



# THE Essential

## CHROMATOGRAPHY & SPECTROSCOPY

### CATALOG

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EDITION

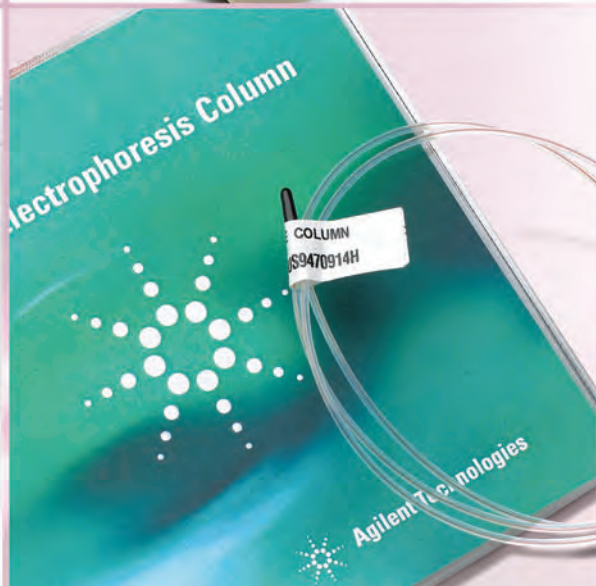
ELECTROPHORESIS  
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The Measure of Confidence



Agilent Technologies

# ELECTROPHORESIS



## In this Chapter

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## ■ CE AND CE/MS

### CE Solutions Kits



Agilent continues to introduce new CE solutions kits designed to simplify many of your applications:

- Inorganic anions
- Cations
- Organic acids
- Forensic anions
- $\mu$ Page

These kits include all you need to begin your CE analyses, including buffers, capillaries, conditioning solutions, test samples, methods and detailed descriptions. Each kit is designed to take advantage of the automation of the Agilent CE system to make your time in the laboratory more efficient. All kits are prepared using the same quality procedures as our buffers and are thoroughly tested and supported.

While the kits have been optimized for use with the Agilent CE system, they may be used with virtually any commercial or home-built CE system.

### Inorganic Anion Solutions Kit

The Inorganic Anion Solutions Kit contains all components needed for the analysis of common inorganic anions such as chloride, bromide, iodide, fluoride, sulfate, and phosphate. Applications include the analysis of inorganic ions in:

- Ultra pure water
- Waste water
- High purity chemicals
- Drug formulations
- Pulp and paper solutions
- Semiconductor solutions

Using an indirect UV detection system optimized for small anions, analyses are sensitive and rapid, and provide an alternative to traditional ion chromatography. The kit contains buffer, capillaries, test mixture, and instructions.



0.1 N sodium hydroxide, 5062-8575



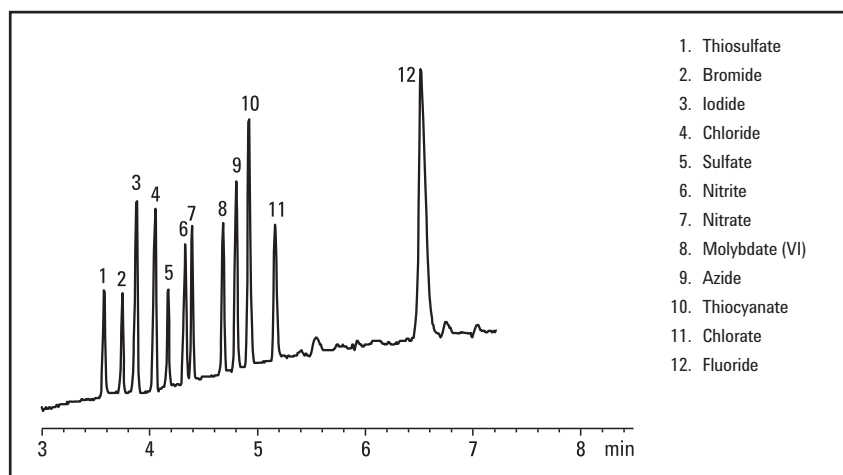
Inorganic anion test mixture, 5062-8524

### Inorganic Anion Solutions Kit

| Description                                       | Unit   | Part No.    |
|---|--------|-------------|
| Inorganic Anion Solutions Kit                     |        | 5063-6511   |
| Inorganic anion buffer                            | 250 mL | 8500-6797   |
| Ultra pure CE water                               | 500 mL | 5062-8578   |
| 0.1 N sodium hydroxide                            | 250 mL | 5062-8575   |
| 1.0 N sodium hydroxide                            | 250 mL | 5062-8576   |
| Bare fused-silica capillary, 50 µm ID, 72 cm long | 2/pk   | G1600-62211 |
| Inorganic anion test mixture                      | 10 mL  | 5062-8524   |

Includes 1000 ppm each of fluoride, chloride, bromide, nitrite, sulfate and 3000 ppm phosphate

Note: The following part should be ordered separately for use with the Agilent CE System:  
 Alignment interface for standard 50 µm ID capillary (P/N G1600-60210) for 1600 HP<sup>3</sup>D CE  
 Alignment interface for standard 50 µm ID capillary (P/N G7100-60210) for 7100 CE



Separation of common anions

## Cation Solutions Kit

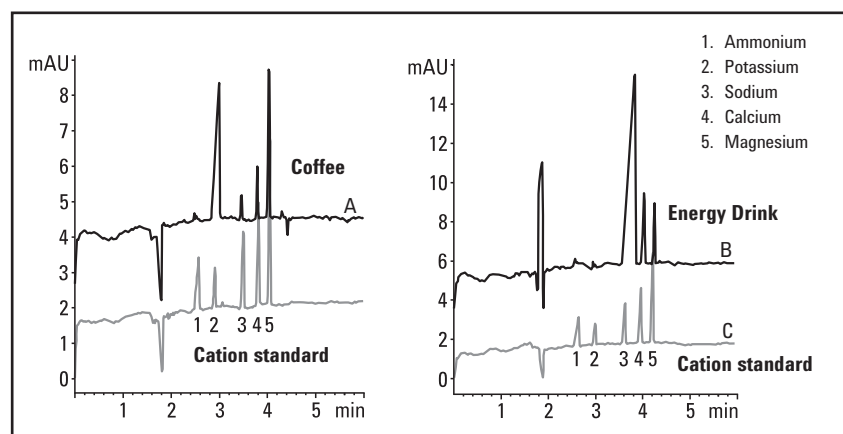
The Cation Solutions Kit provides everything you need for the analysis of inorganic and low-molecular-mass organic cations. It is specially designed for the separation of alkali metal ions, alkaline-earth metal ions and alkyl amines in a wide range of matrices.

Each kit contains a cation buffer, bare fused silica capillaries, cation standard, CE grade water and a detailed description of the analysis method and most common applications, including detection limits and reproducibility data. The Cation Solutions Kit and the separation methods were developed to fit perfectly with the Agilent CE system and to support its high automation capabilities. The methods are very easy to perform and provide accurate and quantitative analyses.

### Cation Solutions Kit

| Component  | Unit   | Part No.    |
|--|--------|-------------|
| Cation Solutions Kit   |        | 5064-8206   |
| Cation buffer  | 250 mL | 5064-8203   |
| Ultra pure CE water  | 500 mL | 5062-8578   |
| Bare fused silica capillary, extended light path bubble factor (3), 50 µm ID, 56 cm long | 2/pk   | G1600-61232 |
| Cation test mixture  | 25 mL  | 5064-8205   |

Note: The following part should be ordered separately for use with the Agilent CE System:  
 Alignment interface for 50 µm ID extended light path capillary (P/N G1600-60230) for 1600 HP3D CE  
 Alignment interface for 50 µm ID extended light path capillary (P/N G7100-60230) for 7100 CE



Cations in coffee and energy drinks

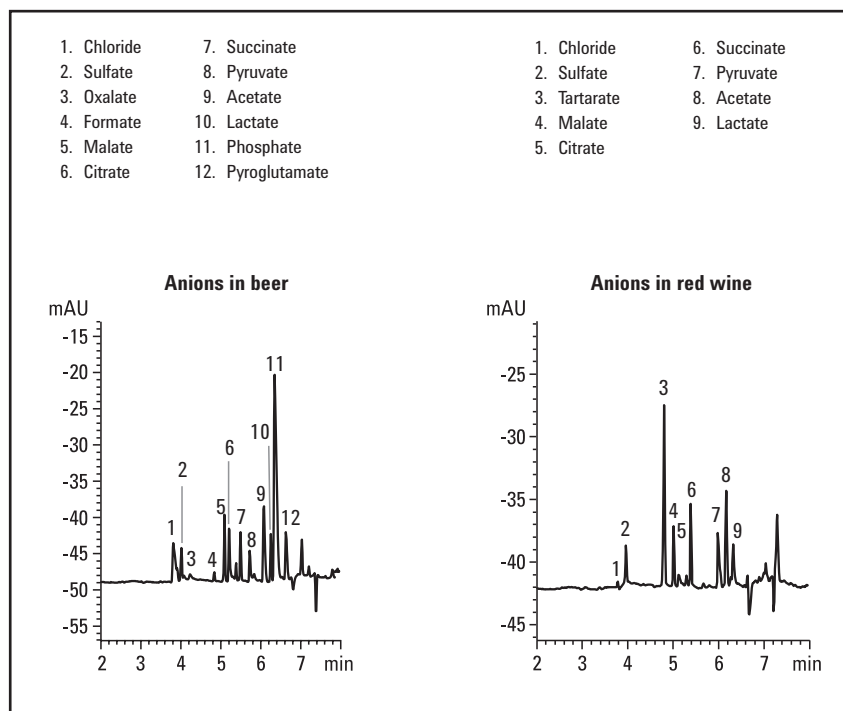
## Organic Acids Solutions Kit

The Organic Acids Solution Kit is ideal for the analysis of short alkyl chain carboxylic acids. Employing an indirect UV detection agent optimized for organic acids, the methodology is simple, sensitive, and provides accurate quantitative analysis. Suited for the analysis of organic acids in a wide range of matrices, it is especially useful for determination of organic acids in beverages and food.

