

Recommended Reagents for GC Derivatization

Chemically Modify Your Sample to Improve the Chromatography

Recommended Reagents for GC Derivatization			
Compound	Type of Derivative	ECD*	Possible Reagent Choices
Alcohols	Acetate		Acetic Anhydride/Pyridine
	TMS		Sil-Prep™, BSTFA/TMCS
	<i>t</i> -Butyl Dimethyl Silyl Ether		<i>t</i> -Butyl-DMCS/Imidazole, MTBSTFA
Aldehydes	Dimethyl Acetal		DMF/DMA
Amines	TMS		Sil-Prep™
	Acetate		Pyridine-Plus
Amine (Primary and Secondary)	Acetate		Acetic Anhydride/Pyridine
	TMS		MSHFBA
Amino Acids	TMS		BSTFA
	HFB-Isobutyl Ester		HFB-IBA Kit
	Trifluoroacetate	X	Trifluoroacetic Anhydride
Bile Acids	Acetate		Pyridine-Plus
Carbohydrates	Acetate		Acetic Anhydride/Pyridine
	TMS		Power Sil-Prep™
Catecholamines	Trifluoroacetate	X	<i>N</i> -(Trifluoroacetyl)imidazole
Drugs:			
Alkaloids	Heptafluorobutyrate	X	Heptafluorobutyric Anhydride
	TMS		MSTFA, Sil-Prep™
Antibiotics	TMS		Sil-Prep™, Power Sil-Prep™
Anticonvulsants	TMS		MSTFA, BSA/TMCS
Barbiturates	<i>N</i> -Methyl		Barb-Prep™
	Dimethyl Ketal		DMF/DMA
Cannabinoids	Trifluoroacetate	X	<i>N</i> -(Trifluoroacetyl)imidazole
	TMS		BSTFA, MSTFA
Estrogens	Acetate		Pyridine-Plus
Fatty Acids:			
C9 and Longer	Methyl Ester		Methanolic HCl, Meth-Prep™ I
Short Chain (Up to C8)	TMS		MSTFA
	Methyl Ester		Methanolic HCl, Meth-Prep™ I
Glycerides (mono and di)	Acetate		Acetic Anhydride/Pyridine
Glycerides (mono, di, and tri)	Methyl Ester		Sodium Methoxide/Methanol, Meth-Prep™ II
Glycolipids, Sphingolipids	Methyl Ester		Sodium Methoxide/Methanol, Meth-Prep™ II
Hydroxyamines	TMS		BSTFA
Hydroxy Groups (Primary/Secondary)	Heptafluorobutyrate	X	Heptafluorobutylimidazole
	Trifluoroacetate	X	<i>N</i> -(Trifluoroacetyl)imidazole
17-Ketosteroids	TMS		DMF-Sil-Prep™
Phenols	Heptafluorobutyrate	X	Heptafluorobutyric Anhydride
	TMS		BSTFA
	Methyl Esters		DMF/DMA
Polyols	TMS		Sil-Prep™, Power Sil-Prep™
Steroids	TMS		Sil-Prep™
	Acetate		Pyridine-Plus
	Trifluoroacetate	X	Trifluoroacetic Anhydride

*Derivatives suitable for use with Electron Capture Detector (ECD).

tech tip

When do you use derivatization?

When you need to:

1. Increase or decrease the volatility of the analytes to improve separation
2. Improve peak symmetry by reducing interaction of sample and column
3. Increase detector response (i.e., ECD)
4. Enhance thermal stability

technical assistance

Contact Tech Support: Phone: 1.800.255.8324 (North America)

Email: contact.alltech@grace.com

Online: www.discoverysciences.com

Ready-To-Use Silylation Mixes

Silylation replaces an active hydrogen atom (-OH, -NH₂, -NHR, -SH) with a silyl group. Generally, it reduces the polarity of the compound and decreases possibility of hydrogen bonding.



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Sil-Prep™ (HMDS:TMCS:pyridine) Reagents

- General purpose reagent for making TMS derivatives

Sil-Prep™

Description	Qty.	Part No.
Sil-Prep™	10 x 1mL	18013

tech tip

Silylation Reagent Strength



HMDS
TMCS
Sil-Prep™
MSTFA
MSHFBA
BSA
BSTFA
TMSIM
BSTFA +1% TMCS
POWER Sil-Prep™

t-Butyldimethylchlorosilyl/Imidazole Reagents

- Derivatives of alcohols are more stable than TMS ethers to hydrolysis

t-Butyldimethylchlorosilyl/Imidazole

Description	Qty.	Part No.
t-BuDMCS/Imidazole	10 x 1mL	18028

POWER Sil-Prep™ (TMSIM:BSA:TMCS) Reagents

- Powerful reagent for sterically hindered groups

POWER Sil-Prep™

Description	Qty.	Part No.
POWER Sil-Prep™	10 x 1mL	18012

DMF Sil-Prep™ (HMDS:TMCS:DMF) Reagents

- Prevents enolization of keto groups

DMF Sil-Prep™

Description	Qty.	Part No.
DMF Sil-Prep™	10 x 1mL	18015

tech tip

What are the requirements for a good reagent?

It will:

1. Not cause any rearrangements or structural changes in the analyte
2. Produce a reaction that is 95–100% complete
3. Produce a stable derivative
4. Not contribute to loss of sample during the reaction
5. Produce a derivative that is inert to the column and connections
6. Not produce interfering byproducts

related product

Looking for a Safe and Easy Way to Open Ampoules?

Try the Ampule Cracker.
See page 380.



