stationary phase, provides thermal stability at higher temperatures for analysis of higher boiling compounds. Compared to other available Carbowax<sup>®</sup> columns, the crossbonded Rtx<sup>®</sup>-Wax column provides a vast operational temperature range, excellent efficiency, selectivity, and superior inertness. These advantages make it a logical improvement for all Carbowax<sup>®</sup> applications.

### Benefits of Low Temperature Analyses

Many PEG columns undergo a solid-liquid phase transition at temperatures below 40°C, which results in loss of efficiency, reduced sample capacity, and poor retention time reproducibility. The new Rtx<sup>®</sup>-Wax column can sustain 20°C for limited periods before solidification of the stationary phase occurs. This is especially advantageous for applications involving purge-and-trap and headspace analyses. Volatile components can be cold-trapped onto the column and elute as sharp, symmetrical, well-resolved peaks because column efficiency is still maintained at this low temperature. **Figures 6A and 6B** demonstrate the difference in PEG column performance at 20°C. The Rtx<sup>®</sup>-Wax column provides better column efficiency and resolution of the analytes, which demonstrates that it is far more suitable for low temperature analyses.

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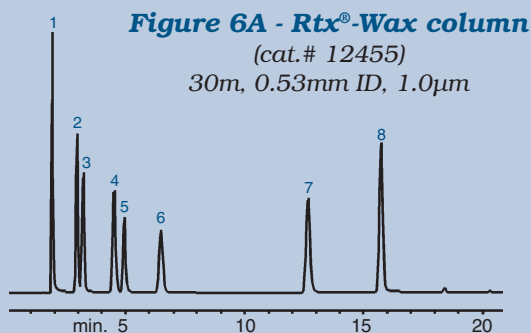
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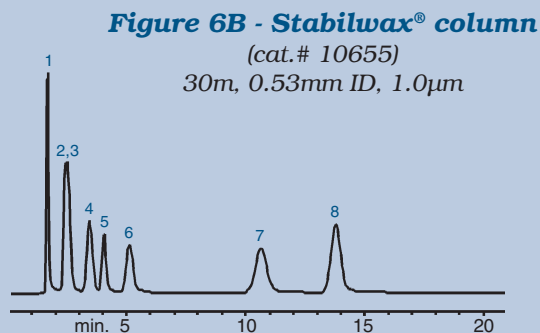
for technical  
 assistance.

### Figures 6A and 6B

Rtx<sup>®</sup>-Wax Columns Maintain Efficiency at 20°C



1. acetaldehyde
2. methanol
3. acetone
4. ethyl formate
5. ethanol
6. ethyl acetate
7. n-propanol
8. isobutanol



0.1µl split injection of volatile solvents.

