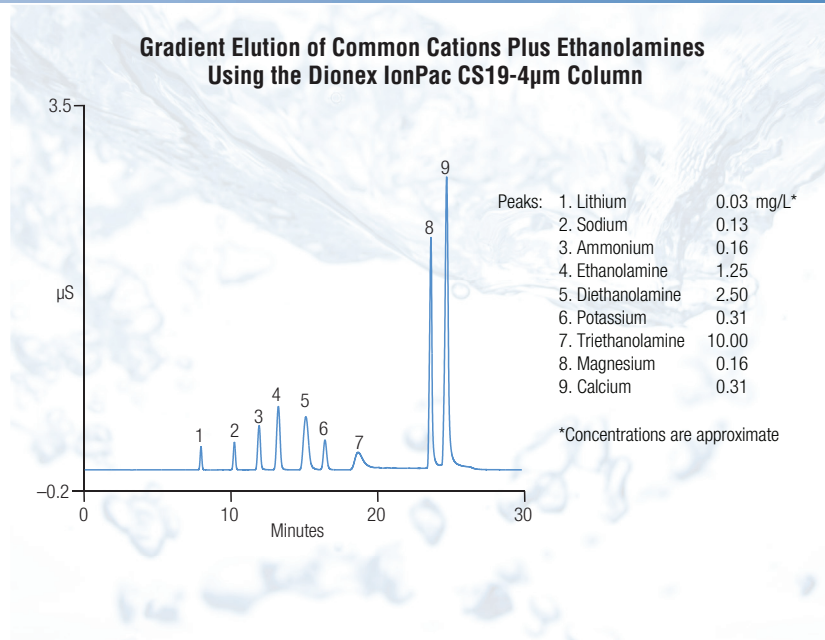


# Thermo Scientific Dionex IonPac CS19-4 $\mu$ m Cation-Exchange Column

The Thermo Scientific™ Dionex™ IonPac™ CS19-4 $\mu$ m cation-exchange column has moderately high capacity and moderate hydrophobicity, and is recommended for isocratic and gradient separations of polar amines such as alkanolamines, methylamines, and moderately hydrophobic amines including biogenic amines. The Dionex IonPac CS19-4 $\mu$ m column is ideally used with an Reagent-Free™ Ion Chromatography (RFIC™) system for automatic methanesulfonic acid (MSA) eluent generation and electrolytic eluent suppression with conductivity detection. Available Dionex IonPac CS19-4 $\mu$ m column formats include 0.4  $\times$  250 mm, 2  $\times$  250 mm, and 4  $\times$  250 mm, allowing flow rates from 10  $\mu$ L/min to 1.3 mL/min.



## Superior Chromatographic Performance

- Universal column for polar amines, including alkanolamines and methylamines in diverse sample matrices.
- Universal column for moderately hydrophobic amines including biogenic amines.
- Simplified RFIC system requires only a deionized water source to produce MSA eluent.
- The Dionex IonPac CS19-4 $\mu$ m capillary and microbore columns offer reduced eluent consumption and reduced operating costs.
- More rugged and reliable column for most Dionex IonPac CS18 column applications.
- RFIC eluent suppressors (Thermo Scientific™ Dionex™ CERS 500 Cation Electrolytically Regenerated Suppressor or Thermo Scientific™ Dionex™ CCES™ 300 Cation Capillary Electrolytic Suppressor) and trap column (Thermo Scientific Dionex CR-CTC Continuously Regenerated Cation Trap Column) together provide electrolytic suppression with minimal baseline shift during gradients and enhanced analyte sensitivity.
- Compatible with 10% organic solvents such as acetonitrile and acetone (excluding alcohols) to enhance analyte solubility, modify column selectivity, and allow effective column cleanup.
- Moderately high capacity: 2400  $\mu$ eq/col (4  $\times$  250 mm column). Allows easier analysis of high ionic strength samples.
- Samples include power plant waters treated with ammonium, morpholine or ethanolamine, chemical additives, chemical process solutions, refinery scrubber solutions, personal care products, and foods.