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Individual Silylation Reagents

BSA [*N,O*-bis(trimethylsilyl)acetamide]

- Powerful silylating reagent and solvent for polar compounds

BSA

Description	Qty.	Part No.
BSA	10mL	18056
BSA	25mL	18057
BSA	10 x 1mL	18034

BSTFA [*N,O*-bis(trimethylsilyl)trifluoroacetamide]

- More volatile reagent and byproducts compared to BSA
- Powerful silylating reagent; even more effective combined with TMCS as a catalyst

BSTFA

Description	Qty.	Part No.
BSTFA	10mL	18085
BSTFA	10 x 1mL	18040
BSTFA + 1% TMCS	10mL	18087
BSTFA + 1% TMCS	10 x 1mL	18089

CMDMCS

- Longer retention times than TMCS derivatives
- Enhanced ECD response

CMDMCS

Description	Qty.	Part No.
CMDMCS	5mL	18031

DMCS (Dimethylchlorosilane)

- DMS derivatives are more sensitive to hydrolysis than TMS derivatives

DMCS

Description	Qty.	Part No.
DMCS	3 x 10mL	18071

HMDS (Hexamethyldisilazane)

- Slow and inefficient used alone
- Very effective in combination with TMCS

HMDS

Description	Qty.	Part No.
HMDS	25mL	18069
HMDS	10 x 1mL	18003

MSHFBA [*N*-Methyl-*N*-trimethylsilylheptafluorobutyramide]

- Similar to MSTFA but does not produce harmful deposits in FID

MSHFBA

Description	Qty.	Part No.
MSHFBA	10mL	214610
MSHFBA	20 x 1mL	2146201

MSTFA

(*N*-Methyl-*N*-trimethylsilyltrifluoroacetamide)

- Ideal reagent for drug analysis because excess reagent and byproducts elute during solvent delay
- May be used directly on HCl salts of compounds

MSTFA

Description	Qty.	Part No.
MSTFA	10mL	18061
MSTFA	1 x 1mL	18038

MTBSTFA [*N*-(*tert*-butyldimethylsilyl)-*N*-methyltrifluoroacetamide]

- Derivatives more stable than common TMS derivatives
- Produces a distinct M-57 ion in GC/MS analysis
- Even more effective when combined with TBDMCS as a catalyst

MTBSTFA

Description	Qty.	Part No.
MTBSTFA	10 x 1mL	18097
MTBSTFA	10mL	18102
MTBSTFA + 1% TBDMCS	10 x 1mL	18155
MTBSTFA + 1% TBDMCS	10mL	18148

TMCS (Trimethylchlorosilane)

- Similar to HMDS when used alone
- Very effective as a catalyst to other reagents

TMCS

Description	Qty.	Part No.
TMCS	3 x 10mL	18091
TMCS	10 x 1mL	18084

TMSIM (*N*-Trimethylsilylimidazole)

- Preferentially silylates hydroxyl groups
- Best silylation reagent when water is present

TMSIM

Description	Qty.	Part No.
TMSIM	10 x 1mL	18050

Glass Conditioning Reagent

Glass-Prep™ (5% DMDCS in toluene)

- Deactivate any glass surface

Glass-Prep™

Description	Qty.	Part No.
Glass-Prep™	100mL	9700
Glass-Prep™	400mL	2233
DMDCS, Neat	10 x 5mL	18090

Alkylation (Esterification) Reagents

Alkylation replaces an acidic hydrogen (carboxylic acids, phenols) with an alkyl group. Alkyl esters are extremely stable and can be stored for long periods of time.

Meth-Prep™ I

- On-column derivatization
- Aqueous solution does not give solvent peak

Meth-Prep™ I is a 0.2N aqueous solution of (m-trifluoromethylphenyl) trimethylammonium hydroxide. When the reagent is mixed with fatty acids and then injected into a GC injector at 240°C, the methyl esters are formed along with the by-product, m-trifluoromethylphenyl dimethylamine. The reaction is clean, fast, and quantitative. Meth-Prep™ I, being in aqueous solution, does not give a solvent peak. This may be advantageous in some cases.

Meth-Prep™ I

Description	Qty.	Part No.
Meth-Prep™ I	10 x 1mL	18005

Instant Methanolic HCl Reagent Kit

- Acid catalyzed esterification of alcohols
- Reagent is generated before use and is stable for one week at room temperature

Instant Methanolic HCl Reagent Kit

Description	Qty.	Part No.
Instant Methanolic HCl Reagent Kit	ea	18053
Anhydrous Acetyl Chloride	5 x 2.8mL	18095
Anhydrous Methanol	10 x 5mL	18157



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related product
Looking for syringes to use with reagents?
See page 337–342.

Transesterification Reagents

Transesterification is the process of converting one type of ester into another. Most commonly this is a very large ester (i.e., triglycerides, steryl esters, wax esters, phospholipids) converted into a methyl ester that is more easily analyzed.

Meth-Prep™ II

- In one step forms fatty acid methyl esters from triglycerides at room temperature
- Requires no extraction before injecting into GC
- Faster than sodium methoxide reagents

Meth-Prep™ II is a 0.2N methanolic solution of m-trifluoromethylphenyl trimethylammonium hydroxide. This one-step reagent simplifies the transesterification of triglycerides to methyl esters. It is faster than sodium methoxide and the reaction occurs at room temperature. This quantitative reaction requires no extractions or additional treatment prior to gas chromatographic analysis.

Meth-Prep™ II

Description	Qty.	Part No.
Meth-Prep™ II	10 x 1mL	18007

Sodium Methoxide/Methanol

- Converts a wide range of large esters to fatty acid methyl esters

Sodium Methoxide/Methanol

Description	Qty.	Part No.
Sodium Methoxide/Methanol	10 x 5mL	18018
Sodium Methoxide/Methanol	25mL	218025

related product

Looking for amino acid derivatization kits?
See page 63.

technical assistance

Contact Tech Support: Phone: 1.800.255.8324 (North America)
Email: contact.alltech@grace.com
Online: www.discoverysciences.com

Acylation

Acylation reduces the polarity of amino, hydroxyl and thiol groups on multi-functional molecules such as carbohydrates and amino acids.

