

## IonPac® AS9-SC and AS9-HC Anion-Exchange Columns



*The IonPac AS9-SC (solvent compatible) is a carbonate-selective anion-exchange column designed for the fast, isocratic separation of inorganic anions and oxyhalides including fluoride, chlorite, bromate, chloride, nitrite, bromide, chlorate, nitrate, phosphate, and sulfate in drinking water, groundwater, wastewater, and other diverse sample matrices. The IonPac AS9-HC is a high-capacity anion-exchange column with selectivity similar to the AS9-SC column. The AS9-HC column is also designed for the analysis of inorganic anions and oxyhalides but has higher capacity and provides improved separation for trace bromate in drinking water matrices using an isocratic carbonate eluent and a large loop injection. The high capacity AS9-HC column also offers improved retention of fluoride out of the water dip.*

### **IonPac AS9-SC Features**

The IonPac AS9-SC has a unique selectivity, permitting the fast, isocratic separation of fluoride, chlorite, bromate, chloride, nitrite, bromide, nitrate, phosphate, and sulfate in less than 10 minutes using a bicarbonate/carbonate eluent coupled with suppressed conductivity detection as illustrated in Figure 1A. The IonPac AS9-SC is specified in validated methods such as U.S. EPA Method 300.0 (B).

### **IonPac AS9-HC Features**

The IonPac AS9-HC column provides improved separation of the common inorganic anions and the oxyhalides over the AS9-SC as illustrated in Figure 1B. Increased retention time on the AS9-HC (approximately 22 minutes) is due to the high capacity (190  $\mu\text{eq}$  for 4 x 250 mm) of the column. High capacity allows for the determination of trace bromate in drinking water using a large loop injection and an isocratic carbonate eluent. The AS9-HC also provides improved separation of bromate/chloride, chloride/nitrite, and chlorate/nitrate analyte pairs. The AS9-HC column is specified in validated methods such as U.S. EPA Method 300.1.



## High Efficiency Particle Structure

The IonPac AS9-SC and AS9-HC column packings have unique structures composed of a highly crosslinked core and a MicroBead™ anion exchange layer attached to the surface, as shown in Figures 2 and 3. The substrate for the IonPac AS9-SC is a 13- $\mu\text{m}$  diameter microporous resin bead and the AS9-HC column substrate is a 9- $\mu\text{m}$  diameter macroporous resin bead, both consisting of ethylvinylbenzene crosslinked with 55% divinylbenzene.

The anion exchange layer is functionalized with quaternary ammonium groups. This anion exchange layer has a controlled thickness, which results in excellent mass transfer characteristics and consequently, very high efficiency peaks.

## Economical Microbore Operation

The IonPac AS9-SC and AS9-HC columns are available in the 2-mm format for microbore operation to offer the advantage of reduced operating costs.

- Ideal for limited sample volumes due to higher mass sensitivity.
- Three- to fourfold reduction in eluent consumption.
- 4-mm applications can be performed using the 2-mm format reducing flow rate by fourfold.

## Solvent Compatible Packing

Because the IonPac AS9-SC and AS9-HC columns are 100% HPLC solvent compatible, organic solvents can be used for efficient column clean-up or to enhance sample solubility. The elimination of time-consuming sample preparation saves time and expense and extends the utility of the column to new applications requiring solvents. Adding organic solvents to the eluent modifies column selectivity and enables the elution of nonpolar analytes or contaminants from the column.