## Unique Carboxylate Cation Exchanger for Small Amines

The Dionex IonPac CS19-4 $\mu$ m column is a unique moderately hydrophobic, moderately high capacity, weak cation exchanger designed for polar amines, and moderately hydrophobic amines, plus the common inorganic cations using suppressed conductivity detection. The supermacroporous resin bead structure of the Dionex IonPac CS19-4 $\mu$ m column is composed of a polymeric 4  $\mu$ m substrate consisting of ethylvinyl benzene cross-linked with 55% divinylbenzene. The raw resin bead is then grafted with weak carboxylic acid groups as shown in Figure 1. The Dionex IonPac CS19-4  $\mu$ m resin bead is produced using a novel low surface area substrate. All commercially available grafted cation exchange materials make use of high surface area substrates which provide good capacity but tend to preclude good peak shape, especially for hydrophobic cations which interacts strongly with the substrate surface. The Dionex IonPac CS19-4  $\mu$ m resin bead architecture overcomes these issues by making use of a low surface area substrate. The use of 4  $\mu$ m particle size substrate allows for further improvements in the chromatographic performance compared to the original Dionex IonPac CS19 resin bead.

The Dionex IonPac CS19-4 $\mu$ m column offers optimum isocratic resolution of sodium, ammonium, and ethanolamine. The common inorganic cations can be separated by gradient elution from methylamine, dimethylamine, and trimethylamine. The column is polymer-based and can be used with eluents of pH 0–7. This column is compatible with 10% of the organic solvents (used with IC acetonitrile and acetone). The Dionex IonPac CS19-4 $\mu$ m column allows gradient elution to resolve difficult analyte pairs and reduce total run time, all with minimal baseline shift during gradients.

### Common Inorganic Cations

The common inorganic cations plus ammonium are separated on the Dionex IonPac CS19-4 $\mu$ m column with 8 mM MSA eluent in approximately 11 min, as shown in Figure 2. Figure 3 illustrates the separation of the common inorganic cations, plus ammonium and ethylamines. Using 4 mM MSA coupled with suppressed conductivity detection, these analytes can be separated in approximately 45 min.

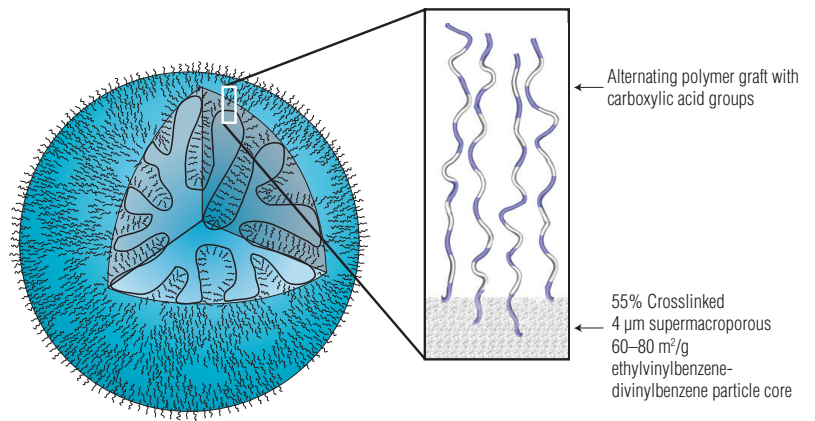


Figure 1. Structure of a Dionex IonPac CS19-4 $\mu$ m packing particle.