### Organic Acids Solutions Kit

| Description  | Unit   | Part No.    |
|--|--------|-------------|
| Organic Acids Solution Kit                               |        | 5063-6510   |
| Organic acids buffer                                     | 250 mL | 8500-6785   |
| Ultra pure CE water                                      | 500 mL | 5062-8578   |
| 1.0 N sodium hydroxide                                   | 250 mL | 5062-8576   |
| Bare fused-silica capillary, 75 µm ID, 72 cm long        | 2/pk   | G1600-62311 |
| Organic acids test mixture                               | 20 mL  | 8500-6900   |
| Includes 1000 ppm each of malate, succinate, and lactate |        |             |

Note: The following part should be ordered separately for use with the Agilent CE System:  
 Alignment interface for 75 µm ID capillary (P/N G1600-60310) for 1600 HP3D CE  
 Alignment interface for 75 µm ID capillary (P/N G7100-60310) for 7100 CE



Organic acids in beer and red wine

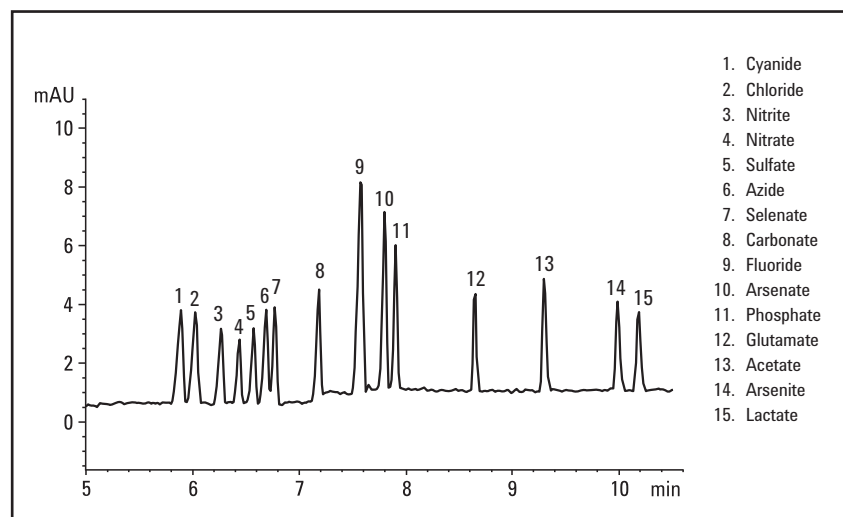
## Forensic Anions Solutions Kit

This highly focused kit was developed specifically for the analysis of poisonous compounds, such as cyanide, azide, selenate, arsenate, and arsenite. In cases of poisoning, analytical tools are needed to determine the identity of toxins quickly and accurately. A rapid determination of anionic toxins in adulterated foods and beverages is possible using CE with indirect UV detection. Forensic and other anions can be detected within 15 minutes with minimal sample preparation.

### Forensic Anions Solutions Kit

| Description  | Unit      | Part No.    |
|--|-----------|-------------|
| Forensic Anions Solutions Kit  | 5 x 50 mL | 5064-8208   |
| Basic anion buffer   | 50 mL     | 5064-8209   |
| Ultra pure CE water  | 500 mL    | 5062-8578   |
| Bare fused-silica capillary, 50 µm ID, 104 cm long   | 2/pk      | G1600-64211 |
| Inorganic anion test mixture   | 10 mL     | 5062-8524   |
| Includes 1000 ppm each of fluoride, chloride, bromide, nitrite, sulfate and 3000 ppm phosphate |           |             |

Note: The following part should be ordered separately for use with the Agilent CE System:  
 Alignment interface for standard 50 µm ID capillary (P/N G1600-60210) for 1600 HP3D CE  
 Alignment interface for standard 50 µm ID capillary (P/N G7100-60210) for 7100 CE



Analysis of an anion standard with the Forensic Anions Solutions Kit



## μPAGE Solution Kits

μPAGE poly-acrylamide gel-filled capillaries are the most direct vehicles to transfer all of your applications from slab gel to CE, utilizing the automation, high speed, high resolution, and quantitative advantages of CE. The capillaries are ideal for high resolution separations of oligonucleotides, single-stranded and double-stranded DNA fragments, polymerase chain reaction (PCR) products, sequencing reaction products and oligosaccharides.

μPAGE capillaries are available in three different pore sizes. The size of the molecular sieving pores is controlled by the monomer concentration (%T) and the degree of polymer cross-linking (%C). Gels with higher %T and %C values have smaller pores and are, therefore, more effective at resolving smaller molecules. μPAGE-10 (10%T, 0%C) capillaries provide high resolution capabilities for separation of antisense therapeutic agents, primers and probes, as well as nucleotides.

μPAGE-5 (5%T, 5%C) allows single base resolution of oligonucleotides [pd(A)] ranging from 20 to 150 bases.

For your convenience, μPAGE capillaries and μPAGE buffers can be purchased together or separately. To achieve the highest reproducibility and provide optimal longevity, use μPAGE buffer with μPAGE capillaries.

### μPAGE Starter Kits

Includes 3 μPAGE capillaries, 75 cm total length, 50 cm effective length, oligonucleotide standard and μPAGE buffer

| Kit as defined by type of μPAGE capillary  | ID (μm) | Part No. |
|--|---------|----------|
| <b>μPAGE-10 (10%T, 0%C)</b><br>μPAGE pd(A) <sub>25-30</sub> oligonucleotide standard for μPAGE-10 kit<br>μPAGE buffer, 2 x 237 mL                  | 100     | 192-1311 |
| <b>μPAGE-5 (5%T, 5%C)</b><br>μPAGE pd(A) <sub>25-30, 40-60</sub> oligonucleotide standard for μPAGE-3 and μPAGE-5 kits<br>μPAGE buffer, 2 x 237 mL | 75      | 192-5211 |
| <b>μPAGE-3 (3%T, 3%C)</b><br>μPAGE pd(A) <sub>25-30, 40-60</sub> oligonucleotide standard for μPAGE-3 and μPAGE-5 kits<br>μPAGE buffer, 2 x 237 mL | 75      | 192-3211 |

**μPAGE Basic Kits**

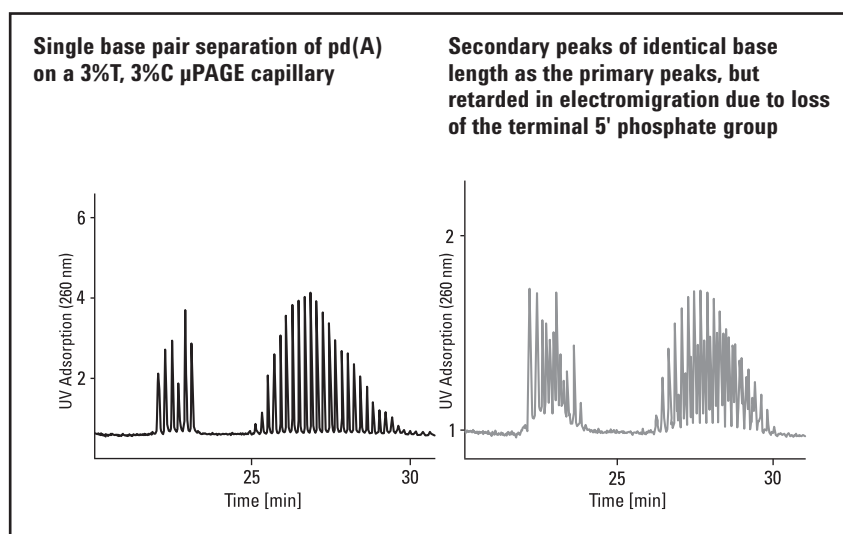
Includes 3 μPAGE capillaries, 75 cm total length, 50 cm effective length

| Kit as defined by type of μPAGE capillary  | ID (μm) | Part No. |
|--|---------|----------|
| μPAGE-10 (10%T, 0%C)<br>μPAGE pd(A) <sub>25-30</sub> oligonucleotide standard for μPAGE-10 kit                     | 100     | 191-1311 |
| μPAGE-5 (5%T, 5%C)<br>μPAGE pd(A) <sub>25-30, 40-60</sub> oligonucleotide standard for μPAGE-3<br>and μPAGE-5 kits | 75      | 191-5211 |
| μPAGE-3 (3%T, 3%C)<br>μPAGE pd(A) <sub>25-30, 40-60</sub> oligonucleotide standard for μPAGE-3<br>and μPAGE-5 kits | 75      | 191-3211 |

Note: The μPAGE capillaries are not pre-aligned for the G1600A CE and G7100 CE systems. To cut them to the correct length, use the CE column cutter (P/N 5183-4669). To create detection window, use the Window Etching Tool (P/N 590-3003).