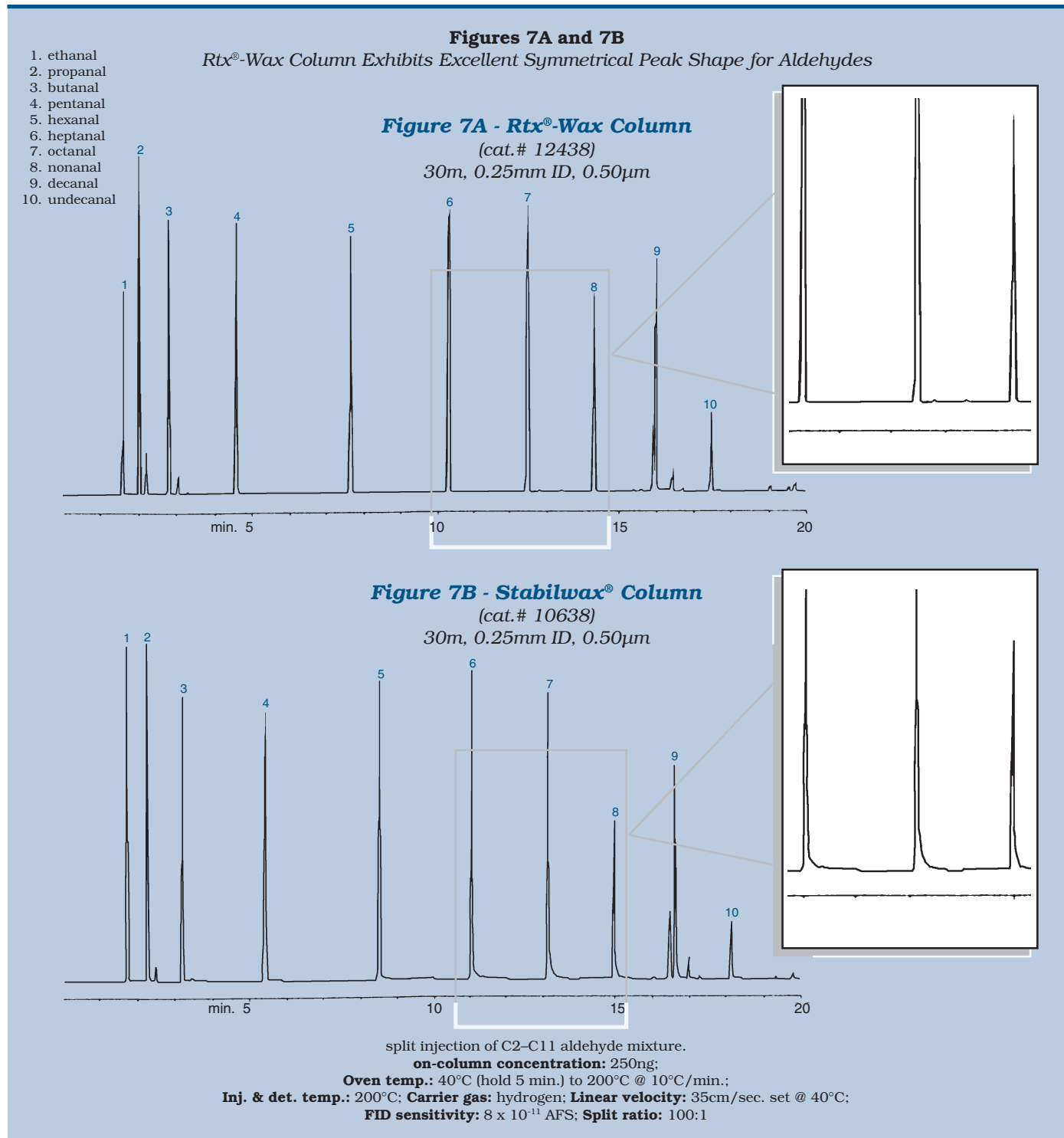
Oven temp.: 20°C (hold 10 min.) to 100°C @ 5°C/min.;

Inj. & det. temp.: 200°C; Carrier gas: helium; Linear velocity: 40cm/sec. set @ 20°C;

FID sensitivity: 8 x 10<sup>-11</sup> AFS; Split ratio: 10:1

## Excellent Inertness for Aldehydes

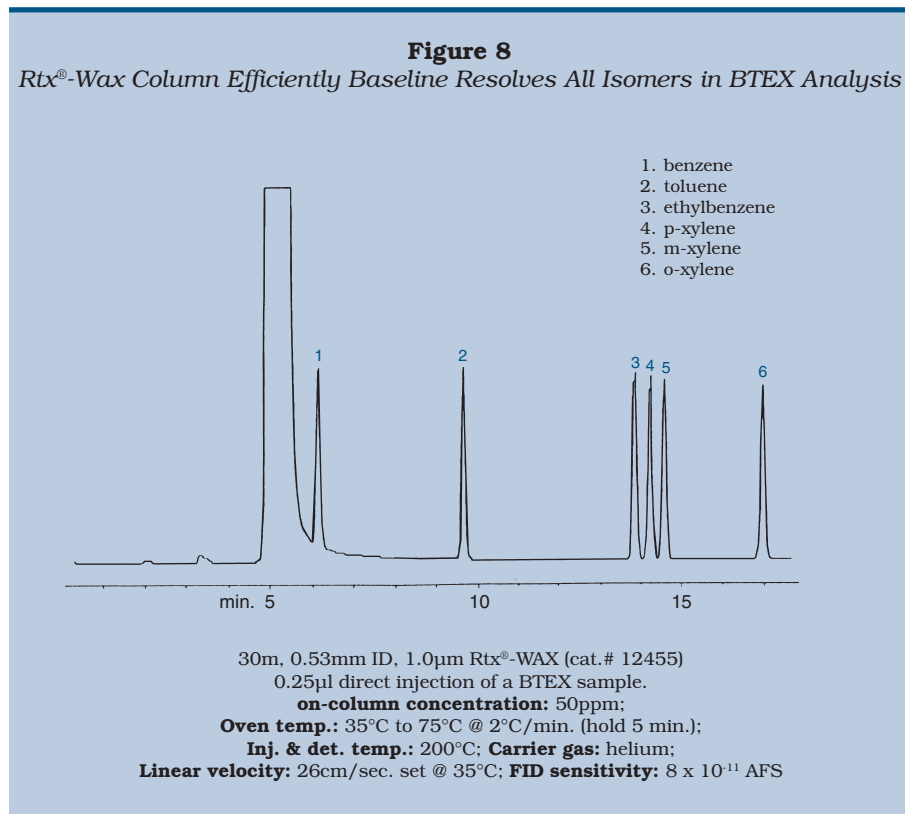
Most PEG columns can effectively analyze alcohols, esters, and acids, but some exhibit peak-tailing with aldehydes. The Rtx<sup>®</sup>-Wax column is inert to aldehydes as well because the stationary phase undergoes an extensive purification procedure. Peak tailing of some straight-chain aldehydes is apparent on a typical bonded PEG column, but is absent on the highly inert Rtx<sup>®</sup>-Wax column (**Figures 7A and 7B**).