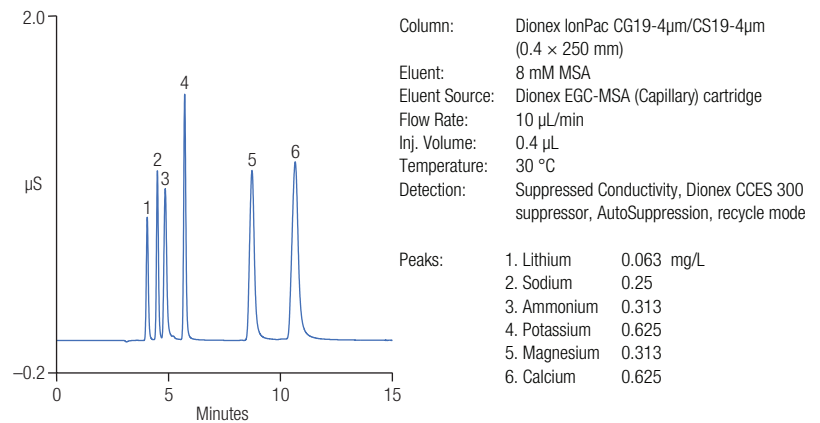
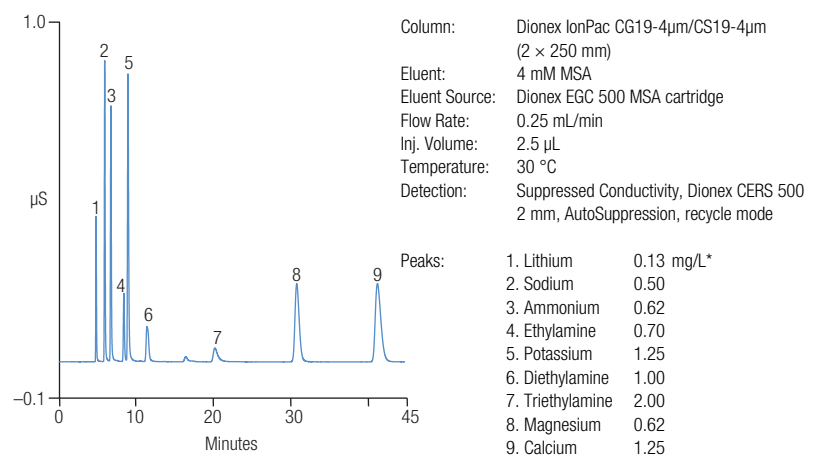


Figure 2. Isocratic separation of six common cations using the Dionex IonPac CG19-4 $\mu$ m/CS19-4 $\mu$ m column.



\*Concentrations are approximate

Figure 3. Separation of six common cations plus ethylamines using the Dionex IonPac CG19-4 $\mu$ m/CS19-4 $\mu$ m column.

## Determination of Alkanolamines and the Common Inorganic Cations

Alkanolamines, including monoethanolamine, diethanolamine, and triethanolamine, are most commonly used individually, but are also used in combination to optimize scrubber treatment efficiency for specific chemical processes. In large plants, different alkanolamines may be used in adjacent units to accommodate different scrubbing requirements. The Dionex IonPac CS19-4 $\mu$ m column has unique selectivity for alkanolamines and therefore can resolve mixtures of these priority scrubber amines using a 4 mM MSA isocratic eluent in about 40 min. However, using an eluent gradient and faster flow rate, the separation is accomplished in about 25 min, as illustrated in Figure 4.