**μPAGE Buffer Solutions and Oligo Standards**

| Kit as defined by type of μPAGE capillary   | Part No. |
|---|----------|
| μPAGE tris-borate and urea buffer for μPAGE-10, 4 x 237 mL                                      | 590-4005 |
| μPAGE tris-borate and urea buffer for μPAGE-3 and μPAGE-5, 4 x 237 mL                           | 590-4001 |
| μPAGE pd(A) <sub>25-30, 40-60</sub> oligonucleotide standard for μPAGE-3 and μPAGE-5, 3 x 50 μL | 590-4000 |

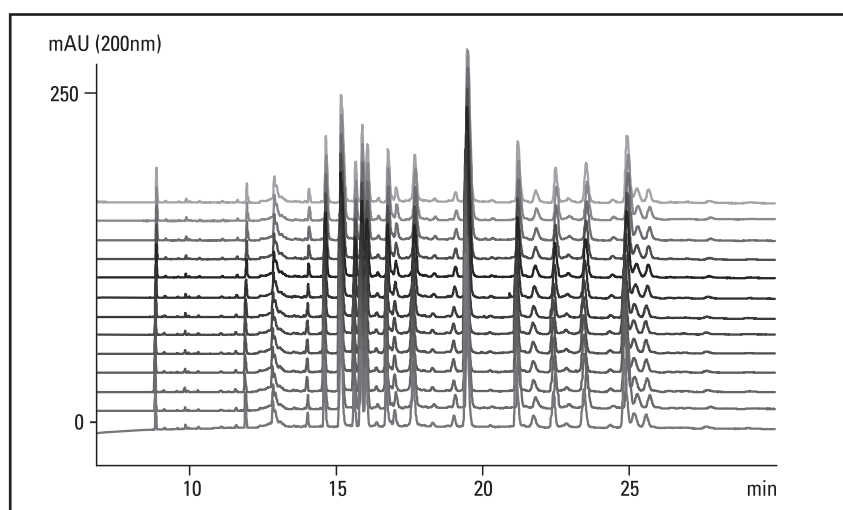


Oligonucleotide samples with or without terminal 5 phosphate group

## CE and CE/MS Capillaries

### Standard Bare Fused-Silica Capillaries

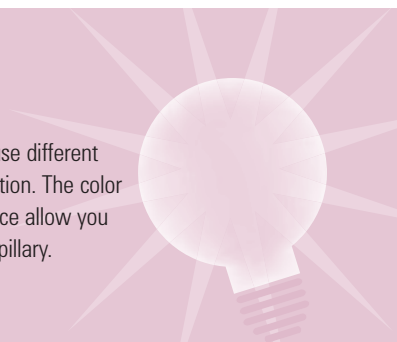
Fused-silica capillaries are the heart of CE. Pre-aligned capillaries from Agilent Technologies are designed and optimized for ease of use and reliability. All capillary ends are cut to a smooth, mirror-like finish. In addition, the polyimide outer coating is removed from the ends. These processes ensure minimal sample adsorption and help maintain sharp peak shapes. All capillaries have a pre-made detection "window" and a built-in alignment stopper that allows rapid and precise insertion in the alignment interface.



CZE of a tryptic digest of recombinant human growth hormone using a standard fused-silica capillary with 75  $\mu\text{m}$  internal diameter

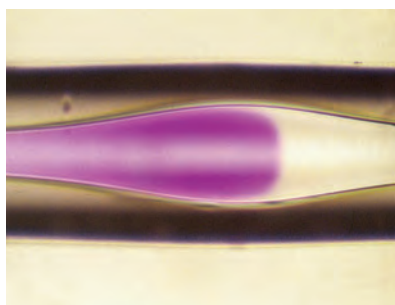
#### Tips & Tools

Different inner diameters of capillaries need to use different alignment interfaces to guarantee optimal detection. The color coding of the capillary and the alignment interface allow you to easily match the correct interface with the capillary.



**Standard Bare Fused-Silica Capillaries, 2/pk**

| <b>ID (μm)</b> | <b>Total Length (cm)</b> | <b>Effective Length (cm)</b> | <b>Color Code</b> | <b>Part No.</b> |
|----------------|--------------------------|------------------------------|-------------------|-----------------|
| 50             | 33                       | 24.5                         | Green             | G1600-63211     |
|                | 48.5                     | 40                           | Green             | G1600-60211     |
|                | 64.5                     | 56                           | Green             | G1600-61211     |
|                | 80.5                     | 72                           | Green             | G1600-62211     |
|                | 112.5                    | 104                          | Green             | G1600-64211     |
| 75             | 33                       | 24.5                         | Blue              | G1600-63311     |
|                | 48.5                     | 40                           | Blue              | G1600-60311     |
|                | 64.5                     | 56                           | Blue              | G1600-61311     |
|                | 80.5                     | 72                           | Blue              | G1600-62311     |
|                | 112.5                    | 104                          | Blue              | G1600-64311     |
| 100            | 33                       | 24.5                         | Gray              | G1600-63411     |
|                | 48.5                     | 40                           | Gray              | G1600-60411     |
|                | 64.5                     | 56                           | Gray              | G1600-61411     |
|                | 80.5                     | 72                           | Gray              | G1600-62411     |
|                | 112.5                    | 104                          | Gray              | G1600-64411     |



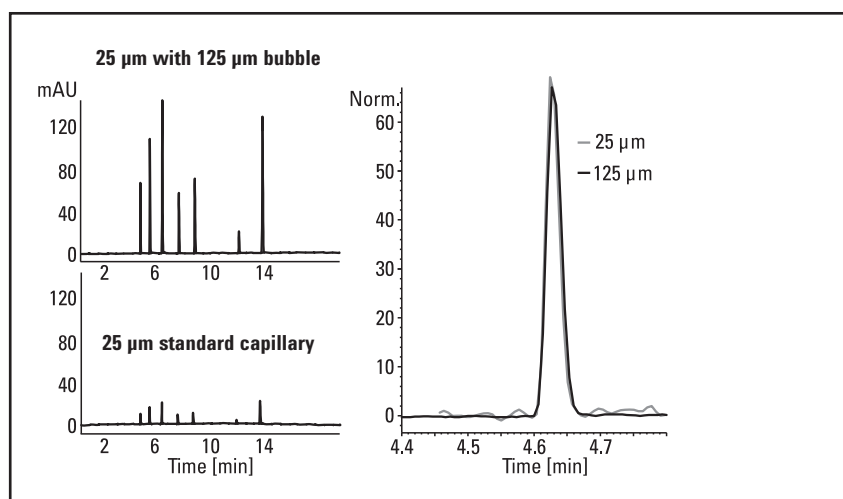
Electroosmotic flow maintains the "plug" flow in the bubble. Optical slits matched to the zone geometry maintain resolution.

## Extended Light Path (Bubble Cell) Bare Fused-Silica Capillaries

Use Agilent Technologies extended light path capillaries ("bubble" cell capillaries) to improve sensitivity 3- to 5-fold over standard capillaries. With extended light path capillaries, the inner diameter is increased only at the detection window, offering the sensitivity of a wide inner diameter capillary and the low current generation of a narrow one.

Resolution is not sacrificed when used with matching optical alignment interfaces from Agilent.

Through a computer-controlled proprietary process, the diameter is increased three to five times, with a manufacturing precision better than 3%. Take advantage of this process to extend the detection pathlength of 25  $\mu\text{m}$  ID capillaries to 125  $\mu\text{m}$ , 50  $\mu\text{m}$  to 150  $\mu\text{m}$ , and 75  $\mu\text{m}$  to 200  $\mu\text{m}$ .



Analysis of cold medicine ingredients in a standard capillary (25  $\mu\text{m}$  ID) and an Agilent Extended Light Path Capillary

**Extended Light Path (Bubble Cell) Bare Fused-Silica Capillaries, 2/pk**

| <b>ID (μm)</b> | <b>Total Length (cm)</b> | <b>Effective Length (cm)</b> | <b>Bubble Factor</b> | <b>Optical Path Length (μm)</b> | <b>Color Code</b> | <b>Part No.</b> |
|----------------|--------------------------|------------------------------|----------------------|---------------------------------|-------------------|-----------------|
| 25             | 48.5                     | 40                           | 5                    | 125                             | Black             | G1600-60132     |
|                | 64.5                     | 56                           | 5                    | 125                             | Black             | G1600-61132     |
|                | 80.5                     | 72                           | 5                    | 125                             | Black             | G1600-62132     |
| 50             | 43.5                     | 35                           | 3                    | 150                             | Red               | G1600-60232     |
|                | 48.5                     | 40                           | 3                    | 150                             | Red               | G1600-60232     |
|                | 64.5                     | 56                           | 3                    | 150                             | Red               | G1600-61232     |
|                | 80.5                     | 72                           | 3                    | 150                             | Red               | G1600-62232     |
|                | 112.5                    | 104                          | 3                    | 150                             | Red               | G1600-64232     |
| 75             | 48.5                     | 40                           | 2.7                  | 200                             | Yellow            | G1600-60332     |
|                | 64.5                     | 56                           | 2.7                  | 200                             | Yellow            | G1600-61332     |
|                | 80.5                     | 72                           | 2.7                  | 200                             | Yellow            | G1600-62332     |
|                | 112.5                    | 104                          | 2.7                  | 200                             | Yellow            | G1600-64332     |

**Tips & Tools**

Use narrow 25 and 50 μm ID "bubble" cell capillaries for highly conductive buffers without sacrificing sensitivity.



## Universal Bare Fused-Silica Capillaries

Universal Bare Fused-Silica Capillaries have a window, 75 cm effective length and 363  $\mu\text{m}$  OD, fitting into any CE instrument. To cut them to the correct length we recommend using the CE column cutter (P/N 5183-4669).

### Universal Bare Fused-Silica Capillaries

| ID ( $\mu\text{m}$ ) | Total Length (cm) | Effective Length (cm) | Part No. |
|----------------------|-------------------|-----------------------|----------|
| 20                   | 100               | 75                    | 190-0431 |
| 50                   | 100               | 75                    | 190-0131 |
| 75                   | 100               | 75                    | 190-0231 |
| 100                  | 100               | 75                    | 190-0331 |

### Bulk Fused-Silica Capillaries

| ID ( $\mu\text{m}$ ) | Total Length (m) | Part No.   |
|----------------------|------------------|------------|
| 20                   | 5                | 160-2660-5 |
| 50                   | 5                | 160-2650-5 |
| 75                   | 5                | 160-2644-5 |

## Polyvinyl Alcohol (PVA) Coated Capillaries

PVA coated capillaries contain a permanently adsorbed layer of polyvinyl alcohol. This coating minimizes hydrophobic and electrostatic solute/wall interactions and eliminates electroosmotic flow (EOF). Using a proprietary deposition process, the PVA coating is stable over a wide pH range, even under basic conditions from 2.5 to 9.5. This stability allows the use of many common CE buffers. Because the silica surface is covered, many proteins and amines can be analyzed without the peak tailing found with uncoated capillaries. In addition, since EOF is eliminated, cumbersome washing procedures are unnecessary and migration time reproducibility may be improved.

Each batch of PVA coated capillaries is rigorously tested by Agilent Technologies and includes a representative electropherogram to assure quality.