Acetic Anhydride/Pyridine

- Used for acetylation of alcoholic and phenolic hydroxyl groups; and primary and secondary amino groups

Acetic Anhydride/Pyridine

Description	Qty.	Part No.
Acetic Anhydride/Pyridine Kit	ea	18100
Acetic Anhydride	10 x 1mL	18103

Pyridine-Plus

- Much more powerful than acetic anhydride/pyridine
- Rapid reaction and fewer byproducts

Pyridine-Plus

Description	Qty.	Part No.
Pyridine-Plus Kit	ea	18105

Fluorinated Imidazoles

- No acidic byproducts compared to anhydride reagents

Fluorinated Imidazoles

Description	Qty.	Part No.
TFAI (<i>N</i> -Trifluoroacetylimidazole)	10 x 0.2g	18046
HFBI (<i>N</i> -Heptafluorobutyrylimidazole)	10 x 0.2g	18048

Perfluoroalkyl Anhydrides

- Produces derivatives suitable to electron capture detection

Perfluoroalkyl Anhydrides

Description	Qty.	Part No.
Trifluoroacetic Anhydride	5 x 1mL	18083
Pentafluoropropionic Anhydride	25g	65192
Pentafluoropropionic Anhydride	5 x 1mL	18116
Heptafluorobutyric Anhydride	25g	63163
Heptafluorobutyric Anhydride	5 x 1mL	18118



4758

related products

Looking for reaction vials to use with reagents? See page 375.

Specialty Reagents

Amino Acid Derivatization Kits

- Simple two-step procedure
- Three different reagents available: TFA, PFP, and HFB

Amino Acid Derivatization Kits

Description	Qty.	Part No.
TFA-IPA Derivatization Kit	ea	18092
PFP-IPA Derivatization Kit	ea	18093
HFB-IPA Derivatization Kit	ea	18094

Barb-Prep™

- On-column methylation of barbiturates
- No byproduct formation

Barb-Prep™

Description	Qty.	Part No.
Barb-Prep™	10 x 1mL	18009

DMF-DMA

- Novel reagent for derivatization of fatty acids, amino acids, amines, and barbiturates

DMF-DMA

Description	Qty.	Part No.
DMF-DMA	10 x 1mL	18051

LC Reagents

UV Enhancing

UV Enhancing

Description	Qty.	Part No.
<i>p</i> -Bromophenacyl Derivatization Kit	—	18036
<i>p</i> -Nitrobenzyloxyamine HCl (PNBA)	1g	510113

Fluorescence Enhancing

Fluorescence Enhancing

Description	Qty.	Part No.
<i>o</i> -Phthalaldehyde (OPA)	5g	35606

IPC™ Reagents

- Comparable to Waters® PIC® Reagents
- Preformulated at optimum concentration and pH
- Convenient—Simply dilute with HPLC grade solvents

“A” Series

- Used for chromatography of acidic compounds

“B” Series

- Used for chromatography of basic compounds

A Series and B Series

Description	Qty.	Part No.
IPC™ A, Tetrabutylammonium Phosphate	5 x 15mL	185101
IPC™ B5, Sodium Pentanesulfonate	5 x 25mL	185110
IPC™ B7, Sodium Heptanesulfonate	5 x 25mL	185103

“Low UV”* Series

- Suitable for use at wavelengths down to 200nm

Low UV Series

Description	Qty.	Part No.
Low UV IPC™ A, Tetrabutylammonium Sulfate	5 x 20mL	185149
Low UV IPC™ B5, Tetrabutylammonium Phosphate	5 x 20mL	184198
Low UV IPC™ B6, Tetrabutylammonium Phosphate	5 x 20mL	184199
Low UV IPC™ B7, Tetrabutylammonium Phosphate	5 x 20mL	184282
Low UV IPC™ B8, Tetrabutylammonium Phosphate	5 x 20mL	184283

*For use at wavelengths below 240nm.

Ion-Pair Salts

Grace offers high-purity ion-pairing salts for those wishing to formulate their own mobile phases.

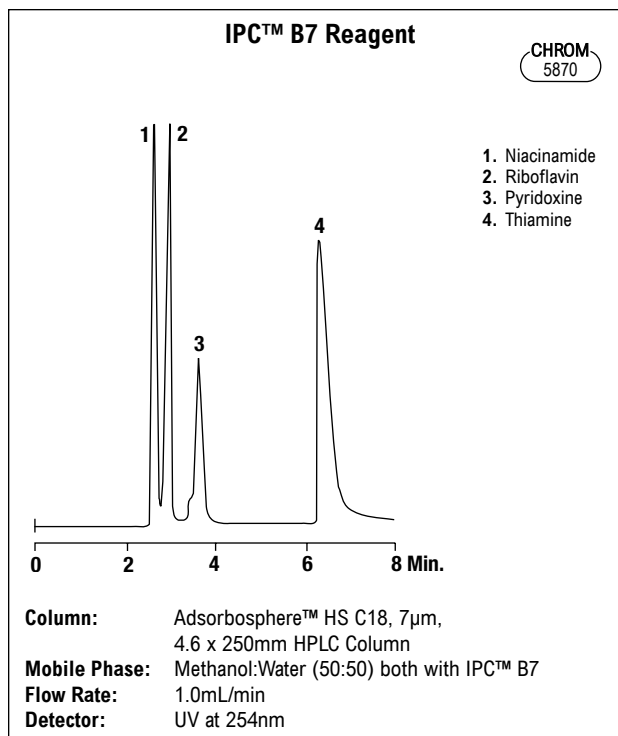
- High purity for HPLC applications

Ion-Pair Salts

Description	Qty.	Part No.
1-Pentanesulfonate	25g	403125
1-Hexanesulfonate	25g	403126
1-Heptanesulfonate	25g	403127
1-Octanesulfonate	25g	403128
Tetrabutylammonium Phosphate, 0.5M, pH 7.5)	10mL	680502

Table 1—IPC™ Reagents

Grace	Waters
IPC™ A	PIC® A
IPC™ B5	PIC® B5
IPC™ B6	PIC® B6
IPC™ B7	PIC® B7
IPC™ B8	PIC® B8
Low UV IPC™ A	Low UV PIC® A
Low UV IPC™ B5	Low UV PIC® B5
Low UV IPC™ B6	Low UV PIC® B6
Low UV IPC™ B7	Low UV PIC® B7
Low UV IPC™ B8	Low UV PIC® B8



related products

Looking for mobile phase storage bottles?
See page 125–127.