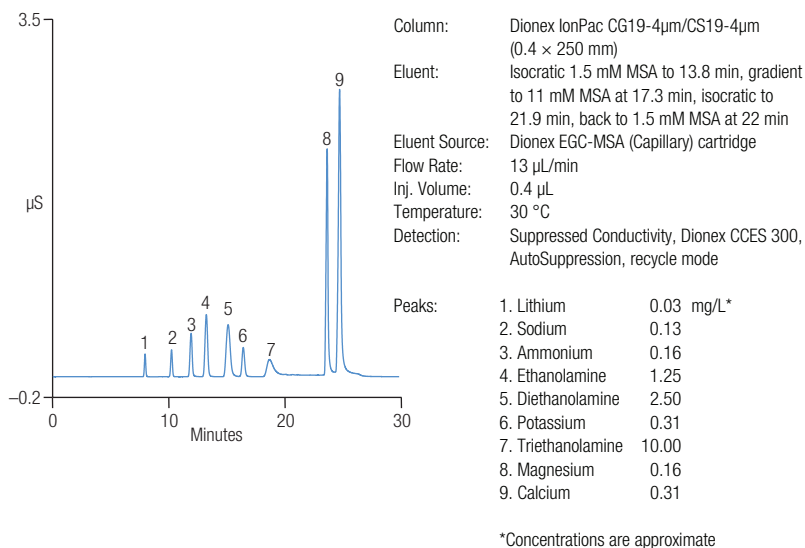


Figure 4. Separation of alkanolamines and the common inorganic cations using the Dionex IonPac CG19-4 $\mu$ m/CS19-4 $\mu$ m column.

## Determination of Ammonium and the Group I and II Cations

The Dionex IonPac CS19-4 $\mu$ m column is the recommended column for the determination of ammonium and the common inorganic cations in diverse sample matrices, including scrubber solutions, process streams, and wastewater. Ammonium and the Group I and II cations are separated and elute with excellent peak efficiencies and symmetries when the column is run with a simple isocratic eluent, as illustrated in Figure 5. Figure 6 shows this same separation using an eluent gradient and faster flow rate decreasing the run time to under 10 min.

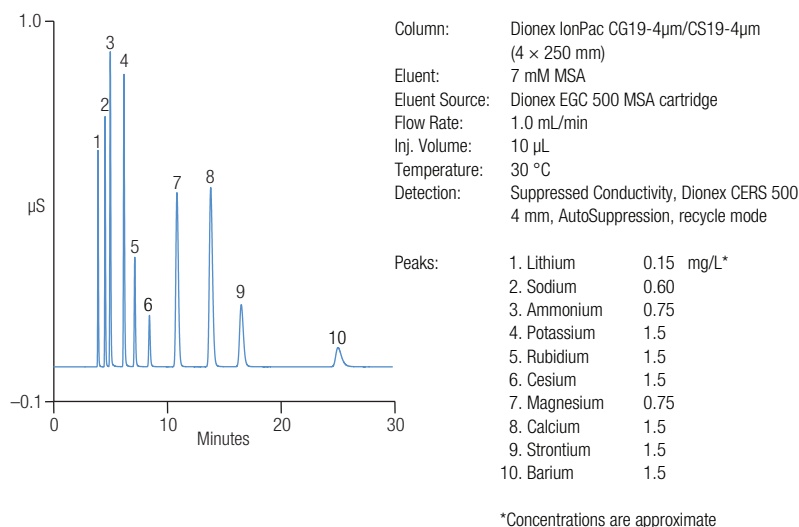


Figure 5. Separation of ammonium and the Group I and Group II inorganic cations using the Dionex IonPac CG19-4 $\mu$ m/CS19-4 $\mu$ m column.