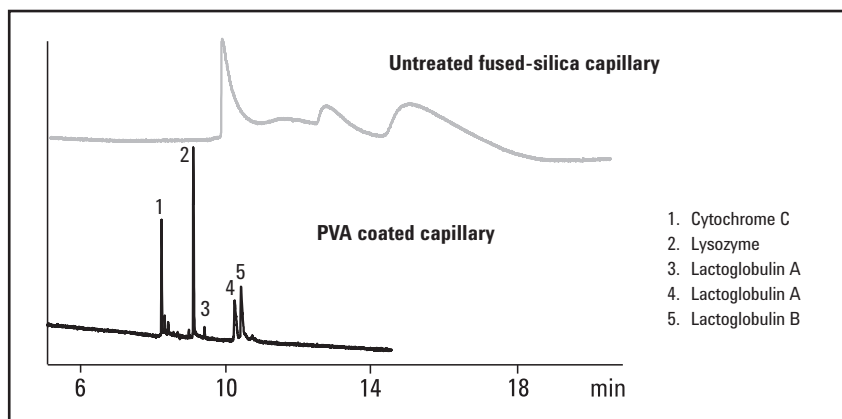
The color coding of the capillary (alignment stopper) and the alignment interfaces allow you to easily combine the correct interface with the capillary. Capillaries for non-Agilent CE systems have removable alignment stoppers without color code.

PVA coated capillaries can be used for a variety of applications, including protein analysis at physiological pH, isoelectric focusing, and small anion analysis without the need for flow-reversal agents in the buffer.

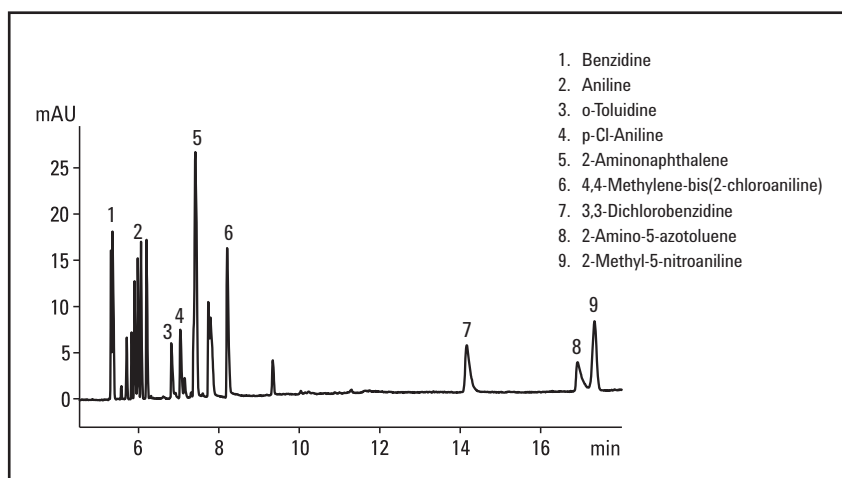
PVA coating is available in standard capillaries, or in Agilent Extended Light Path Capillaries ("bubble" cell capillaries) for high sensitivity applications. Both capillary types are available in longer lengths for use in non-Agilent systems.

PVA is also available for use with the High Sensitivity Detection Cell for even further improved HPLC-like sensitivity. In addition, PVA coated capillaries are offered for CE-MS applications. The capillaries are provided with a normally positioned detection window to allow tandem UV-Vis and MS detection for improved sample identification.

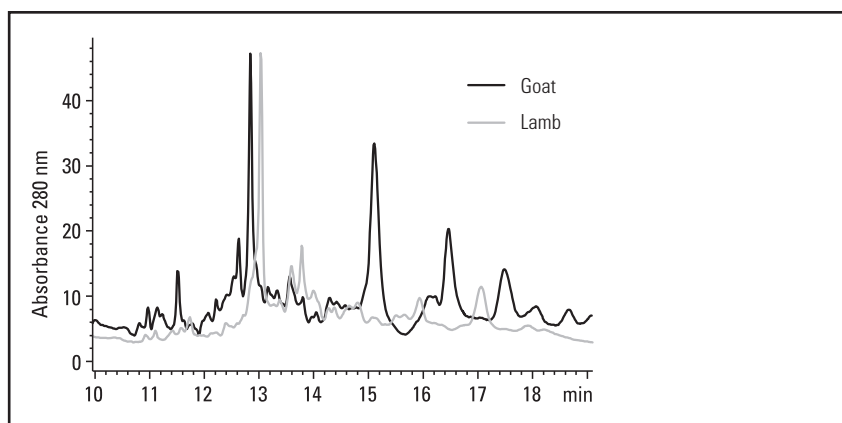




Use of PVA coated capillaries to reduce protein adsorption



CZE analysis of basic amines using PVA coated capillaries (decomposition products of azo dyes)



Analysis of meat proteins by c-IEF using PVA capillaries

**PVA Coated Capillaries for Agilent CE Systems\***

| ID (µm) | Total Length (cm) | Effective Length (cm) | Bubble Factor | Optical Path Length (µm) | Color Code | Part No.    |
|---------|-------------------|-----------------------|---------------|--------------------------|------------|-------------|
| 50      | 64.5              | 56                    | 0             | 50                       | Green      | G1600-61219 |
|         | 64.5              | 56                    | 3             | 150                      | Red        | G1600-61239 |
|         | 125               | 21.5                  | 0             | 50                       | Green      | G1600-67219 |
| 75      | 64.5              | 56                    | 0             | 1200                     |            | G1600-68319 |
|         | 125               | 21.5                  | 0             | 75                       | Blue       | G1600-67319 |
| 100     | 48.5              | 40                    | 0             | 100                      | Gray       | G1600-60419 |
|         | 64.5              | 56                    | 0             | 100                      | Gray       | G1600-61419 |

\*Not compatible with borate buffers

Note: PVA coated capillaries for CE/MS have a blue alignment stopper matching the blue color code of the alignment interface for MS-UV detection. The alignment stopper of the 50 µm ID PVA capillary for CE/MS has a black dot for easy identification.

**PVA Coated Capillaries for Non-Agilent CE Systems\***

| ID (µm) | Total Length (cm) | Effective Length (cm) | Bubble Factor | Optical Path Length (µm) | Part No.    |
|---------|-------------------|-----------------------|---------------|--------------------------|-------------|
| 50      | 71                | 60                    | 0             | 50                       | G160U-61219 |
|         | 71                | 60                    | 3             | 150                      | G160U-61239 |
| 100     | 56                | 45                    | 0             | 100                      | G160U-60419 |
|         | 71                | 60                    | 0             | 100                      | G160U-61419 |

\*Not compatible with borate buffers

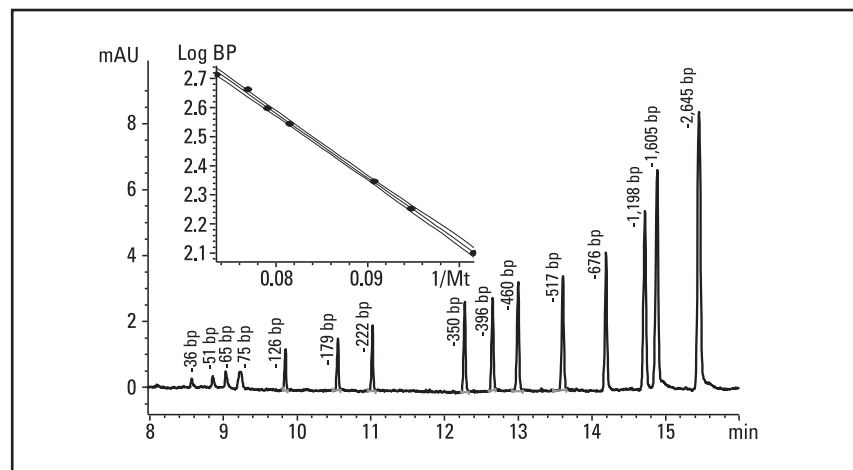
Note: When extended pathlength capillaries are used in non-Agilent systems, loss of resolution may be found if the axial slit width is not reduced. In Agilent systems, the alignment interface contains properly matched slits to maintain resolution.

## CEP Coated Capillaries

CEP coated capillaries contain a permanently bonded polymer coating. This CEP coating shields the silanol functionality of the capillary surface and helps prevent sample adsorption. Additionally, EOF is nearly eliminated, making the capillary ideal for applications such as DNA separations with sieving polymer buffers.

Elimination of EOF also simplifies analysis of anions and organic acids by direct UV detection. Without EOF reduction, highly mobile ions such as nitrate can migrate in the opposite direction to the slower, longer chain acids.

The CEP coated capillary is stable from pH 2 to 8. It can be used with borate buffers, offering a different surface functionality to help alleviate sample adsorption. Each batch of CEP coated capillaries is rigidly tested by Agilent Technologies and each capillary includes a representative electropherogram to assure quality.



Restriction fragment separation (36–2645 bp)

### CEP Coated Capillaries, 2/pk

| ID (µm) | Total Length (cm) | Effective Length (cm) | Bubble Factor | Optical Path Length (µm) | Part No.    |
|---------|-------------------|-----------------------|---------------|--------------------------|-------------|
| 75      | 80.5              | 72                    | 0             | 75                       | G1600-62318 |



## Cross-linked and Bonded $\mu$ SIL Capillaries

### $\mu$ SIL-FC and $\mu$ SIL-DNA Capillaries with Windows

A series of coated capillaries specifically designed for CE, which are prepared by cross-linking and bonding a novel, proprietary fluorocarbon (FC) polymer.  $\mu$ SIL-FC capillaries are chemically inert, hydrophobic, and stable from pH 2.5-10.

These capillaries are a must-have for cIEF, protein, peptide and carbohydrate separations, as well as replaceable gel CE applications such as oligonucleotides, DNA fragments, and PCR product separations.

$\mu$ SIL-DNA capillaries are also coated with an FC polymer but have a 75  $\mu$ m ID to accommodate the viscosity of entangled polymer solutions. All  $\mu$ SIL capillaries are batch tested to ensure the highest performance and reproducibility.