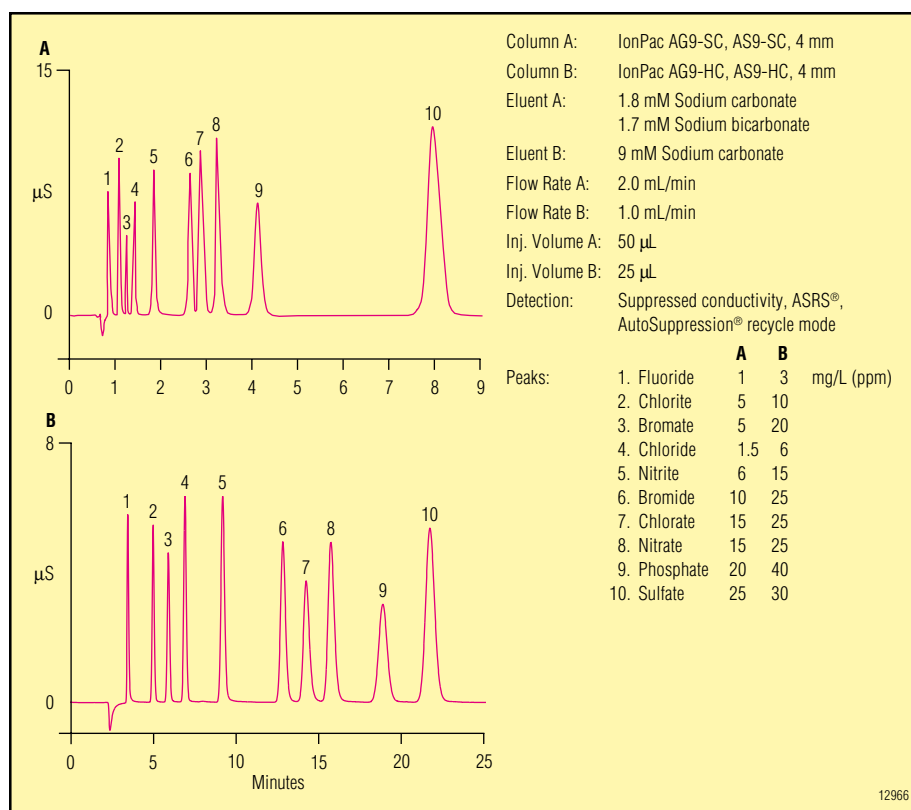


Figure 1. Comparison of the AS9-SC and AS9-HC columns for the separation of inorganic anions and oxyhalides.

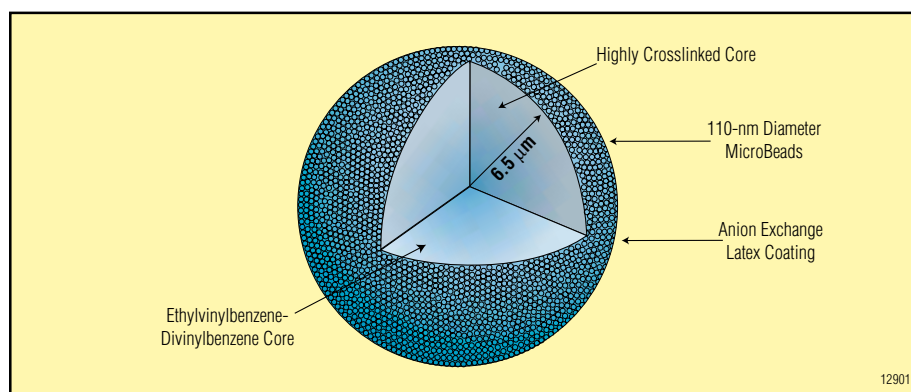


Figure 2. Structure of an IonPac AS9-SC packing particle.

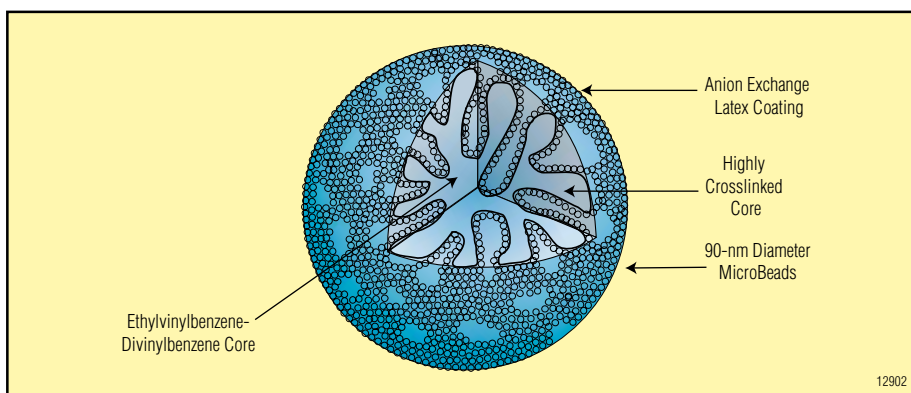


Figure 3. Structure of an IonPac AS9-HC packing particle.

## Determination of Trace Bromate in Drinking Water Matrices

Bromate, a disinfection byproduct of the ozonation disinfection process for drinking water, has been cited by the U.S. EPA and the World Health Organization as a potential carcinogen, even at low  $\mu\text{g/L}$  (ppb) concentrations.