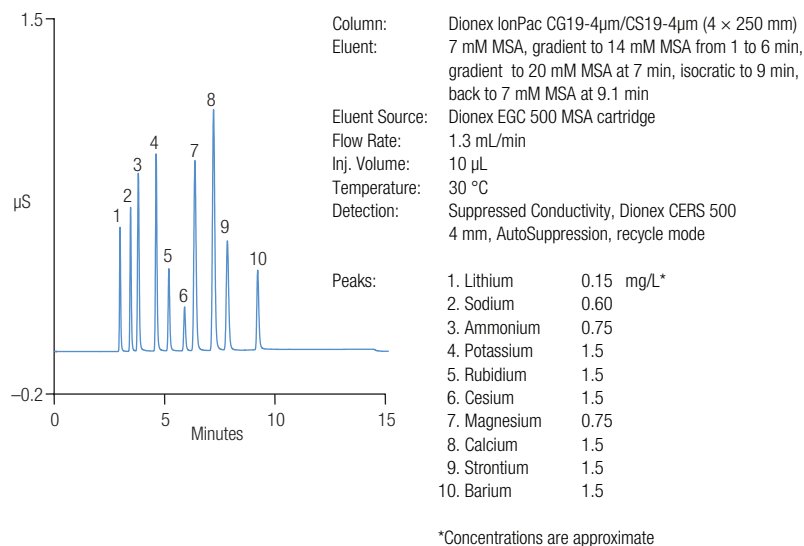


Figure 6. Fast gradient elution of ammonium and Group I and Group II cations using the Dionex IonPac CS19-4 $\mu$ m column.

## Temperature Effects on Cation Separations

The effect of temperature on potassium is higher than for the other monovalent cations and dimethylamine. At the standard operating temperature of 30 °C, dimethylamine and potassium co-elute. At a lower column temperature, potassium is retained longer than dimethylamine, and their resolution is achieved at 15 °C as shown in Figure 7. As expected, total system pressure increases as the column temperature is decreased. When developing a method application, make sure the total system pressure is within the operational pressure of the system.

## Determination of Biogenic Amines and the Common Cations

Biogenic amines including putrescine, cadaverine, histamine, agmatine, spermidine, and spermine are important to monitor in foods because they are indicators of spoilage. As shown in Figure 8, the Dionex IonPac CS19-4 $\mu$ m column can easily separate the common cations and biogenic amines using an aqueous eluent without the need for organic solvent. Using the optimized gradient and increased flow rate shown in Figure 8, the biogenic amines and cations elute with good peak efficiencies and symmetries in less than 15 min.

Using the Dionex IonPac CS19-4 $\mu$ m column and suppressed conductivity detection, these biogenic amines can easily be determined in complex food matrices. Amperometric detection can also be used to detect biogenic amines. This detection mode provides the advantage of specificity for oxidizable amines including the biogenic amines. Inorganic cations present in the sample are not detected using amperometric detection.

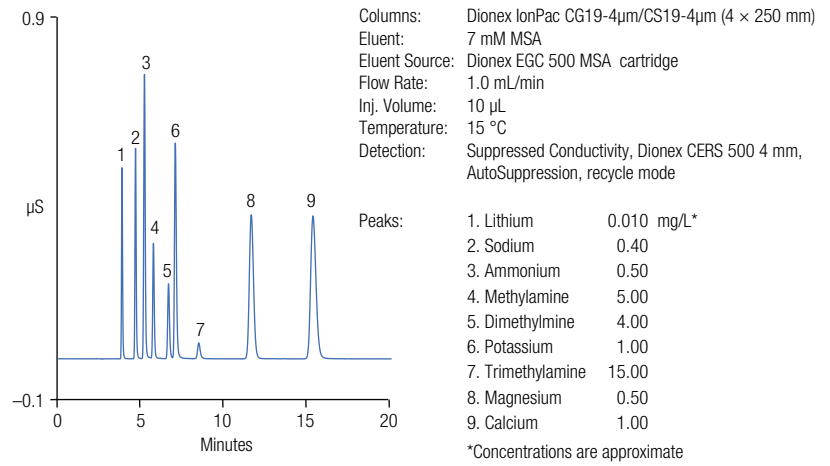


Figure 7. Isocratic separation of methylamines and the common inorganic cation using the Dionex IonPac CS19-4 $\mu$ m column at 15 °C.