## All Components Resolved for BTEX isomers

The Rtx<sup>®</sup>-Wax column offers the same selectivity as other Carbowax<sup>®</sup> columns for isomers of substituted aromatics. This is useful for BTEX analyses requiring the quantitation of the individual xylene isomers. **Figure 8** illustrates that all components in the BTEX analysis are resolved. The meta-, para-, and ortho-xylene are baseline resolved in just 17 minutes.



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## FAMEWAX<sup>™</sup> Columns for FAME Analysis

- Fast, efficient analyses.
- Thermally stable to 250°C.
- Meets AOCS and AOAC method requirements.

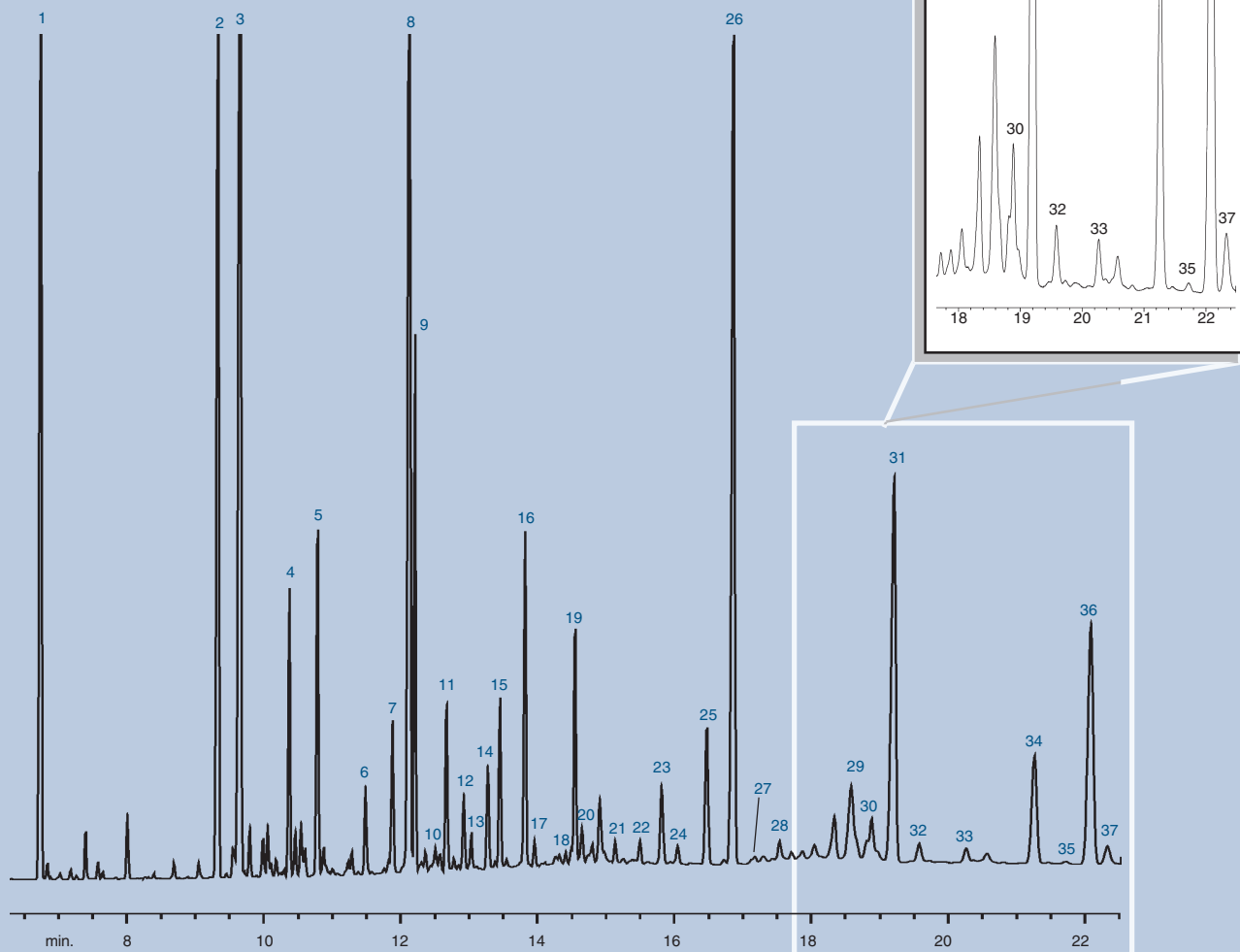
The FAMEWAX<sup>™</sup> column provides superb stationary phase consistency, excellent column efficiency, and thermal stability to 250°C. The elution order of complex polyunsaturated fatty acid methyl esters (FAMES) is comparable to that on other Carbowax<sup>®</sup> columns, but baseline resolution is achieved in significantly less time.