A simple, isocratic method has been developed using the high capacity IonPac AS9-HC column to determine bromate at low  $\mu\text{g/L}$  concentrations. This method uses a large loop injection with an isocratic carbonate eluent coupled with suppressed conductivity detection as illustrated in Figure 4.

### Sample Pretreatment

For drinking water samples containing excessive chloride concentrations, an OnGuard<sup>®</sup> Ag cartridge can be used to remove the chloride followed by an OnGuard H to remove residual silver ions. The OnGuard H also removes carbonate. Figure 5 illustrates the use of this pretreatment.

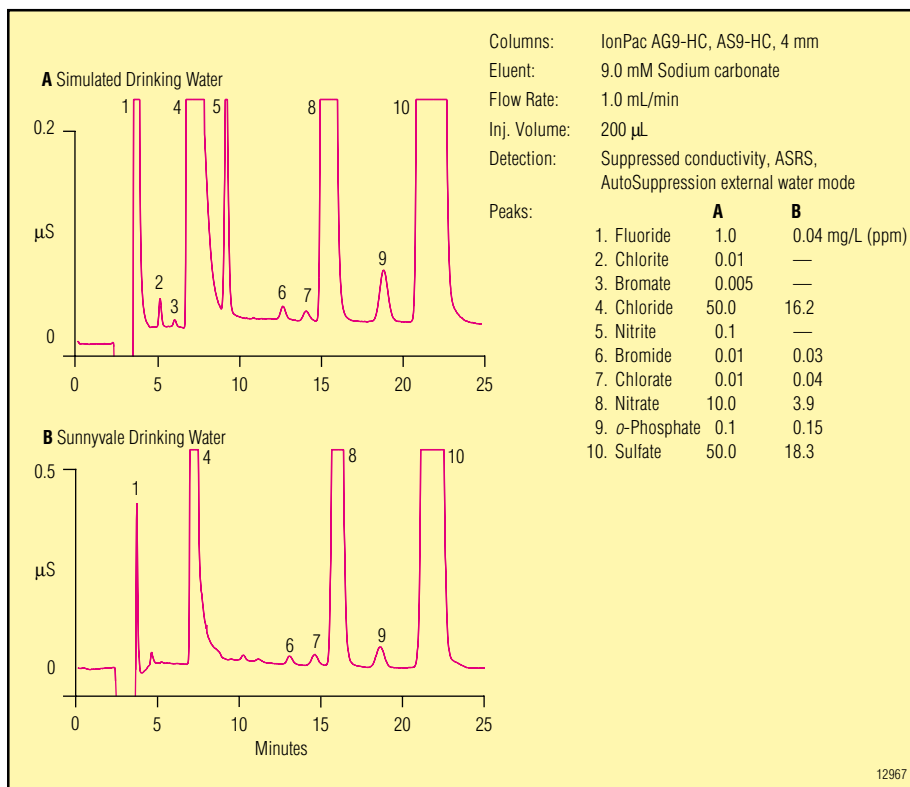


Figure 4. Determination of trace bromate in drinking water using the AS9-HC column.