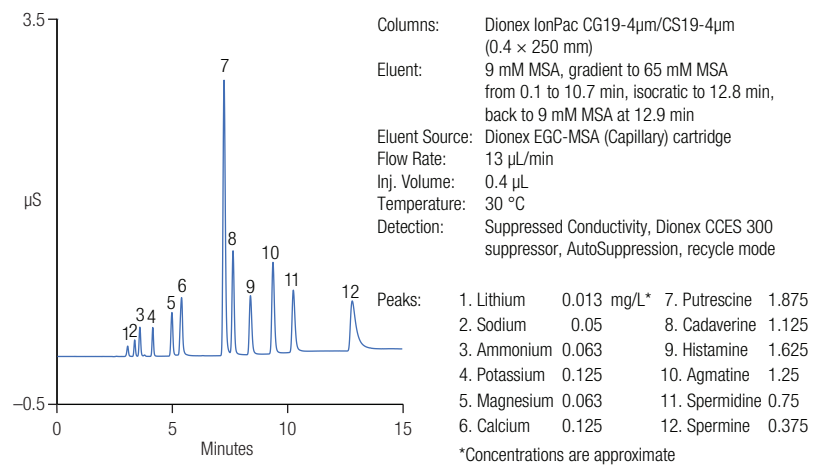


Figure 8. Biogenic amines and the common six cations separated using the Dionex IonPac CG19-4 $\mu$ m/CS19-4 $\mu$ m column.

## Solvent-Compatible Packing

The Dionex IonPac CS19-4 $\mu$ m column is compatible with up to 10% organic solvents, such as acetonitrile and acetone. Alcohols can only be used at very low flow rates to avoid high pressure on the column. Thus, alcohols can be present in samples or can be used for washing the column at 1/5 of the standard flow rate for the column format. Adding acetonitrile to the eluent modifies column selectivity and enables the elution of nonpolar analytes, hydrophobic analytes, or contaminants from the column. Acetonitrile can be used to enhance sample solubility, reduce retention times due to hydrophobic interactions, and improve the peak shapes of hydrophobic amines. Time and expense can be saved by eliminating time-consuming sample preparation steps. This feature allows complex sample matrices to be analyzed with minimal sample preparation.

## System Requirements

The Dionex IonPac CS19-4 $\mu$ m column operated in the suppressed conductivity mode is recommended for use with the Thermo Scientific™ Dionex™ ICS-5000+ Reagent-Free™ HPIC™ system equipped with an eluent generator. Capillary columns (0.4 mm) require the use of a capillary system such as the Dionex ICS-5000+ HPIC system or the Thermo Scientific Dionex ICS-4000 Capillary HPIC system. The eluent generator automatically produces methane-sulfonic acid gradients from deionized water.

## Suppressor Recommendations

For optimum ease of use and performance, the Dionex IonPac CS19-4 $\mu$ m analytical column should be used with the Dionex CERS 500 Cation Electrolytically Regenerated Suppressor. The Dionex CCES 300 Cation Capillary Electrolytic Suppressor is used with the Dionex IonPac CS19-4 $\mu$ m capillary column. We recommend operating the Dionex IonPac CS19-4 $\mu$ m column at a slightly elevated temperature (30 °C) to ensure reproducible retention times in all environmental conditions.

## Cation Trap Columns

When using the eluent generator for eluent delivery and to achieve an almost flat baseline when using gradient elution, we recommend installing a Dionex CR-CTC 500 Continuously Regenerated Cation Trap Column to remove cationic contaminants from the eluent. The Dionex CR-CTC 500 Continuously Regenerated Cation Trap Column should be installed between the Thermo Scientific Dionex EGC Eluent Generator Cartridge and the eluent generator degas module.

Alternatively, a Thermo Scientific Dionex IonPac CTC 500 Cation Trap Column can be used with 2 mm and 4 mm columns, and is installed between the gradient pump and the injection valve to remove cationic contaminants from the eluent. For capillary applications, the Thermo Scientific Dionex CR-CTC II Continuously Regenerated Cation Trap Column (Capillary) is used to reduce the background conductivity during gradient separations.

## Concentrator Columns

For trace analysis work, use the Thermo Scientific Dionex IonPac Trace Cation Concentrator Column (Dionex IonPac TCC-LP1, TCC-ULP1, or TCC-XLP1) when the sample is delivered with a syringe or with an autosampler.