Capillary column performance requirements for PUFA analysis are specified in American Oil Chemists Society (AOCS) and Association of Official Analytical Chemists (AOAC) methods. The AOCS Method CE 1b-89 *FAMES analysis by Capillary GLC* requires baseline resolution of C21:5n3 and C23:0 (internal standard [IS]), and C24:0 and C22:6n3 (DHA). The AOAC Official Method #991.39 *Fatty Acids in Encapsulated Fish Oils and Fish Oil Methyl and Ethyl Esters* requires the same elution pattern as Carbowax<sup>®</sup> 20M and the additional resolution of C23:0(IS) from C22:4n6.

FAMEWAX™ columns meet all the criteria listed in the methods in significantly less time, with faster flow and temperature program rates than other Carbowax® columns. The menhaden oil PUFA analysis on a FAMEWAX™ column in **Figure 9** shows that C21:5n3 and C23:0 (IS) are well resolved, as are C24:0, C22:6n3 (DHA), and C24:1n9, with a total analysis time of only 22 minutes. The same analysis on another PEG column typically used for FAMES analysis shows peaks C21:5n3 and C23:0 are not baseline resolved, nor are C22:6n3 and C24:1n9. To achieve resolution of these components on this other column, the program rate must be decreased to 2°C or 3°C/minutes, which increases the analysis time by 59%!

**Figure 9**  
FAMEWAX™ Columns Meet the Resolution Criteria of AOCS and AOAC  
Methods and Cut Analysis Time By Up To 50%

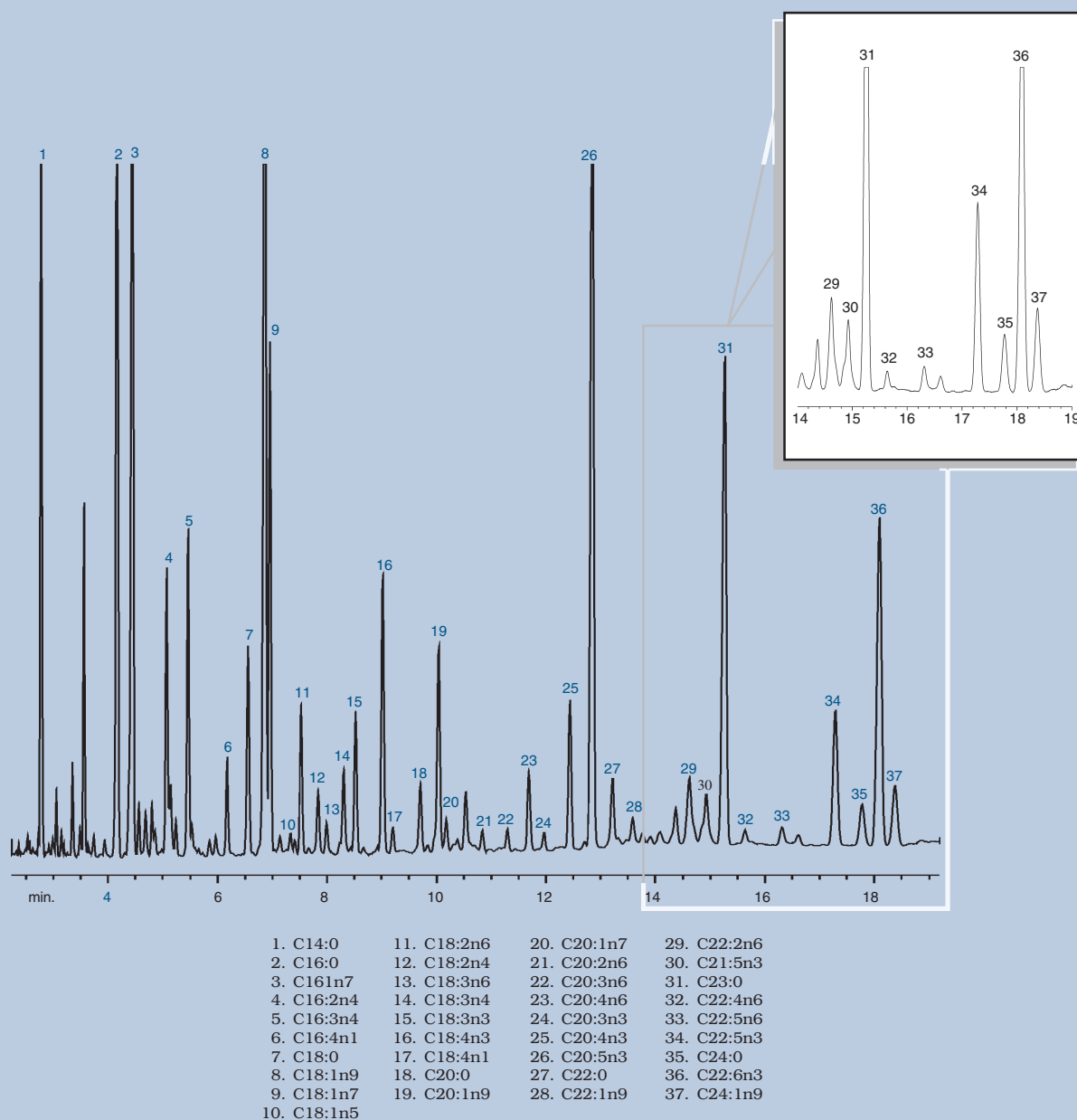
For peak identifications, please refer to Figure 10.