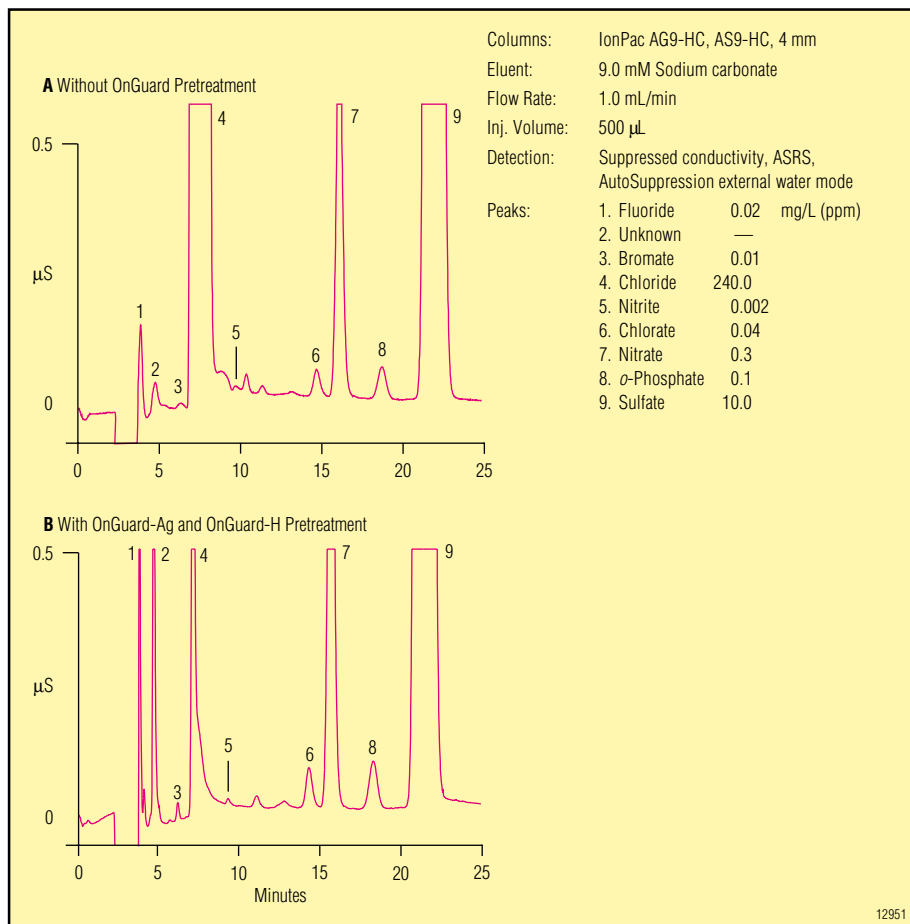


Figure 5. Effect of OnGuard pretreatment on drinking water samples with excessive chloride concentrations.

### AS9-SC Fast Run for Chloride and Sulfate

Sulfur and chlorine play important roles in many catalytic processes used for petrochemical production. With combustion-IC, the total sulfur and chlorine contents of polymeric catalysts can be determined with high accuracy and precision. The AS9-SC provides a rapid method to determine chloride and sulfate in polymeric catalysts. With an optimized carbonate eluent, these analytes can be determined in less than 8 minutes, as illustrated in Figure 6.

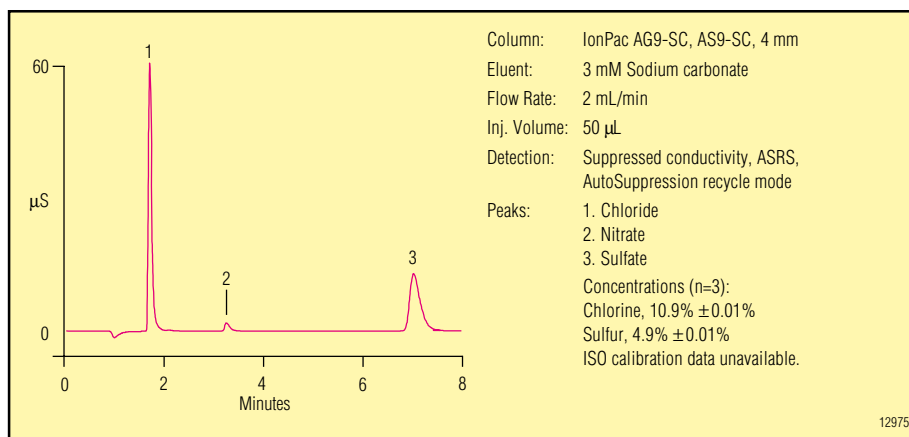


Figure 6. Determination of chloride and sulfate in a polymeric catalyst using the AS9-SC column.

### AS9-HC for Inorganic Anions in Solvents

Monitoring anionic contaminants in the manufacture of semiconductor materials such as organic solvents is important because yield and reliability can be significantly compromised by ionic contamination. An isocratic method has been developed using the high-capacity AS9-HC column to determine trace anions in water-miscible organic solvents. Figure 7 illustrates the separation of trace anions in semiconductor isopropyl alcohol. For more details on this application please refer to Dionex Application Note 85.