5595

Gas Standards

- Portable, lightweight, and easy-to-use disposable cylinders
- Each standard comes with a certificate of analysis



6346
MicroMAT™-10
10L Disposable Cylinder



6347
MicroMAT™-14
14L Disposable Cylinder



6675
MicroMAT™-58
58L Disposable Cylinder

Single Component Gas Standards

Single Component Mixtures

Analyte/Concentration	Balance	Cylinder Size	Part No.
<i>Acetylene</i>			
1%	Helium	MicroMAT™-10	G0413
1%	Nitrogen	MicroMAT™-10	G0423
<i>Argon</i>			
99.995%	—	MicroMAT™-14	M7003
<i>Carbon Dioxide</i>			
99.80%	—	MicroMAT™-14	M7006
100ppm	Helium	MicroMAT™-10	G1211
1000ppm	Helium	MicroMAT™-10	G1212
1%	Helium	MicroMAT™-10	G1213
10%	Helium	MicroMAT™-10	G1214
<i>Carbon Monoxide</i>			
1000ppm	Helium	MicroMAT™-10	24047
10%	Helium	MicroMAT™-10	24054
<i>Ethane</i>			
99.00%	—	MicroMAT™-14	M7012
<i>Ethylene</i>			
100ppm	Helium	MicroMAT™-10	G0311
100ppm	Helium	MicroMAT™-14	M7030
1000ppm	Helium	MicroMAT™-10	G0312
1000ppm	Nitrogen	MicroMAT™-14	24022
8-10ppm	Air	MicroMAT™-14	24096
<i>Helium</i>			
99.995%	—	MicroMAT™-14	M7005
<i>Hydrogen</i>			
99.99%	—	MicroMAT™-14	M7004
100ppm	Nitrogen	MicroMAT™-14	M7125
1000ppm	Nitrogen	MicroMAT™-10	G1522
1%	Nitrogen	MicroMAT™-10	G1523
<i>Nitrogen</i>			
99.998%	—	MicroMAT™-14	M7002

Single Component Mixtures

Analyte/Concentration	Balance	Cylinder Size	Part No.
<i>Nitrous Oxide</i>			
98.00%	—	MicroMAT™-14	M7009
0.1ppm	Nitrogen	MicroMAT™-14	24042
1.0ppm	Nitrogen	MicroMAT™-14	24044
100ppm	Nitrogen	MicroMAT™-10	G1721
1000ppm	Nitrogen	MicroMAT™-10	G1722
<i>Methane</i>			
99.00%	—	MicroMAT™-14	M7011
100ppm	Helium	MicroMAT™-10	G0111
1000ppm	Helium	MicroMAT™-10	G0112
1%	Helium	MicroMAT™-10	G0113
10%	Helium	MicroMAT™-14	24066
100ppm	Nitrogen	MicroMAT™-14	M7029
1%	Nitrogen	MicroMAT™-10	G0123
10%	Nitrogen	MicroMAT™-14	24067
10ppm	Air	MicroMAT™-14	19781
<i>Oxygen</i>			
99.5%	—	MicroMAT™-14	M7001
100ppm	Helium	MicroMAT™-14	M7121
1%	Helium	MicroMAT™-10	G1613
1%	Nitrogen	MicroMAT™-10	G1623
2%	Nitrogen	MicroMAT™-14	24094
6%	Nitrogen	MicroMAT™-14	24095
10%	Nitrogen	MicroMAT™-10	G1624
<i>Propane</i>			
99.00%	—	MicroMAT™-14	M7014
<i>Vinyl Chloride (NIST Traceable)</i>			
10ppm	Nitrogen	MicroMAT™-14	G2001
1000ppm	Nitrogen	MicroMAT™-14	G2004