30m, 0.25mm ID, 0.25µm Famewax™ (cat.# 12497).  
0.8µl split injection of menhaden oil PUFA with C23:0 (IS).  
**On-column concentration:** 100-150ng.  
**Oven temp.:** 120°C to 220°C @ 7°C/min. (hold 20 min.);  
**Inj./det. temp.:** 220°C; **Carrier gas:** hydrogen; **Linear velocity:** 60cm/sec. @ 120°C;  
**FID sensitivity:**  $8 \times 10^{-11}$  AFS **Split ratio:** 50:1.

The 0.32mm ID FAMEWAX™ column also meets the resolution criteria for PUFA analysis in less time. Plus, the larger inner diameter columns provide 4 to 5 times more sample capacity (400–500ng vs. 50–100ng) to minimize overloading of more concentrated samples without losing column efficiency. **Figure 10** shows an analysis of menhaden oil FAMES completed in less than 19 minutes on a 30m, 0.32mm ID, 0.25µm FAMEWAX™ column.

**Figure 10**  
0.32mm ID FAMEWAX™ Columns Allow More Concentrated Samples to be Analyzed in Less Than 20 Minutes



30m, 0.32mm ID, 0.25µm FAMEWAX™ (cat.# 12498). 0.5µl each split injection of menhaden oil PUFA & Omegawax® test mix.

**On-column concentration:** 200-350ng.

**Oven temp.:** 190°C (hold 4 min.) to 225°C @ 4°C/min. (hold 15 min.); **Inj./det. temp.:** 225°C/250°C;

**Carrier gas:** helium; **Linear velocity:** 35cm/sec. @ 190°C;

**FID sensitivity:**  $8 \times 10^{-11}$  AFS; **Split ratio:** 50:1.

## Product List

**Stabilwax<sup>®</sup> (Fused Silica)** Crossbond<sup>®</sup> Carbowax<sup>®</sup> - provides oxidation resistance; Stable to 250°C

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	40 to 250/260°C	10605	10608	10611
	0.25	40 to 250/260°C	10620	10623	10626
	0.50	40 to 250/260°C	10635	10638	10641
0.32mm	0.10	40 to 250/260°C	10606	10609	10612
	0.25	40 to 250/260°C	10621	10624	10627
	0.50	40 to 250/260°C	10636	10639	10642
0.53mm	1.00	40 to 240/250°C	10651	10654	10657
	0.10	40 to 250/260°C	10607	10610	10613
	0.25	40 to 250/260°C	10622	10625	10628
	0.50	40 to 250/260°C	10637	10640	10643
	1.00	40 to 240/250°C	10652	10655	10658
	1.50	40 to 230/240°C	10666	10669	10672
	2.00	40 to 220/230°C	10667	10670	

**Stabilwax<sup>®</sup>-DA (Fused Silica)** Crossbond<sup>®</sup> Carbowax<sup>®</sup> for acidic compounds; Stable to 250°C