### $\mu$ SIL-WAX Capillaries with Windows

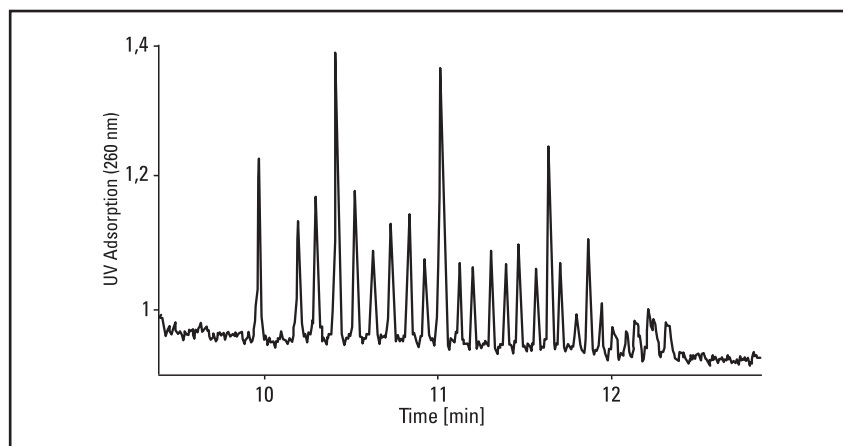
$\mu$ SIL-WAX features a modified, polyethylene oxide, hydrophilic coating made through a special cross-linking and bonding process. The coating effectively masks active silanol sites, offering exceptional efficiency, resolution, peak shape and reproducibility. The highly stable coating and near-zero EOF of  $\mu$ SIL-WAX makes the capillary ideal for CE-MS, and protein and peptide separations from pH 2-5.

| Capillary     | ID ( $\mu$ m) | Total Length (cm) | Effective Length (cm) | Film Thickness ( $\mu$ m) | Unit | Part No. |
|---------------|---------------|-------------------|-----------------------|---------------------------|------|----------|
| $\mu$ SIL-FC  | 50            | 80                | 50                    | 0.075                     | 3/pk | 194-8111 |
| $\mu$ SIL-DNA | 75            | 65                | 50                    | 0.075                     | 2/pk | 199-2602 |
| $\mu$ SIL-WAX | 50            | 100               | 75                    | 0.1                       | 2/pk | 196-7203 |
| $\mu$ SIL-WAX | 100           | 100               | 75                    | 0.1                       | 2/pk | 197-7202 |

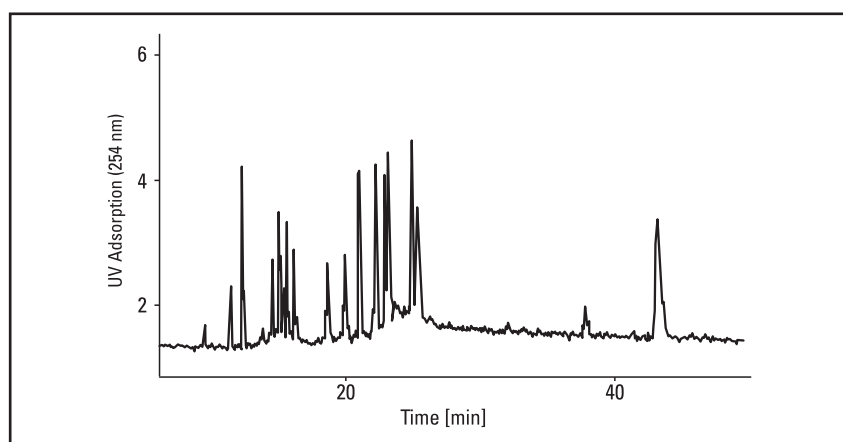
## Bulk $\mu$ SIL-DB Capillaries

$\mu$ SIL-DB coated capillaries are available as  $\mu$ SIL-DB-1 and  $\mu$ SIL-DB-17. In combination with a cellulose based buffer system,  $\mu$ SIL-DB coated capillaries have been widely used in cIEF applications, PCR product and DNA fragment separation, and many other CE applications which require reduced EOF.

| Capillary | ID (mm) | Length (m) | Film Thickness ( $\mu$ m) | Part No. |
|-----------|---------|------------|---------------------------|----------|
| DB-1      | 0.05    | 10         | 0.05                      | 126-1012 |
| DB-1      | 0.20    | 10         | 0.05                      | 126-1013 |
| DB-1      | 0.10    | 10         | 0.10                      | 127-100A |
| DB-17     | 0.10    | 10         | 0.05                      | 126-1713 |
| DB-17     | 0.10    | 10         | 0.10                      | 127-1712 |
| DB-17     | 0.20    | 10         | 0.10                      | 127-1713 |



Analysis of Allelic ladder with  $\mu$ SIL-DNA



Analysis of Myoglobin tryptic digest using  $\mu$ SIL-WAX

## Capillary Electrochromatography (CEC) Capillaries

Capillary electrochromatography is a hybrid of CE and LC and can be performed in the Agilent CE system. Using CE capillaries packed with LC stationary phases, CEC offers the loadability and selectivity of LC and the high efficiency of CE.

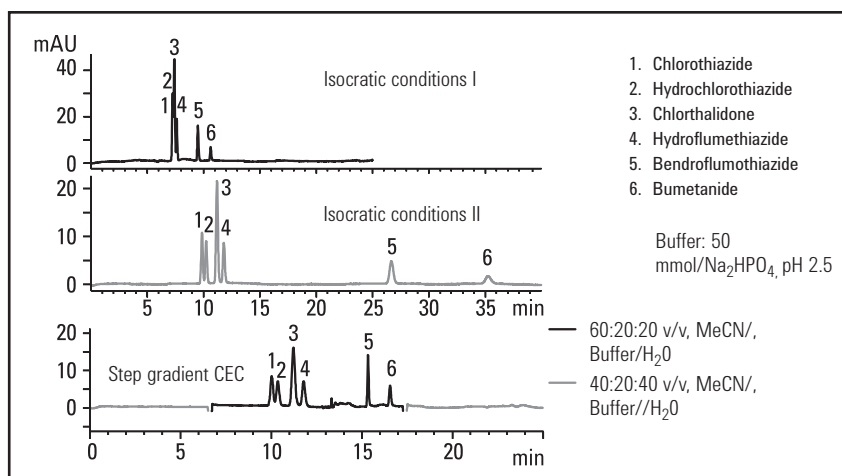
Using the high pressure capabilities of the Agilent CE system, both ends of the CEC capillary can be pressurized. This process prevents outgassing upon application of high voltage and significantly extends capillary lifetime.

Use CEC to improve resolution of solutes, which are difficult to resolve by HPLC, for hydrophobic solutes which cannot be solubilized in MEKC buffers, or for reduced sample and solvent consumption compared to HPLC.

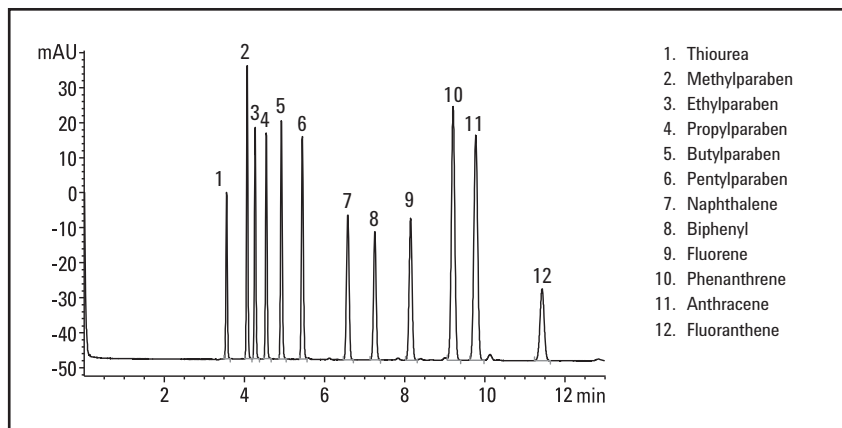
### Standard Packed CEC Capillaries, 2/pk

| Description             | ID ( $\mu\text{m}$ ) | Total Length (cm) | Effective Length |      | Color Code* | Part No.  |
|-------------------------|----------------------|-------------------|------------------|------|-------------|-----------|
|                         |                      |                   | (cm)             | (cm) |             |           |
| C18, 3 $\mu\text{m}$    | 100                  | 33.5              | 25               |      | Gray        | 5063-6512 |
|                         | 100                  | 48.5              | 40               |      | Gray        | 5063-6513 |
| C8, 3 $\mu\text{m}$     | 100                  | 33.5              | 25               |      | Gray        | 5063-6535 |
|                         | 100                  | 48.5              | 40               |      | Gray        | 5063-6540 |
| Phenyl, 3 $\mu\text{m}$ | 100                  | 33.5              | 25               |      | Gray        | 5063-6536 |
|                         | 100                  | 48.5              | 40               |      | Gray        | 5063-6541 |

\*The color coding of the capillary (alignment stopper) and the interface allows you to easily combine the correct alignment interface with the capillary.



Capillary Electrochromatography of diuretic test mixture (courtesy of Dr. Melvin Euerby, Astra Charnwood, UK)



Capillary Electrochromatography of parabenes and aromatics

### Tips & Tools

CEC capillaries require an Agilent CE system with external gas supply capabilities.

## Alignment Interfaces and Capillary Cassette

Agilent Technologies alignment interfaces are an integral part of the Agilent diode-array detection (DAD) system. These interfaces contain optical slits which are precisely matched to the capillary inner diameter for optimized sensitivity and linear detection range.

In combination with the capillary cassette, alignment interfaces simplify capillary exchange, protect the fragile detection window and ensure exact alignment of the window in the detector. Quick-change cassette allows capillary exchange in less than one minute.

Note: The color code of the alignment interface must match the color code of the capillary's built-in alignment stopper.



Alignment interface for standard capillary, G1600-60310

### Alignment Interfaces

| Description  | ID (µm) | Color Code | Corresponding Capillary | G7100 CE Part No. | G1600 CE Part No. |
|--|---------|------------|-------------------------|-------------------|-------------------|
| Alignment interface for standard capillary                       | 50      | Green      | Green                   | G7100-60210       | G1600-60210       |
|  | 75      | Blue       | Blue                    | G7100-60310       | G1600-60310       |
|  | 100     | Gray       | Gray                    |                   |                   |
|  | 150     | Brown      | Brown                   |                   |                   |
| Alignment interface for Agilent Extended Light Path capillaries  | 25      | Black      | Black                   | G7100-60150       | G1600-60150       |
|  | 50      | Red        | Red                     | G7100-60230       | G1600-60230       |
|  | 75      | Yellow     | Yellow                  | G7100-60330       | G1600-60330       |
| CE/MS alignment interface for 360 µm OD capillaries, nonmetallic |         | Blue       | Blue<br>Gray            | G7100-60400       |                   |

Note: 75, 100 and 150 µm ID standard capillaries use the same interface (color blue).