Multi-Component Gas Mixtures

Multi-Component Gas Mixtures

Description	Concentration	Cylinder Size	Part No.
<i>BTEX in Nitrogen</i>			
Benzene, Ethylbenzene, Toluene, Xylene	1ppm (mix)	MicroMAT™-58	24076
	10ppm (mix)	MicroMAT™-58	24099
	100ppm (mix)	MicroMAT™-58	24115
<i>C₂ to C₄ Alkyne in Nitrogen</i>			
Acetylene, 1-Butyne, 2-Butyne, Propyne	15ppm each	MicroMAT™-10	19797
<i>C₁ to C₄ Hydrocarbons in Nitrogen</i>			
Methane, Ethane, Ethylene, Acetylene, Propane, Propylene, Propyne, <i>n</i> -Butane	15ppm each	MicroMAT™-14	24130
<i>C₄ Hydrocarbons in Nitrogen</i>			
<i>n</i> -Butane, Isobutane, 2-Butene (<i>cis</i> and <i>trans</i>), 1-Butene, Isobutylene, 1,3-Butadiene, Ethyl Acetylene	15ppm each	MicroMAT™-14	24132
<i>2-Olefin Mixture in Nitrogen</i>			
2-Butene (<i>cis</i> and <i>trans</i>), 2-Pentene (<i>cis</i> and <i>trans</i>), 2-Hexene (<i>cis</i> and <i>trans</i>)	15ppm each	MicroMAT™-14	19775
<i>C₂ to C₆ Olefin Mixture in Helium</i>			
Ethylene, Propylene, 1-Butene, 1-Pentene, 1-Hexene	100ppm each	MicroMAT™-14	19784
	1000ppm each	MicroMAT™-14	M7020
<i>C₂ to C₆ Olefin Mixture in Nitrogen</i>			
Ethylene, Propylene, 1-Butene, 1-Pentene, 1-Hexene	1000ppm each	MicroMAT™-14	M7019
<i>C₁ to C₆ n-Paraffin Mixture in Helium</i>			
Methane, Ethane, Propane, Butane, Pentane, Hexane	100ppm each	MicroMAT™-14	19782
	1000ppm each	MicroMAT™-14	M7018
<i>C₁ to C₆ n-Paraffin Mixture in Nitrogen</i>			
Methane, Ethane, Propane, Butane, Pentane, Hexane	15ppm each	MicroMAT™-14	19772
	100ppm each	MicroMAT™-14	19783
	1000ppm each	MicroMAT™-14	M7017
<i>Branched Paraffin Mixture in Nitrogen</i>			
Isobutane, 2-Methylbutane, 2,2-Dimethylpropane, 2-Methylpentane, 3-Methylpentane, 2,2-Dimethylbutane	15ppm each	MicroMAT™-14	19774
<i>CO and CO₂ in Nitrogen</i>			
Carbon Monoxide, Carbon Dioxide	25ppm (CO), 1000ppm (CO ₂)	MicroMAT™-14	24136
<i>CO, CO₂, Methane, Ethane, Ethylene, Acetylene in Nitrogen</i>			
	1% each	MicroMAT™-14	M7035
<i>CO, CO₂, Methane, H₂, O₂ in Nitrogen</i>			
	1% each	MicroMAT™-14	M7036
<i>CO, CO₂, CH₄, H₂, O₂, N₂ in Helium</i>			
Carbon Monoxide, Carbon Dioxide, Methane, Hydrogen, Oxygen, Nitrogen	5% (CO), 5% (CO ₂), 4% (CH ₄), 4% (H ₂), 5% (O ₂), 5% (N ₂)	MicroMAT™-14	19792
<i>CO, CO₂, O₂ in Nitrogen</i>			
Carbon Monoxide, Carbon Dioxide, Oxygen	7% (CO), 15% (CO ₂), 3% (O ₂)	MicroMAT™-14	M7041
<i>CO, CO₂, CH₄, O₂ in Nitrogen</i>			
Carbon Monoxide Carbon Dioxide, Methane, Oxygen	7% (CO), 15% (CO ₂), 4.5% (CH ₄), 7% (O ₂)	MicroMAT™-14	19791
<i>CO, CO₂, H₂, O₂ in Nitrogen</i>			
	0.5% each	MicroMAT™-14	24138
	0.5% each (CO, CO ₂ , O ₂), 5% H ₂	MicroMAT™-14	M7037
<i>CO₂, O₂ in Nitrogen</i>			
	1% each	MicroMAT™-14	24029
	1% (CO ₂), 2% (O ₂)	MicroMAT™-14	M7040
	2% (CO ₂), 24% (O ₂)	MicroMAT™-14	24034

Special Gas Standards

Reactive Gas Standards

Reactive Gas Standards			
Description	Concentration	Cylinder Size	Part No.
Hydrogen Sulfide in Nitrogen	10ppm	MicroMAT™-58	24102
	95ppm	MicroMAT™-58	24105
Nitric Oxide in Nitrogen	20-30ppm	MicroMAT™-58	24107

Natural Gas Standards

- Certificate of analysis
- Shelf life one year

Natural Gas Standards Concentrations				
	GPA	Calorimetric	High Ethane	Helium-Enriched
Helium	0.50	—	—	2.00
Nitrogen	5.00	2.50	9.00	1.60
Carbon Dioxide	1.00	3.00	0.50	0.20
Ethane	9.00	3.50	12.50	3.00
Propane	6.00	1.00	7.00	1.70
Isobutane	3.00	0.40	3.00	1.00
<i>n</i> -Butane	3.00	0.40	3.00	1.00
Isopentane	1.00	0.15	0.50	0.30
<i>n</i> -Pentane	1.00	0.15	0.50	0.30
Neopentane	—	0.10	—	—
<i>n</i> -Hexane	—	0.05	—	—
<i>n</i> -Heptane	—	0.02	—	—
Methane	Balance	Balance	Balance	Balance

Natural Gas Standards

Description	Concentration	Cylinder Size	Part No.
Natural Gas GPA Standard	See above	MicroMAT™-14	24100
Natural Gas Calorimetric Standard	See above	MicroMAT™-14	24116
Natural Gas High Ethane Standard	See above	MicroMAT™-14	24128
Natural Gas Helium-Enriched Standard	See above	MicroMAT™-14	24131

related product

Looking for GASTIGHT™ syringes?

See pages 339–340.



5156

Hardware for Using Gas Cylinders

MicroMAT™-10 Syringe Adapter

- Maximum pressure 120psig



5386

MicroMAT™-10 Syringe Adapter

MicroMAT™-10 Syringe Adapter

Description	Cylinder Size	Part No.
Aerosol Syringe Adapter	MicroMAT™-10	8048
Replacement Septa, 12/pk	—	75801

MicroMAT™-14 Syringe Adapter

- Maximum pressure 240psig
- May be used with any 1/8" NPT (F) outlet



5385

MicroMAT™-14 Syringe Adapter

MicroMAT™-14 Syringe Adapter

Description	Cylinder Size	Part No.
Syringe Adapter	MicroMAT™-14	8810
Replacement Septa, 10/pk	—	8812

MicroMAT™-58 Regulator

- Stainless steel with hose barb outlet
- Push button on/off control
- Preset 0.3SLPM flow rate