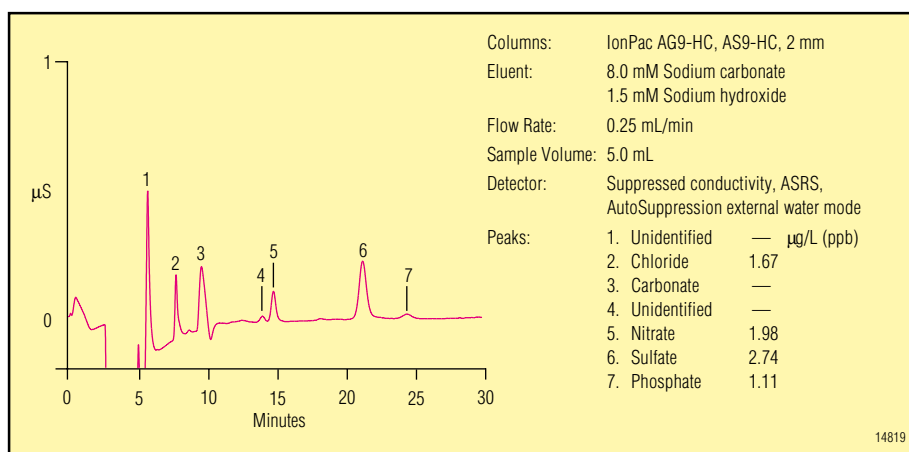


Figure 7. Trace anion analysis of spiked semiconductor isopropyl alcohol using the AS9-HC column.

## AS9-HC for High Ionic Strength Samples

The high capacity AS9-HC column is ideal for difficult applications such as trace nitrite in complex matrices, including meat and milk products, fertilizers, soil extracts, and wastewater. Figure 8A illustrates the analysis of 0.2 ppm nitrite spiked into ASTM synthetic wastewater containing 2000 ppm chloride. Using an isocratic carbonate eluent and suppressed conductivity detection, a 10,000:1 ratio of chloride/nitrite can be analyzed with the AS9-HC column.

UV detection at 214 nm provides improved sensitivity for nitrite and allows ratios up to 111,000:1 of chloride/nitrite to be analyzed as illustrated in Figure 8B. Chloride, which is UV transparent, is seen as a large dip at 7 minutes, and does not interfere with the quantification of nitrite.

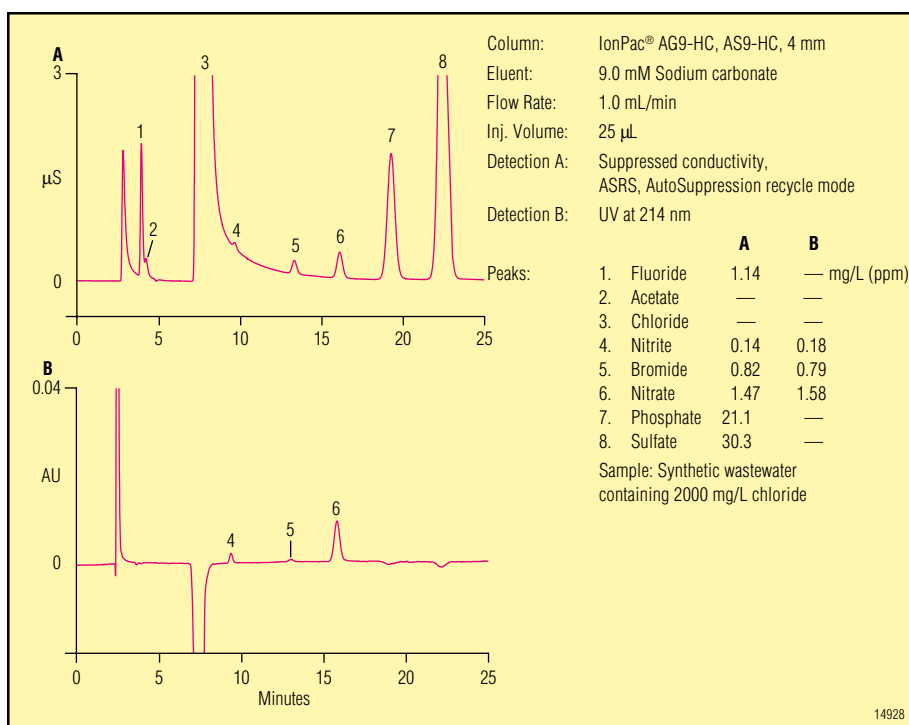


Figure 8. Comparison of suppressed conductivity detection and UV detection for the determination of trace nitrite in a wastewater sample containing high levels of chloride.