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	40 to 250/260°C	11005	11008	11011
	0.25	40 to 250/260°C	11020	11023	11026
	0.50	40 to 250/260°C	11035	11038	11041
0.32mm	0.10	40 to 250/260°C	11006	11009	11012
	0.25	40 to 250/260°C	11021	11024	11027
	0.50	40 to 250/260°C	11036	11039	11042
0.53mm	1.00	40 to 240/250°C	11051	11054	11057
	0.10	40 to 250/260°C	11007	11010	11013
	0.25	40 to 250/260°C	11022	11025	11028
	0.50	40 to 250/260°C	11037	11040	11043
	1.00	40 to 240/250°C	11052	11055	11058
	1.50	40 to 230/240°C	11062	11065	11068

**Stabilwax<sup>®</sup>-DB (Fused Silica)** Crossbond<sup>®</sup> Carbowax<sup>®</sup> for amines and basic compounds; Stable to 220°C

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.25	40 to 210/220°C	10820	10823	
	0.50	40 to 210/220°C		10838	
0.32mm	0.25	40 to 210/220°C	10821	10824	
	0.50	40 to 210/220°C		10839	
	1.00	40 to 210/220°C		10854	10857
0.53mm	0.50	40 to 210/220°C		10840	
	1.00	40 to 210/220°C	10852	10855	10858
	1.50	40 to 210/220°C		10869	

**Rtx<sup>®</sup>-Wax (Fused Silica)** Crossbond<sup>®</sup>; Stable to 250°C

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	20 to 250°C	12405	12408	
	0.25	20 to 250°C	12420	12423	12426
	0.50	20 to 250°C	12435	12438	12441
0.32mm	0.10	20 to 250°C	12406	12409	
	0.25	20 to 250°C	12421	12424	12427
	0.50	20 to 250°C	12436	12439	12442
0.53mm	1.00	20 to 240/250°C	12451	12454	12457
	0.25	20 to 250°C	12422	12425	
	0.50	20 to 250°C	12437	12440	12443
	1.00	20 to 240/250°C	12452	12455	12458
ID	df (µm)	temp. limits	10-Meter	20-Meter	
0.10mm	0.10	20 to 250°C	41601	41602	
	0.20	20 to 240/250°C	41603	41604	



**MXT<sup>®</sup>-WAX (Silcosteel<sup>®</sup>)** Crossbond<sup>®</sup> Carbowax<sup>®</sup> - provides oxidation resistance; Stable to 250°C

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.28mm	0.25	40 to 250°C	70621	70624	70627
	0.50	40 to 250°C	70636	70639	70642
	1.00	40 to 240°C	70651	70654	70657
0.53mm	0.25	40 to 250°C	70622	70625	70628
	0.50	40 to 250°C	70637	70640	70643
	1.00	40 to 240°C	70652	70655	70658
	1.50	40 to 230°C	70666	70669	70672
	2.00	40 to 220°C	70667	70670	

**FAMEWAX<sup>™</sup> (Fused Silica)** Crossbond<sup>®</sup>; Stable to 250°C

ID	df (µm)	temp. limits	30-Meter
0.25mm	0.25	20 to 250°C	12497
0.32mm	0.25	20 to 250°C	12498
0.53mm	0.50	20 to 250°C	12499

## Analytical Reference Materials

### Fatty Acid Methyl Esters

Neat fatty acid methyl esters can be used to prepare specific mixtures not commercially available. These products are of the highest purity available, typically 99% by GC/FID analysis. Each compound is packaged under a nitrogen blanket to ensure product stability. A Certificate of Analysis is provided with each ampul.

Carbon Number	Compound	CAS #	quantity	cat. #
C6:0	Methyl caproate	106-70-7	100mg	35037
C7:0	Methyl heptanoate	106-73-0	100mg	35038
C8:0	Methyl caprylate	111-11-5	100mg	35039
C9:0	Methyl nonanoate	1731-84-6	100mg	35040
C10:0	Methyl caprate	110-42-9	100mg	35041
C11:0	Methyl undecanoate	1731-86-8	100mg	35042
C12:0	Methyl laurate	111-82-0	100mg	35043
C13:0	Methyl tridecanoate	1731-88-0	100mg	35044
C14:0	Methyl myristate	124-10-7	100mg	35045
C14:1 D 9 cis	Methyl myristoleate	56219-06-8	100mg	35046
C15:0	Methyl pentadecanoate	7162-64-1	100mg	35047
C16:0	Methyl palmitate	112-39-0	100mg	35048
C16:1 D 9 cis	Methyl palmitoleate	1120-25-8	100mg	35049
C17:0	Methyl heptadecanoate	1731-92-6	100mg	35050
C18:0	Methyl stearate	112-61-8	100mg	35051
C18:1 D 9 cis	Methyl oleate	112-62-9	100mg	35052
C18:2 D 9,12 cis	Methyl linoleate	112-63-0	100mg	35053
C18:3 D 9,12,15 cis	Methyl linolenate	301-00-8	100mg	35054
C19:0	Methyl nonadecanoate	1731-94-8	100mg	35055
C20:0	Methyl arachidate	1120-28-1	100mg	35056
C20:1 D 11 cis	Methyl eicosenoate	2390-09-2	100mg	35057
C20:2 D 11,14 cis	Methyl eicosadienoate	2463-02-7	100mg	35058
C20:3 D 11,14,17 cis	Methyl eicosatrienoate	55682-88-7	100mg	35059
C20:4 D 5,8,11,14 cis	Methyl arachidonate	2566-89-4	100mg	35060
C21:0	Methyl heneicosanoate	6064-90-0	100mg	35061
C22:0	Methyl behenate	929-77-1	100mg	35062
C22:1 D 13 cis	Methyl erucate	1120-34-9	100mg	35063
C24:0	Methyl lignocerate	2442-49-1	100mg	35064
C24:1 D 15 cis	Methyl nervonate	2733-88-2	100mg	35065