6674

MicroMAT™-58 Regulator

MicroMAT™-58 Regulator

Description	Cylinder Size	Part No.
0–30psig, C-10 Valve	MicroMAT™-58	37201

Fatty Acid and Methyl Ester Standards

- Quality certificate supplied with every standard and mix

Fatty Acid and Methyl Ester Standards

Carbon #	Description	Free Fatty Acids		Fatty Acid Methyl Esters	
		Qty.	Part No.	Qty.	Part No.
11:0	Henedecanoic Acid (Undecylic)	0.5g	622110	0.5g	623110
12:0	Dodecanoic Acid (Lauric)	1g	622120	1g	623120
13:0	Tridecanoic Acid (Tridecylic)	1g	622130	1g	623130
14:0	Tetradecanoic Acid (Myristic)	1g	623140	1g	623140
15:0	Pentadecanoic Acid (Pentadecylic)	0.5g	622150	0.5g	623150
16:0	Hexadecanoic Acid (Palmitic)	1g	622160	1g	623160
16:1	<i>cis</i> -9-Hexadecenoic Acid (Palmitoleic)	0.1g	6221610	0.1g	6231610
17:0	Heptadecanoic Acid (Margaric)	1g	622170	1g	623170
18:0	Octadecanoic Acid (Stearic)	1g	622180	1g	623180
18:1	<i>cis</i> -9-Octadecenoic Acid (Oleic)	1g	6221810	1g	6231810
18:1	<i>trans</i> -9-Octadecenoic Acid (Elaidic)	1g	6221811	0.5g	6231811
18:1	<i>cis</i> -11-Octadecenoic Acid (<i>cis</i> -Vaccenic)	—	—	0.1g	62318101
18:1	<i>trans</i> -11-Octadecenoic Acid (<i>trans</i> -Vaccenic)	—	—	0.1g	62318121
18:2	<i>cis, cis</i> -9,12-Octadecadienoic Acid (Linoleic)	1g	6221820	1g	6231820
18:2	<i>trans,trans</i> -9,12-Octadecadienoic Acid (Linoelaidic)	0.1g	6221821	0.1g	6231821
18:3	All <i>cis</i> -9,12,15-Octadecatrienoic Acid (Linolenic)	0.1g	62218300	0.1g	6231830
18:3	All <i>cis</i> -6,9,12-Octadecatrienoic Acid (γ -Linolenic)	0.1g	62218301	0.1g	6231831
20:0	Eicosanoic Acid (Arachidic)	1g	6220200	1g	623200
20:1	<i>cis</i> -11-Eicosenoic Acid	0.1g	6220201	0.1g	623201
20:4	All <i>cis</i> -5,8,11,14-Eicosatetraenoic Acid (Arachidonic)	0.1g	6220204	0.1g	623204
20:5	All <i>cis</i> -5,8,11,14,17-Eicosapentaenoic Acid	10mg	6220205	10mg	623205
22:0	Docosanoic Acid (Behenic)	1g	6220220	1g	623220
22:5	All <i>cis</i> -7,10,13,16,19-Docosapentaenoic Acid	10mg	6220225	10mg	6232250
23:0	Tricosanoic Acid	0.1g	6220230	0.1g	623230
24:0	Tetracosanoic Acid (Lignoceric)	0.1g	6220240	0.1g	623240

Fatty Acid Methyl Ester Mixes

Description	Components	Qty.	Part No.
K101	C8:0, C10:0, C12:0, C14:0, C16:0, C18:0, C20:0	100mg	625001
K103	C12:0, C14:0, C14:1, C16:0, C16:1 <i>cis</i>	50mg	625002
K1000	C13:0, C15:0, C17:0, C19:0, C21:0	50mg	625003
K104	C14:0, C16:0, C18:0, C20:0, C22:0, C24:0	100mg	625004
K110	C16:0, C16:1 <i>cis</i> , C16:1 <i>trans</i> , C18:0, C18:1 <i>cis</i> -9, C18:1 <i>trans</i> -9, C18:2 <i>cis,cis</i> , C18:2 <i>trans,trans</i>	100mg	625005
K108	C16:0, C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i>	50mg	625006
K2000	C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i> , C20:4 all <i>cis</i>	50mg	625007
K3000	C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i> , C20:4 all <i>cis</i> , C22:6 all <i>cis</i>	50mg	625008
K4000	C20:0, C20:1 <i>cis</i> , C20:2 <i>cis,cis</i> , C20:3 all <i>cis</i> , C20:4 all <i>cis</i>	50mg	625009
K107	C20:0, C20:1 <i>cis</i> , C22:0, C22:1 <i>cis</i> , C24:0, C24:1 <i>cis</i>	50mg	625010
K5000 Mix A	C6:0, C8:0, C10:0, C12:0	100mg in 5mL	625017
K5000 Mix B	C12:0, C14:0, C16:0, C18:0	100mg in 5mL	625018
L207	C18:0, C18:1 <i>cis</i> -9, C20:0, C22:0, C22:1 <i>cis</i> , C24:0, C24:1 <i>cis</i>	50mg	625021
L205	C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i> , C20:4 all <i>cis</i>	100mg	625022
L209	C20:0, C20:1 <i>cis</i> , C20:4 all <i>cis</i> , C22:1 <i>cis</i> , C22:6 all <i>cis</i>	25mg	625023
AOCS Mix 1	C16:0, C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i> , C20:0	50mg	625024
AOCS Mix 3	C16:0, C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i> , C20:0, C22:0, C22:1 <i>cis</i> , C24:0	50mg	625026
AOCS Mix 3A	C16:0, C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i> , C20:0, C20:1 <i>cis</i> , C22:0, C22:1 <i>cis</i> , C24:0	25mg	625027
AOCS Mix 5	C8:0, C10:0, C12:0, C14:0, C16:0, C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i>	50mg	625029
AOCS Mix 6	C14:0, C16:0, C16:1 <i>cis</i> , C18:0, C18:1 <i>cis</i> -9, C18:2 <i>cis,cis</i> , C18:3 all <i>cis</i>	50mg	625030

Hydrocarbons and Miscellaneous Standards and Kits

- Quality certificate supplied with every standard and mix

Use Standards and Mixes with complete confidence in purity and quality. Don't waste your valuable lab time to verify the standards you need. To satisfy your documentation needs, Grace supplies a purity certificate for every standard and mix.