## SPECIFICATIONS

### IonPac AS9-SC Column

#### Dimensions:

IonPac AS9-SC Analytical Column:  
4 x 250 mm

IonPac AG9-SC Guard Column:  
4 x 50 mm

Maximum Operating Pressure:  
4000 psi

Mobile Phase Compatibility:  
pH 2–11; 0–100% HPLC solvents

Substrate Characteristics:  
Bead Diameter: 13.0 µm  
Crosslinking (%DVB): 55%

Latex Characteristics:  
Functional Group: Alkyl quaternary ammonium ion  
Latex Crosslinking: 20%  
Latex Diameter: 110 nm  
Hydrophobicity: Medium

Capacity:  
30–35 µeq (4 x 250 mm column)

Column Construction:  
PEEK with 10–32 threaded ferrule-style end fittings. All components are nonmetallic.

### IonPac AS9-HC Column

#### Dimensions:

IonPac AS9-HC Analytical Column:  
2 x 250 mm and 4 x 250 mm

IonPac AG9-HC Guard Column:  
2 x 50 mm and 4 x 50 mm

Maximum Operating Pressure:  
4000 psi

Mobile Phase Compatibility:  
pH 0–12; 0–100% HPLC solvents

Substrate Characteristics:  
Bead Diameter: 9.0 µm  
Pore Size: 2000 Å  
Crosslinking (%DVB): 55%

Latex Characteristics:  
Functional Group: Alkyl/alkanol quaternary ammonium ion  
Latex Crosslinking: 15%  
Latex Diameter: 90 nm  
Hydrophobicity: Medium-Low

Capacity:  
47.5 µeq (2 x 250 mm column)  
190 µeq (4 x 250 mm column)

Column Construction:  
PEEK with 10–32 threaded ferrule-style end fittings. All components are nonmetallic.

## Ordering Information

For optimum ease-of-use and economy, the IonPac AS9-SC and AS9-HC columns should be used with the Anion Self-Regenerating Suppressor®. For added ease-of-use, Dionex offers AS9-SC and AS9-HC Eluent Concentrates and a line of anion standards to make your chromatography analysis even easier. See the part numbers listed or refer to the Dionex Product Selection Guide for more details.

When performing sodium tetraborate gradient anion exchange applications on the AS9-SC and AS9-HC, an Anion Trap Column (ATC) should be installed between the gradient pump and the injection valve to remove anionic contaminants from the eluent.

For 4-mm concentrator work, use the appropriate guard (IonPac AG9-SC or AG9-HC), TAC Concentrator column, or the AMC-1 Anion MicroConcentrator when a single piston pump such as the DQP or DXP is used for sample delivery. Use the TAC-LP1 Concentrator column when the sample is delivered with a syringe or with an autosampler such as the AS40 or AS50.

For 2-mm concentrator work, use the appropriate guard (IonPac AG9-SC or AG9-HC) or the AMC-1 Anion MicroConcentrator when a single piston pump such as the DQP or DXP is used for sample delivery.

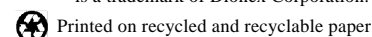
## ORDERING INFORMATION

In the U.S., call 1-800-346-6390 or contact the Dionex regional office nearest you. Outside the U.S., order through your local Dionex office or distributor. Refer to the following part numbers.

Description	Part Number
<b>IonPac AS9 Columns</b>	
IonPac AS9-SC Analytical Column (4 x 250 mm) .....	043185
IonPac AG9-SC Guard Column (4 x 50 mm) .....	043186
IonPac AS9-HC Analytical Column (4 x 250 mm) .....	057186
IonPac AG9-HC Guard Column (4 x 50 mm) .....	051791
IonPac AS9-HC Analytical Column (2 x 50 mm) .....	052244
IonPac AG9-HC Guard Column (2 x 50 mm) .....	052248
<b>Trap Columns</b>	
ATC-1 Anion Trap Column (for use with 4-mm columns) .....	037151
ATC (2-mm) Anion Trap Column (for use with 3-mm columns) .....	043131
<b>Concentrator Columns</b>	
TAC-2 Trace Anion Concentrator (3 x 35 mm) .....	043101
TAC-LP1 Trace Anion Concentrator (4 x 35 mm) .....	046026
AMC-1 Anion MicroConcentrator (2 x 15 mm) .....	051760
<b>Eluent Concentrates</b>	
Sodium Carbonate/Bicarbonate Concentrate (500 mL of 100X concentrate. For use with AS9-SC column) .....	039513
0.5 M Carbonate Anion Eluent Concentrate (500 mL of 100X concentrate. For use with AS9-HC column) .....	037162



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\* Designed, developed, and manufactured under an NSAI registered ISO 9001 Quality System.



LPN 0912-02 4M 1/01  
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