**For pricing & ordering information, please call  
Restek's Customer Service Department at 800-356-1688, ext. 3.**

## Analytical Reference Materials

### Quantitative Fatty Acid Methyl Ester (FAME) Mixtures

Analysis of fatty acid profiles for food products has come to prominent attention in recent years. While these analyses have been performed for some time, the focus on healthy living has been increasing the demand for food testing. More consumers are concerned about the level of saturated and unsaturated fatty acids in the foods they eat.

To help analytical chemists identify and calibrate their instruments, we now offer several common fatty acid methyl ester mixtures. The mixtures, listed in the following chart, can be used for quantitation (AOCS Method CE 1-62) and correspond to the following types of oils:

**AOCS #1:** Suitable for corn, poppy seed, cotton seed, soybean, walnut, safflower, sunflower, rice, bran, and sesame.

**AOCS #2:** Suitable for linseed, perilla, hempseed, and rubberseed.

**AOCS #3:** Suitable for peanut, rapeseed, and mustard seed.

**AOCS #4:** Suitable for olive, teaseed, and neatsfoot.

**AOCS #5:** Suitable for coconut, palm kernel, babassu, and ouri-curi.

**AOCS #6:** Suitable for lard, beef or mutton tallow, and palm.

**FAME #13:** Suitable for mustard seed oil.

**FAME #14:** Suitable for cocoa butter.

**FAME #15:** Suitable for peanut oil.

Composition of each compound listed as a weight/weight % basis.

Chain	Compound	Packaged by volume to contain 50+mg of mixture.														
		AOCS #1 cat.# 35022	AOCS #2 cat.# 35023	AOCS #3 cat.# 35024	AOCS #4 cat.# 35025	AOCS #5 cat.# 35026	AOCS #6 cat.# 35027	NIH-A cat.# 35028	NIH-B cat.# 35029	NIH-C cat.# 35030	NIH-D cat.# 35031	NIH-E cat.# 35032	NIH-F cat.# 35033	FAME #13 cat.# 35034	FAME #14 cat.# 35035	FAME #15 cat.# 35036
6:00	methyl caproate															
7:00	methyl heptanoate															
8:00	methyl caprylate					7.0				1.5		6.3				
9:00	methyl nonanoate															
10:00	methyl caprate					5.0				3.0		9.1				
11:00	methyl undecanoate															
12:00	methyl laurate					48.0				6.0		12.1				
13:00	methyl tridecanoate															
14:00	methyl myristate			1.0	15.0	2.0	25.0	4.0	12.0	11.8	23.3	2.5			0.1	
15:00	methyl pentadecanoate															
16:00	methyl palmitate	6.0	7.0	4.0	11.0	7.0	30.0	10.0	40.0	19.4	23.6	49.2	4.2	3.0	26.3	10.0
16:01	methyl palmitoleate						3.0				6.9			1.0	0.4	
17:00	methyl heptadecanoate															0.3
18:00	methyl stearate	3.0	5.0	3.0	3.0	3.0	14.0	65.0	56.0	24.9	13.1		7.3	2.0	33.7	3.0
18:01	methyl oleate	35.0	18.0	45.0	80.0	12.0	41.0				44.6			20.0	34.3	50.0
18:02	methyl linoleate	50.0	36.0	15.0	6.0	3.0	7.0							15.0	3.1	30.0
18:03	methyl linolenate	3.0	34.0	3.0			3.0							10.0	0.2	
20:00	methyl arachidate	3.0		3.0						33.2			13.6	1.0	1.3	1.5
20:01	methyl eicosenoate													10.0	0.1	1.5
20:02	methyl eicosadienoate														2.0	
22:00	methyl behenate			3.0									25.4	1.0	0.2	3.0
22:01	methyl erucate			20.0										30.0		
22:02	methyl docosadienoate													2.0		
24:0	methyl lignocerate			3.0									47.0	1.0		1.0
24:1	methyl nervonate													2.0		

The NIH mixtures are composed to the original compositions specified by the National Institutes of Health per Horning, et al., *Journal of Lipid Research*, Volume 5, 20-27, 1964.