Organic Acid Standards

Description	Qty.	Part No.
Oxalic Acid, 1000ppm	125mL	37033
Maleic Acid, 1000ppm	125mL	37037
Malic Acid, 1000ppm	125mL	37039
Succinic Acid, 1000ppm	125mL	37043
Formic Acid, 1000ppm	125mL	37045
Acetic Acid, 1000ppm	125mL	37047
Citric Acid, 1000ppm	125mL	37049
Tartaric Acid, 1000ppm	125mL	37051
Lactic Acid, 1000ppm	125mL	37053
Abietic Acid, 1000ppm	125mL	37055
Methane Sulfonic Acid, 1000ppm	125mL	37057

n-Paraffin Mixtures

Description	Qty.	Part No.
<i>Neat Mixtures (No Solvent—Equal Weights of Components)</i>		
C5, C6, C7, C8	2mL	628001
C7, C8, C9, C10	2mL	628002
C9, C10, C11, C12	2mL	628003
C11, C12, C13, C14	2mL	628004
C12, C14, C16, C18	2mL	628005
<i>Mixtures (In 5mL Hexane—Equal Weight of Components)</i>		
C16, C18, C20, C22	0.5g	628006
C20, C22, C24, C26	0.1g	628007
C24, C26, C28, C30	50mg	628008
C28, C30, C32, C34	50mg	628009
C32, C34, C36, C38	50mg	628010

Hydrocarbons (n-Paraffins)

Carbon No.	Description	Qty.	Part No.
C5	<i>n</i> -Pentane	1g	620050
C6	<i>n</i> -Hexane	1g	620060
C7	<i>n</i> -Heptane	1g	620070
C8	<i>n</i> -Octane	1g	620080
C9	<i>n</i> -Nonane	1g	620090
C10	<i>n</i> -Decane	1g	620100
C11	<i>n</i> -Hendecane	1g	620110
C12	<i>n</i> -Dodecane	1g	620120
C13	<i>n</i> -Tridecane	1g	620130
C14	<i>n</i> -Tetradecane	1g	620140
C15	<i>n</i> -Pentadecane	1g	620150
C16	<i>n</i> -Hexadecane	1g	620160
C17	<i>n</i> -Heptadecane	1g	620170
C18	<i>n</i> -Octadecane	1g	620180
C19	<i>n</i> -Nonadecane	1g	620190
C20	<i>n</i> -Eicosane	1g	620200
C21	<i>n</i> -Heneicosane	1g	620210
C22	<i>n</i> -Docosane	1g	620220
C23	<i>n</i> -Tricosane	1g	620230
C24	<i>n</i> -Tetracosane	1g	620240
C25	<i>n</i> -Pentacosane	0.1g	620250
C26	<i>n</i> -Hexacosane	0.1g	620260
C27	<i>n</i> -Heptacosane	0.1g	620270
C28	<i>n</i> -Octacosane	1g	620280
C29	<i>n</i> -Nonacosane	0.1g	620290
C30	<i>n</i> -Triacontane	0.1g	620300
C32	<i>n</i> -Dotriacontane	0.1g	620320
C34	<i>n</i> -Tetracontane	0.1g	620340
C36	<i>n</i> -Hexatriacontane	0.1g	620360
C38	<i>n</i> -Octatriacontane	0.1g	620380
C40	<i>n</i> -Tetracontane	0.1g	620400
C44	<i>n</i> -Tetratetracontane	0.1g	620440

Aromatic Hydrocarbon Mix

Description	Qty.	Part No.
BETX Mix	2g	629001

Contains equal amounts of benzene, toluene, ethylbenzene, *o*-xylene, *m*-xylene, and *p*-xylene.

Standards Kits

Description	Kit Contains 100mg Each Component	Part No.
<i>Free Fatty Acid Kits</i>		
Short Chain	C2, C3, C4, C5, C6, C7, C8	18600
Even Carbon	C10, C12, C14, C16, C18, C20, C22	186021
Odd Carbon	C9, C11, C13, C15, C17, C19, C21, C23	18608
<i>Fatty Acid Ester Kits</i>		
Methyl Esters, Even Carbon	C10, C12, C14, C16, C18, C20, C22	18603
Methyl Esters, Odd Carbon	C9, C11, C13, C15, C17, C19, C21	18609
Ethyl Esters, Even Carbon	C6, C8, C10, C12, C14, C16, C18, C20, C22, C24	18610
Ethyl Esters, Odd Carbon	C7, C9, C11, C13, C15, C17, C19, C21, C23	18611
<i>Hydrocarbon Kits</i>		
Saturated, Even Carbon	C10, C12, C14, C16, C18, C20, C22, C24, C28, C32, C36	18484
Saturated, Odd Carbon	C9, C11, C13, C15, C17, C19, C21, C23, C25	18485

Alltech® IC Standards

- High purity for sensitive applications
- Prepared from NIST standard reference materials
- Certified by two independent methods
- Detailed Certificate of Analysis included



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Certified Anion and Cation Standards

Anion Standards (125mL)

Description	1000ppm Part No.	200ppm Part No.
Bromate	37058	—
Bromide	37005	37006
Chlorate	37034	—
Chloride	37009	37010
Chlorite	37038	—
Chromate	37042	—
Fluoride	37011	37012
Iodide	37013	—
Nitrate	37019	37020
Nitrate-N	37234	—
Nitrite	37021	37022
Nitrite-N	37235	—
Perchlorate	37048	—
Phosphate	37023	37024
Phosphate-P	37236	—
Sulfate	37031	37032
Thiocyanate	37046	—

Cation Standards (125mL)

Description	1000ppm Part No.	200ppm Part No.
Ammonium	37001	37002
Ammonium-N	37233	—
Calcium	37007	37008
Lithium	37015	37016
Magnesium	37017	37018
Potassium	37025	37026
Sodium	37029	37030

Certified Organic Anion Standards

Organic Anion Standards (125mL)