PVA coated 50 and 75 µm ID capillary for CE/MS use the same nonmetallic interface with color code blue for use with standard and extended light path capillaries, and the high sensitivity detector cell.



Capillary cassette, G7100-60002

### Capillary cassette

| Description        | G7100 CE Part No. | G1600 CE Part No. |
|--------------------|-------------------|-------------------|
| Capillary cassette | G7100-60002       | G1600-60002       |

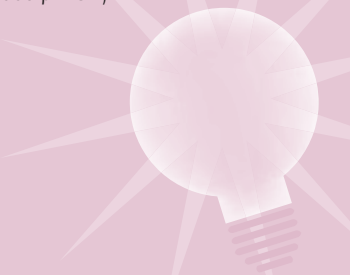
Note: Only use G7100-60002 cassette in G7100 and G1600-60002 cassette in G1600. Never mix cassettes.

### Optical filter for DAD

| Description  | G7100 CE Part No. | G1600 CE Part No. |
|--|-------------------|-------------------|
| Optical filter for DAD<br>260 nm, for DNA analysis with polyacrylamide filled capillaries and oligonucleotide analysis | G7100-62700       | G1600-62700       |

#### Tips & Tools

Cassette and interfaces accept all commercially available capillaries (~365 µm OD).





## Instrument Parts and Supplies

### High Sensitivity Detection Cell



High Sensitivity Detection Cell

The Agilent high sensitivity detection cell – a technological leap which extends sensitivity by an order of magnitude – provides a solution to sensitivity limitations often encountered in CE. This improvement will substantially increase the utility of CE for impurity analysis of chiral drugs, biologicals, and compounds of environmental interest, among others.

The high linear range allows quantification of both <0.1% impurities and the main component in one run. This is useful for all impurity determinations and is especially useful for determining chiral excess.

The high sensitivity detection cell for the Agilent CE system not only improves detection sensitivity more than 10-fold over standard capillaries, but also extends linearity beyond 2000 mAU and provides unsurpassed spectral fidelity. These improvements are a result of a proprietary micromachined design which increases the detection pathlength from 75  $\mu\text{m}$  to 1200  $\mu\text{m}$  while dramatically reducing stray light.

The high sensitivity detection cell has a design comprised of a fused-silica cell body and removable capillaries. The light path through the cell is made from black fused-silica which significantly minimizes stray light and defines the aperture for the diode-array spectrometer. In addition, the reflective interior functions as a "lightpipe," ensuring almost 100% transmission of light which entered the cell. These properties result in enhanced linearity and unsurpassed spectral fidelity with the diode-array detector.

## Characteristics of the Agilent High Sensitivity Detection Cell

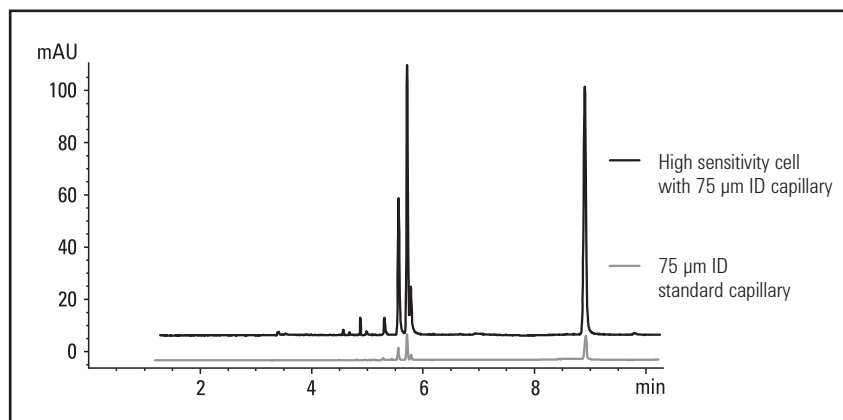
- Up to 10-fold increase in signal-to-noise
- Detector linearity beyond 2000 mAU for accurate quantitative analysis
- Decoupled design allows replaceable capillaries and reduced cost operation
- Special capillary geometry ensures maintenance of peak symmetry
- Full diode-array spectral capabilities
- Design fits all Agilent CE instruments

### High Sensitivity Detection Cell

| Description   | G7100 CE Part No. | G1600 CE Part No. |
|---|-------------------|-------------------|
| High sensitivity cell kit<br>Includes detection cell, 75 µm ID inlet capillary (72 cm) and outlet capillary (8.5 cm) pair, capillary cassette, fittings (3 fitting screws with seals, 2 fitting caps), cleaning solution, CE Partner CD-ROM | G7100-68723       | G1600-68723       |
| CE cell fitting kit<br>Includes 3 fitting screws, 2 fitting caps  |                   | G1600-63200       |
| Replacement detection cell  |                   | G1600-60027       |
| Cell cleaning fluid, 1 L  |                   | 5062-8529         |

### Capillary Kits for High Sensitivity Detection Cell

| Description                                       | Effective Length (cm) | G1600 CE Part No. |
|---|-----------------------|-------------------|
| 75 µm capillary kit with 8.5 cm outlet            | 56                    | G1600-68716       |
|   | 72                    | G1600-68715       |
|   | 88                    | G1600-68714       |
| PVA coated 75 µm capillary kit with 8.5 cm outlet | 56                    | G1600-68319       |



Agilent high sensitivity detection cell vs. 75 µm standard capillary for the CZE separation of naphthalene sulfonic acids

## CE/MS Accessories

The CE/MS Adapter Kit simplifies coupling the Agilent CE system with MS systems equipped with an electrospray ionization (ESI) source. Integral to this kit is the CE/MS cassette, which completely thermostats the capillary until it exits the CE system. The cassette offers multiple capillary paths that vary the capillary length. A method development configuration uses online diode array detection and MS. For rapid or routine MS analysis, the detector can be bypassed to decrease the total capillary length and reduce analysis time. The CE/MS adapter kit can be used with the complete Agilent 6000 Series mass spectrometers, or virtually any electrospray-MS platform.

The CE-MS cassette completely thermostats the capillary until it exits the CE system. Methods development configuration uses online diode array detection (DAD) and MS. For rapid or routine MS analysis the DAD can be by-passed to decrease the total capillary length and reduce analysis time.

The CE-ESI-MS Nebulizer Kit includes the electrospray needle and splitter assembly, which allows the direct connection of the CE instrument with Agilent and other electrospray MS systems. The CE-ESI-MS Nebulizer Kit needs the CE-MS Adapter Kit to fully support CE/MS coupling.

CE with tandem UV-Vis and MS detection allows the analysis of complex mixtures. Analyte mixtures are separated and the components detected via UV-Vis absorption, allowing preliminary identification based on peak elution time and UV-Vis spectra, or both, when compared to a standard. Online coupling to electrospray-ionization mass spectrometry (ESI-MS) then reveals unambiguous information on the solute's molecular weight, and possibly structure.

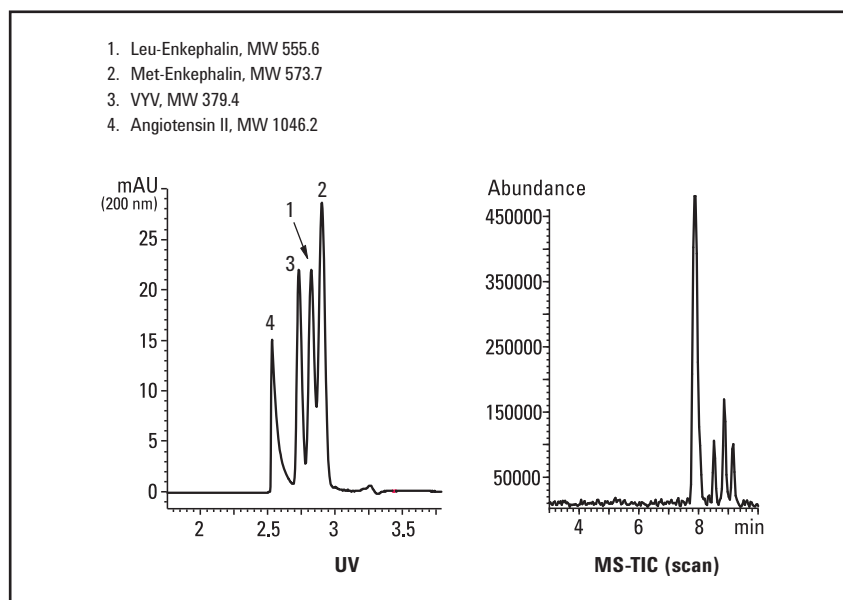


Interfacing the capillary requires an electrospray needle which is not included in this kit but in the CE-ESI-MS Nebulizer Kit. For coupling with non-Agilent MS please contact the MS vendor.