### Important Information From Restek:

We certify that all raw materials used have a minimum purity of 99%. The exact composition of each mixture is determined by precise gravimetric techniques based on a weight/weight % basis and is confirmed using high resolution capillary gas chromatography. A Certificate of Analysis is supplied with each product and lists mixture composition, analysis conditions, and includes a sample chromatogram. Products are packaged by volume and are guaranteed to contain a minimum amount of 50mg/ampul.

Improper storage or handling after opening may result in degradation of the unsaturated compounds, for which we cannot be responsible. All materials must be stored under nitrogen at -18°C to prevent degradation.

**Custom fatty acid methyl ester mixtures are also available. Call (800) 356-1688 for details.**

*Composition of each compound listed as a weight/weight % basis.*

Packaged by volume to contain 50+mg of mixture.													
		FAME #1 cat.# 35010	FAME #2 cat.# 35011	FAME #3 cat.# 35012	FAME #4 cat.# 35013	FAME #5 cat.# 35014	FAME #6 cat.# 35015	FAME #7 cat.# 35016	FAME #8 cat.# 35017	FAME #9 cat.# 35018	FAME #10 cat.# 35019	FAME #11 cat.# 35020	FAME #12 cat.# 35021
Chain	Compound												
6:0	methyl caproate		20					20					
7:0	methyl heptanoate							20				20	
8:0	methyl caprylate		20	20				20					
9:0	methyl nonanoate							20				20	
10:0	methyl caprate		20	20				20					
11:0	methyl undecanoate								20			20	
12:0	methyl laurate		20	20					20				
13:0	methyl tridecanoate								20			20	20
14:0	methyl myristate		20	20					20				
15:0	methyl pentadecanoate								20			20	20
16:0	methyl palmitate	20		20	20					20			
16:1	methyl palmitoleate					20							
17:0	methyl heptadecanoate									20			20
18:0	methyl stearate	20			20					20	20		
18:1	methyl oleate	20				20							
18:2	methyl linoleate	20											
18:3	methyl linolenate	20											
19:0	methyl nonadecanoate									20	20		20
20:0	methyl arachidate				20		20			20	20		
20:1	methyl eicosenoate					20	20						
20:2	methyl eicosadienoate						20						
20:3	methyl homo gamma linolenate						20						
20:4	methyl arachidonate						20						
21:0	methyl heneicosanoate										20		20
22:0	methyl behenate				20						20		
22:1	methyl erucate					20							
24:0	methyl lignocerate				20								
24:1	methyl nervonate					20							

## Restek's Customer Response Team



(L to R) Seated: Sherri Comly, Sharon Paloskey;  
Standing: Cindy Ross, Kim Holliday, Tracy Hazenstab

*Satisfying your needs is our number one priority!* The recent expansion of our Customer Response Team gives you a 24-hour turnaround from the time we receive a literature request until it ships out the door. We continually update our database with information about your communications, so we can meet your specific needs more easily. Customers are contacted through our follow-up program to keep them informed and to ensure that overnight shipments were delivered on time. We also schedule and organize our technical service department and act as a liaison for our outside technical sales people.

Whether your chromatography problem is simple or complex, call the Customer Response Team and we will do everything we can to help you find a solution.

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**Other Trademarks:** Innowax (HP), Carbowax (Union Carbide Corp.), NUKOL (Supelco), SUPELCOWAX (Supelco), SP (Supelco), Omegawax (Supelco)



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# RESTEK CORPORATION

**Restek (U.S.):** 110 Benner Circle  
Bellefonte, PA 16823  
Phone: (800) 356-1688  
(814) 353-1300  
Fax: (814) 353-1309

**Restek France:** 1, rue Montespan  
91024 Evry Cedex  
Phone: (33) 01 60 78 32 10  
Fax: (33) 01 60 78 70 90

**Restek GmbH:** Sulzbacher Str. 15  
D-65812 Bad Soden  
Phone: 49-6196-65130  
Fax: 49-6196-62301

**Thames Restek U.K. LTD:**  
Fairacres Industrial Centre  
Dedworth Road, Windsor  
England  
Berkshire SL4 4LE  
Phone: 01753 624111  
Fax: 01753 624666

<http://www.restekcorp.com>