For concentrator work with a 0.4 mm capillary column, use the Thermo Scientific™ Dionex™ IonSwift™ MCC-100 concentrator column.

## SPECIFICATIONS

<b>Dimensions</b>	Dionex IonPac CS19-4 $\mu$ m Analytical Column: 2 $\times$ 250 mm and 4 $\times$ 250 mm Dionex IonPac CG19-4 $\mu$ m Guard Column: 2 $\times$ 50 and 4 $\times$ 50 mm Dionex IonPac CS19-4 $\mu$ m Capillary Column: 0.4 $\times$ 250 mm Dionex IonPac CG19-4 $\mu$ m Capillary Guard Column: 0.4 $\times$ 50 mm
<b>Maximum Operating Pressure</b>	5000 psi (standard, microbore, and capillary)
<b>Mobile Phase Compatibility</b>	Acidic eluents (pH 0–7), 10% HPLC solvents, alcohols should be avoided.
<b>Substrate Characteristics</b>	Particle Diameter: 4 $\mu$ m Guards: 8 $\mu$ m Crosslinking: 55% DVB
<b>Ion-Exchange Group</b>	Grafted carboxylic acid
<b>Functional Group Characteristics</b>	Medium hydrophobicity
<b>Capacity</b>	2410 $\mu$ eq/column (4 $\times$ 250 mm) 46 $\mu$ eq/column (4 $\times$ 50 mm) 600 $\mu$ eq/column (2 $\times$ 250 mm) 11 $\mu$ eq/column (2 $\times$ 50 mm) 24 $\mu$ eq/column (0.4 $\times$ 250 mm) 0.5 $\mu$ eq/column (0.4 $\times$ 50 mm)
<b>Column Construction</b>	PEEK with 10-32 threaded ferrule-style end fittings. All components are nonmetallic.

## Ordering Information

In the U.S., call (800) 346-6390 or contact the Thermo Fisher Scientific Regional Office nearest you. Outside the U.S., order through your local Thermo Fisher Scientific office or distributor. Refer to the following part numbers.

Analytical, Capillary and Guard Columns	Part Number
Dionex IonPac CS19-4 $\mu$ m Capillary Column (0.4 $\times$ 250 mm)	078835
Dionex IonPac CG19-4 $\mu$ m Capillary Guard Column (0.4 $\times$ 50 mm)	078838
Dionex IonPac CS19-4 $\mu$ m Analytical Column (4 $\times$ 250 mm)	078837
Dionex IonPac CG19-4 $\mu$ m Guard Column (4 $\times$ 50 mm)	078840
Dionex IonPac CS19-4 $\mu$ m Analytical Column (2 $\times$ 250 mm)	078836
Dionex IonPac CG19-4 $\mu$ m Guard Column (2 $\times$ 50 mm)	078839
Cation Trap Columns	Part Number
Dionex CR-CTC 500 Continuously Regenerated Cation Trap Column	075551
Dionex CR-CTC II Continuously Regenerated Cation Trap Column (Capillary) (for use with Capillary Cation Columns)	072079
Dionex IonPac CTC 500 Cation Trap Column (9 $\times$ 24 mm) (for use with 4 mm columns)	075977
Dionex IonPac CTC 500 Cation Trap Column (4 $\times$ 35 mm) (for use with 2 mm columns)	079019
Trace Cation Concentrator Columns	Part Number
Dionex IonPac TCC-LP1 Trace Cation Concentrator Low Pressure (4 $\times$ 35 mm)	046027
Dionex IonPac TCC-ULP1 Trace Cation Concentrator Ultralow Pressure (5 $\times$ 23 mm)	063783
Dionex IonPac TCC-XLP1 Trace Cation Concentrator Extremely Low Pressure (6 $\times$ 16 mm)	063889
Dionex IonSwift MCC-100 Monolith Cation Concentrator Column (0.5 $\times$ 80 mm)	075462

[www.thermoscientific.com/dionex](http://www.thermoscientific.com/dionex)

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