### CE/MS Adapter Kit

| Description  | Part No.    |
|--|-------------|
| CE/MS Adapter Kit  | G1603A      |
| For interfacing the Agilent CE system with a mass spectrometer<br>Includes parts below, which can be ordered separately* |             |
| CE/MS interface cassette, metallic, for G1600 and G7100 CE   | G1600-60013 |
| CE/MS alignment interface for 360 µm OD capillaries, nonmetallic, for G1600 CE   | G1600-60400 |
| CE/MS alignment interface for 360 µm OD capillaries, nonmetallic, for G7100 CE   | G7100-60400 |
| Bare fused-silica, 50 µm ID, 125 cm long, 2/pk   | G1600-67311 |

\*Interfacing the capillary requires an electrospray needle which is not included in this kit



CE/MS of 4-component peptide mixture (210 fmol)

**CE/MS Sprayer Kit**

| <b>Description</b>  | <b>Unit</b> | <b>Part No.</b> |
|---|-------------|-----------------|
| CE/MS Sprayer Kit   |             | G1607A          |
| Includes CE/MS test sample (5 g quinine sulfate dihydrate) and the parts listed below |             |                 |
| ES needle assembly  |             | G1607-60041     |
| CE-ESI sprayer  |             | G1607-60001     |
| Splitter assembly   |             | G1607-60000     |
| PEEK ferrule, 360 µm for CE/MS Sprayer  |             | 5022-2141       |
| Nut, fingertight fitting and ferrule  | 2/pk        | 0100-1543       |
| Flex loc element  | 2/pk        | 1520-0401       |
| Gasket  | 1/pk        | G1607-20030     |
| Ion kit (ammonium acetate)  | 5 x 5 mL    | 8500-4410       |

**CE/MS Capillaries**

| <b>Description</b>                          | <b>Color Code</b> | <b>Unit</b> | <b>Part No.</b> |
|---|-------------------|-------------|-----------------|
| Bare fused-silica, 50 µm ID, 125 cm long    | Green             | 2/pk        | G1600-67311     |
| PVA coated capillary, 50 µm ID, 125 cm long | Green             | 1/pk        | G1600-67219     |
| PVA coated capillary, 75 µm ID, 125 cm long | Blue              | 1/pk        | G1600-67319     |

## CE Standards & Reagents

Premade buffers help eliminate the time-consuming buffer preparation process. All Agilent buffers and reagents are designed to meet the stringent demands of CE. Manufactured under GLP/GMP conditions in ISO9001 facilities, each is shipped with assay information and verification of purity. Chemicals are all electrophoresis grade, with nearly all ionic and organic impurities removed. Solutions are prepared under Class 10 clean room conditions and prefiltered through 0.2  $\mu\text{m}$  filters to ensure removal of particulates. Superior quality control ensures reproducible results bottle-to-bottle and batch-to-batch.

In addition to a set of kit buffers, which are specially designed for dedicated applications, Agilent offers a series of basic CZE buffers covering a broad pH range. The product portfolio also includes special buffers for protein analysis and for Micellar Electrokinetic Chromatography (MEKC). Cleaning and conditioning solutions complete the offering.



Ultra pure CE water, 5062-8578

### Ultra Pure CE Water

| Description         | Volume (mL) | Part No.  |
|---------------------|-------------|-----------|
| Ultra pure CE water | 500         | 5062-8578 |



50 mM sodium phosphate buffer, pH 2.5,  
5062-8571

### Capillary Conditioning Solutions

| Description            | Volume (mL) | Part No.  |
|------------------------|-------------|-----------|
| 0.1 N sodium hydroxide | 250         | 5062-8575 |
| 1.0 N sodium hydroxide | 250         | 5062-8576 |
| 0.1 N phosphoric acid  | 250         | 5062-8577 |

### CZE Buffers for Charged Analytes

| Description                             | Volume (mL) | Part No.  |
|---|-------------|-----------|
| 50 mM sodium phosphate buffer, pH 2.5   | 250         | 5062-8571 |
| 50 mM sodium phosphate buffer, pH 7.0   | 250         | 5062-8572 |
| 50 mM sodium tetraborate buffer, pH 9.3 | 250         | 5062-8573 |
| 20 mM sodium tetraborate buffer, pH 9.3 | 100         | 8500-6782 |

**CZE Buffers for Proteins**

| Description  | Volume (mL) | Part No.  |
|--|-------------|-----------|
| 50 mM phosphate, 0.05% hydroxyethyl cellulose buffer, pH 2.5 | 250         | 8500-6786 |
| 150 mM phosphate, 200 mM ammonium sulfate buffer, pH 7.0     | 250         | 8500-6787 |

**MEKC Buffers for Neutral and Charged Analytes**

| Description   | Volume (mL) | Part No.  |
|---|-------------|-----------|
| 50 mM sodium tetraborate, 100 mM sodium dodecyl sulfate buffer, pH 9.3* | 250         | 5062-8574 |

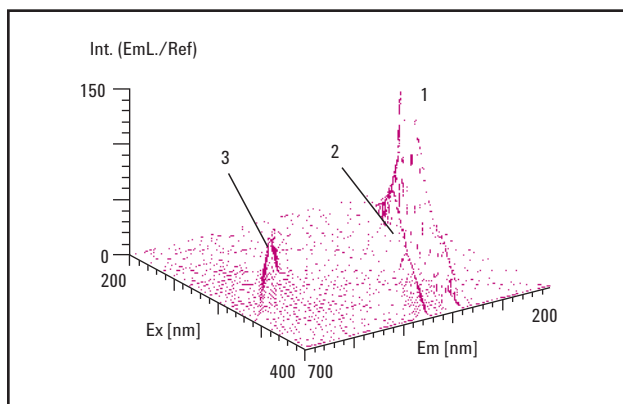
\*Dilute with 50 mM sodium tetraborate, pH 9.3 (P/N 5062-8573) to reduce SDS concentration without affecting the tetraborate composition or pH

**Plating Bath Analysis Buffer**

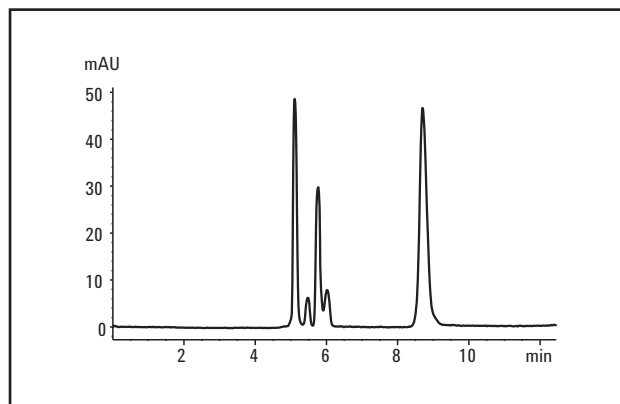
| Description                  | Volume (mL) | Part No.  |
|------------------------------|-------------|-----------|
| Plating bath analysis buffer | 250         | 5064-8236 |

**μPAGE Buffer Solutions and Oligo Standards**

| Description   | Part No. |
|---|----------|
| μPAGE tris-borate and urea buffer for μPAGE-10, 4 x 237 mL                                      | 590-4005 |
| μPAGE tris-borate and urea buffer for μPAGE-3 and μPAGE-5, 4 x 237 mL                           | 590-4001 |
| μPAGE pd(A) <sub>25-30, 40-60</sub> oligonucleotide standard for μPAGE-3 and μPAGE-5, 3 x 50 μL | 590-4000 |



The total fluorimetry spectrum of the 50 mM borate buffer pH 9.2 verifies that the solution is free of fluorescence-active impurities (1 and 2 = Rayleigh stray light of zero and first order, 3 = Raman stray light).



CZE analysis of a peptide mixture using pre-made 50 mM sodium phosphate buffer, pH 2.5

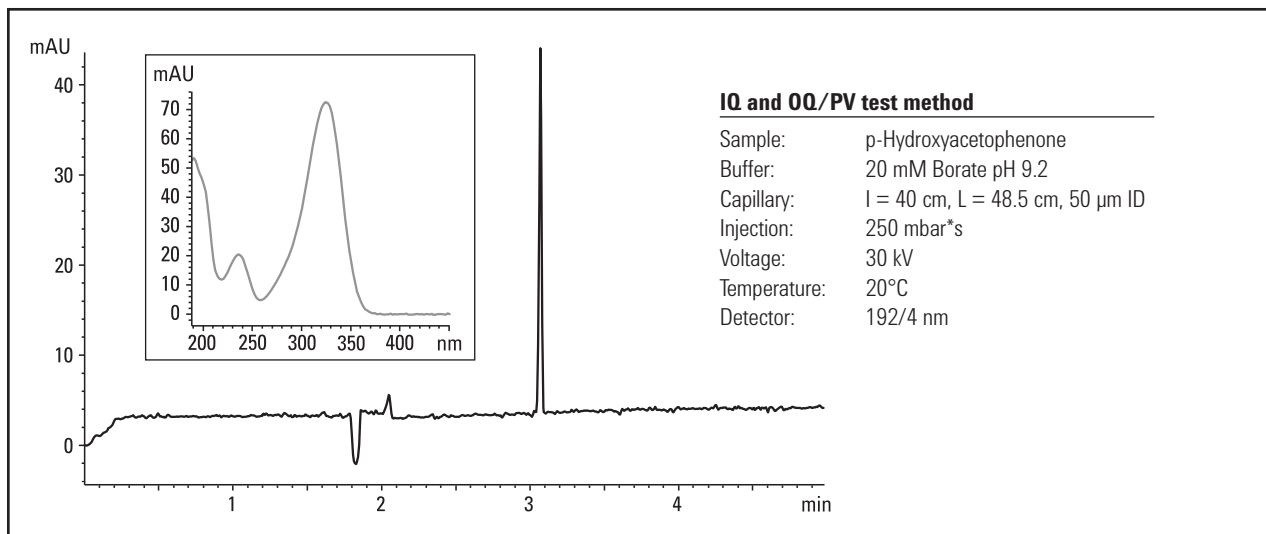
## CE System Start-up and Test Kits

Chemical test kits and validation packages are available to help comply with regulatory and quality standards. The Installation Qualification (IQ) Chemical Kit and Hardware Start-Up Kits, which are shipped with new instruments, are useful for rapidly verifying system functionality. For rigorous testing, the Operational Qualification (OQ)/Performance Verification (PV) Kit can be used to verify DAD noise, drift, linearity, wavelength accuracy and replenishment functionality. The OQ/PV kit is only part of the validation services available from Agilent Technologies. When implemented by qualified Agilent personnel, our service packages can be used to help validate your Agilent CE system.