Description	1000ppm Part No.
Acetate	37052
Citrate	37091
Formate	37050
Glycolate	37054
Lactate	37093
Malate	37095
Maleate	37099
Methanesulfonate	37221
Nitilotriacetate (NTA)	37228
Oxalate	37056
Propionate	37229
Succinate	37223
Tartrate	37224

Certified Organic Acid Standards

Organic Acid Standards (125mL)

Description	1000ppm Part No.
Oxalic Acid	37033
Maleic Acid	37037
Malic Acid	37039
Succinic Acid	37043
Formic Acid	37045
Acetic Acid	37047
Citric Acid	37049
Tartaric Acid	37051
Lactic Acid	37053
Abietic Acid	37055
Methanesulfonic Acid	37057

Certified Amine Standards

Amine Standards (125mL)

Description	1000ppm Part No.
Ethanolamine	37225
Diethanolamine	37226
Triethanolamine	37227
Monomethylamine	37230
Dimethylamine	37231
Trimethylamine	37232

Alltech® IC Standards



Certified Multi-Standard Kits

- Cost-effective ways to purchase multiple single-ion standards

Multi-Standard Kits

Description	Part No.
<i>Anion Kits</i>	
200ppm Kit: Contains 125mL ea of 200ppm Certified Cl, F, Br, NO ₃ , NO ₂ , PO ₄ , and SO ₄	37035
1000ppm Kit: Contains 125mL ea of 1000ppm Certified Cl, F, Br, NO ₃ , NO ₂ , PO ₄ , and SO ₄	37036
Anion and Oxyhalide Kit: (EPA 300.1Part B) Contains 125mL ea of 200ppm certified Cl, F, Br, NO ₃ , NO ₂ , PO ₄ , and SO ₄ , ClO ₂ , ClO ₃ , BrO ₃	37085
<i>Cation Kits</i>	
200ppm Kit: Contains 125mL ea of 200ppm Certified Li, Na, NH ₄ , K, Mg, and Ca	37040
1000ppm Kit: Contains 125mL ea of 1000ppm Certified Li, Na, NH ₄ , K, Mg, and Ca	37041

Certified Multi-Component Mixtures

- Multiple ions in a single mixture

Multi-Component Mixtures (125mL)

Description	Part No.
<i>Anion Mixtures</i>	
Mix A: 125mL Mixture Contains: F(10ppm), Cl(20ppm), O ₂ (20ppm), Br(20ppm), NO ₃ (20ppm), PO ₄ (30ppm), SO ₄ (30ppm)	26910200
Mix 1: 125mL Mixture Contains: F(1ppm), Cl(5ppm), NO ₂ (5ppm), Br(5ppm), NO ₃ (5ppm), PO ₄ (5ppm), SO ₄ (5ppm)	269106
Mix 2: 125mL Mixture Contains: F(1ppm), Cl(10ppm), NO ₂ (10ppm), Br(10ppm), NO ₃ (10ppm), PO ₄ (10ppm), SO ₄ (10ppm)	269107
Mix 3: 125mL Mixture Contains: F(10ppm), Cl(20ppm), NO ₂ (20ppm), Br(20ppm), NO ₃ (20ppm), PO ₄ (20ppm), SO ₄ (20ppm)	269108
Mix 4: 125mL Mixture Contains: F(20ppm), Cl(40ppm), NO ₂ (40ppm), Br(40ppm), NO ₃ (40ppm), PO ₄ (40ppm), SO ₄ (40ppm)	269109
Mix 5: 125mL Mixture Contains: F(25ppm), Cl(50ppm), NO ₂ (50ppm), Br(50ppm), NO ₃ (50ppm), PO ₄ (50ppm), SO ₄ (50ppm)	269110
Mix 6: 125mL Mixture Contains: Cl(1000ppm), Br(1000ppm), NO ₃ (1000ppm), PO ₄ (1000ppm), SO ₄ (1000ppm)	269111
Mix 7: 125mL Mixture Contains: Cl(15ppm), Br(15ppm), NO ₃ (15ppm), PO ₄ (15ppm), SO ₄ (5ppm)	269112
Mix 8: 125mL Mixture Contains: F(25ppm), Cl(50ppm), SO ₄ (100ppm)	269113
<i>Cation Mixtures</i>	
Mix A: 125mL Mixture Contains: Li(0.5ppm), Na(3ppm), NH ₄ (3ppm), K(6ppm)	26910300
Mix B: 125mL Mixture Contains: Li(0.2ppm), Na(1.5ppm), NH ₄ (1.5ppm), K(2.5ppm), Mg(2.0ppm), Ca(2.0ppm)	26910400

EZ-LUTE™ Buffer Concentrates

- Simplify mobile phase preparation
- For anion, cation, and organic acid analyses
- Dilution instructions included



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EZ-LUTE™ Buffers for accurate concentrations every time.

EZ-LUTE™ Buffer Concentrates*

Description	Part No.
<i>Non-suppressed Buffers, 12 x 25mL</i>	
4mM Phthalic Acid	470217
4mM Phthalic Acid, pH 4.5	470216
4mM p-Hydroxybenzoic Acid	470212
5mM p-Hydroxybenzoic Acid	470215
7mM p-Hydroxybenzoic Acid	470214
5mM LiOH/Benzoate	470213
3mM Methanesulfonic Acid	470211
<i>Suppressor-based Buffers, 1 x 100mL</i>	
1.7mM Bicarbonate/1.8mM Carbonate	470119
2.8mM Bicarbonate/2.2mM Carbonate	470201
2.1mM Bicarbonate/1.6mM Carbonate	470203
0.85mM Bicarbonate/0.9mM Carbonate	470208
0.7mM Bicarbonate/1.2mM Carbonate	470122
3.6mM Carbonate	470123
500mM Bicarbonate	470209
500mM Carbonate	470210

*Concentration after dilution.

more info

Custom Standards Available

If you need it, we can make it, whether a single ion or a complex mixture. Request a quote for part number **C2690**, in any volume from 125mL to 1-liter. Fast delivery!