## CE System Start-up and Test Kits

| Description  | Part No.  |
|--|-----------|
| CE Installation Qualification (IQ) Kit<br>Includes buffer (20 mM borate, pH 9.3, 100 mL), test sample (4-(hydroxy)-acetophenone, 2 mL), capillary conditioning solution (0.1 N sodium hydroxide, 100 mL)   | 5063-6514 |
| CE Operational Qualification Performance Verification (OQ/PV) Chemical Kit<br>Includes buffer (20 mM borate, pH 9.3, 100 mL), test samples (0.1, 0.5, 1.0, and 5.0 mM 4-(hydroxy)-acetophenone, 2 mL ea.), capillary conditioning solution (0.1 N sodium hydroxide, 100 mL), test capillary (L 48.5 cm, I 40 cm, ID 50 µm), diskette with methods, sequence, spectral library. Note: Method is supported for G1600 only. | 5063-6515 |
| CE OQ/PV Chemicals Only Kit<br>Includes buffer (20 mM borate, pH 9.3, 100 mL), test samples (0.1, 0.5, 1.0, and 5.0 mM 4-(hydroxy)-acetophenone, 2 mL)   | 5063-6520 |





## Instrument Parts and Supplies



Snap caps, polyurethane, 5181-1512, 5042-6491



Electrode assembly, standard (for G1600 only), G1600-60007



Electrode O-ring, silicone, 5062-8544



Electrolyte bottle, 500 mL, 9300-1748



Filter frit adapters, 5062-8517

Air filter, 5  $\mu$ m, 3150-0619

Pre-puncher, G1600-67201



Screws for pre-puncher/insulation plate holding, G1600-62402

## Vials and Caps for CE

| Description  | Unit    | Part No.  |
|--|---------|-----------|
| Crimp/snap top vial, 1 mL, Polypropylene, crimp/snap top     | 100/pk  | 5182-0567 |
| Clear, wide opening crimp/snap top vial, 2 mL                | 100/pk  | 5182-9697 |
| Clear, wide opening crimp/snap top glass vial, 2 mL          | 500/pk  | 5183-4623 |
| Amber, wide opening crimp/snap top vial, write-on spot, 2 mL | 100/pk  | 5183-4619 |
| Crimp/snap top vial, 250 $\mu$ L                             | 1000/pk | 9301-0978 |
| Snap caps PEO (polyethylene olefin for chemical resistance)  | 100/pk  | 5181-1507 |
| Snap caps PEO (polyethylene olefin for chemical resistance)  | 500/pk  | 5181-1513 |
| Snap caps PUR (polyurethane for resealing)*                  | 100/pk  | 5181-1512 |
| Snap caps PUR (polyurethane for resealing)*                  | 500/pk  | 5042-6491 |

\*PUR caps are recommended to help prevent sample or buffer evaporation even after multiple injections

## Instrument Supplies

| Description  | Unit  | Part No.    |
|--|-------|-------------|
| Long life HiS Deuterium lamp (8-pin) with RFID tag |       | 5190-0917   |
| Deuterium lamp                                     |       | 2140-0585   |
| Electrode assembly, standard (for G1600 only)      |       | G1600-60007 |
| Electrode assembly, short (for G1600 only)         |       | G1600-60033 |
| Electrode assembly, standard (for G7100 only)      |       | G7100-60007 |
| Electrode assembly, short (for G7100 only)         |       | G7100-60033 |
| Electrode O-ring, silicone                         | 5/pk  | 5062-8544   |
| Electrolyte bottle, 500 mL                         |       | 9300-1748   |
| Electrolyte bottle, 100 mL                         |       | 5042-6478   |
| Electrolyte bottle cap                             |       | 9300-1747   |
| Bottle sealing O-ring                              |       | 0905-1163   |
| Glass filter, solvent inlet, 20 $\mu$ m            |       | 5041-2168   |
| Filter frit adapter, 3 mm                          | 4/pk  | 5062-8517   |
| Bottle cap plug                                    |       | G1600-23223 |
| Air filter, 5 $\mu$ m                              |       | 3150-0619   |
| Pre-puncher  |       | G1600-67201 |
| Screws for pre-puncher/insulation plate holding    | 10/pk | G1600-62402 |



CE column cutter, 5183-4669

## Accessories

| Description   | Part No.    |
|---|-------------|
| CE accessory kit  | G7100-68705 |
| Includes electrode tool, screwdriver, fuses, air filter, glass frit, vials and caps alignment interfaces (red and green) standard and 50 $\mu$ m ID capillaries: L 64.5 cm, Standard: L 64.5 cm, Extended Light Path: L 48.5 cm |             |
| Rack for 12 mm, 2 mL vials, holds 50 vials per rack, 5/pk   | 9301-0722   |
| CE column cutter  | 5183-4669   |
| Diamond blade replacement kit for CE column cutter  | 5183-4670   |
| Capillary tubing cutter, 4/pk   | 5181-8836   |



Window etching tool, 590-3003

## Window Etching Tool

The window etching tool is designed for fast, convenient and reproducible preparation of detection windows on fused-silica capillaries. The polyimide coating is removed without destroying the inner polymeric coating. The tool contains three glass blocks with fine grooves, precisely controlling the size of the windows.

| Description               | Part No. |
|---------------------------|----------|
| Window etching tool, 3/pk | 590-3003 |

# Troubleshooting

## Basic Capillary Electrophoresis Troubleshooting

| Symptom                  | Possible Cause                                  | Solution(s)   |
|--------------------------|---|---|
| <b>Unstable Current</b>  |   |   |
| Variable or no current   | Air bubble formed in capillary                  | Flush capillary, ramp voltage to limit initial heating, and/or degas buffers.   |
|                          | Clogged capillary                               | Flush capillary with absorbing solution (such as NaOH). A "step" on the baseline should be observed when viewing the online signal at 200 nm. If still plugged, flush manually with syringe or high pressure gas. |
|                          | Broken capillary                                | Replace capillary.  |
|                          | No or incorrect solution in buffer vials        | Fill/change buffer vials.   |
|                          | Large volume injection                          | Normal situation. Current should stabilize during analysis.   |
| <b>Unstable Baseline</b> |   |   |
| Spikes in baseline       | Precipitates in buffer                          | Filter buffer through 0.2 or 0.45 µm filter.  |
|                          | Micro air bubbles in buffer                     | Degas buffer by ultrasonication or vacuum.  |
|                          | Precipitation of sample                         | Verify that sample components are sufficiently soluble in buffer.   |
| Noisy baseline           | Optical slit in capillary interface is occluded | Clean slit with methanol or water. View under magnifier.  |
|                          | Aging deuterium lamp                            | Use DAD test to measure lamp output and time-on. Replace if necessary.  |
|                          | Data acquisition rate too high                  | Determine peak width and decrease acquisition rate if appropriate.  |
|                          | Improper reference wavelength                   | Acquire UV spectrum during analysis. Use lowest wavelength possible without impinging where sample absorbs. Also use wide bandwidth.  |
|                          | Buffer absorbs at detection wavelength          | Use minimally UV-absorbing buffers such as phosphate and borate, especially below 210 nm.   |
| Drifting baseline        | Improper capillary alignment                    | Re-seat capillary cartridge in detector block.  |
|                          | Unequilibrated temperature                      | Allow 10-20 minutes for equilibration after opening top cover.  |
|                          | Lamp recently ignited                           | Allow 15-30 minutes for equilibration after igniting lamp.  |

(Continued)

| <b>Basic Capillary Electrophoresis Troubleshooting</b> |  |   |
|--|--|---|
| <b>Symptom</b>   | <b>Possible Cause</b>  | <b>Solution(s)</b>  |
| <b>Poor Peak Efficiency</b>                            |  |   |
| Broad peaks  | Sample overloading   | Decrease sample injection or concentration.   |
|  | Excessive Joule heating  | Reduce voltage, buffer conductivity, or capillary ID.   |
| Skewed peaks   | Mismatched sample buffer ion mobilities  | Match mobilities or increase difference between buffer and sample conductivity.                       |
|  | Sample overloading   | Decrease sample injection or concentration.   |
| Tailing peaks  | Adsorption to capillary wall   | Use pH extremes, high buffer concentrations, polymer additives, or coated capillary.                  |
| <b>Poor Migration Time Reproducibility</b>             |  |   |
| Adsorption to capillary walls                          | Changes in EOF caused by buffer (especially phosphates and detergents) or sample adsorption          | Condition capillary and allow sufficient equilibration time. Replace capillary.                       |
| Hysteresis of wall charge                              | Caused by conditioning capillary at high (or low) pH and employing a low (or high) pH running buffer | Avoid pH differences. Allow sufficient equilibration time.  |
| Changes in buffer composition                          | pH changes due to electrolysis   | Replenish buffer.   |
|  | Buffer evaporation   | Tightly cap buffer vials and reduce carousel temperature.   |
|  | Conditioning solution waste flushed into outlet reservoir  | Use separate vial to collect waste.   |
|  | Conditioning solution carried over into buffer vial  | First dip capillary in separate buffer or water vial.   |
| Buffer reservoirs not level                            | Generation of laminar flow   | Level liquid in reservoirs. If not replenishing buffer, do not use inlet vial for flushing capillary. |
| Different silanol content of capillary batches         | Different wall charge and variations in EOF  | Measure EOF and normalize.  |
| Temperature changes                                    | Changes in viscosity and EOF   | Use system with capillary thermostating.  |

(Continued)

**Basic Capillary Electrophoresis Troubleshooting**

| Symptom   | Possible Cause  | Solution(s)   |
|---|---|---|
| <b>Poor Peak Area Reproducibility</b>                               |   |   |
| Sudden application of high voltage                                  | Heating, thermal expansion of buffer, and expulsion of sample | Ramp separation voltage or inject buffer plug after sample.   |
| Sample evaporation  | Increasing sample concentration and peak area                 | Cap vials and/or reduce temperature of sample carousel.   |
| Instrumental limitations  | System rise time significant proportion of injection time     | Increase injection time.  |
| Sample carry-over   | Extraneous injection  | Use capillary with flat, smooth injection end.<br>Remove polyimide from end of capillary.               |
| Zero-injection caused by simply dipping the capillary in the sample | Extraneous injection  | Cannot be totally eliminated. Increase injection amount to minimize effect.                             |
| Sample adsorption to capillary walls                                | Distorted peak shape (tailing)<br>Non-eluting sample          | Change buffer pH. Increase buffer concentration.<br>Use additive such as cellulose or coated capillary. |
| Low signal-to-noise ratio   | Integration errors  | Optimize integration parameters. Increase sample concentration. Use peak height.                        |
| Temperature changes of capillary environment                        | Changes in viscosity and injection amount                     | Use system with capillary thermostating.  |



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