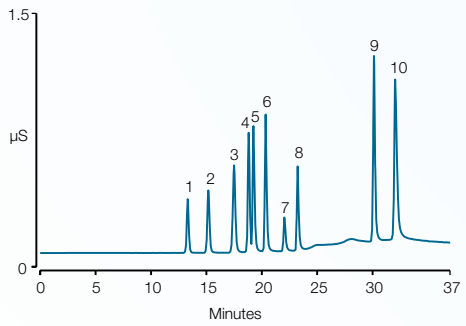
thermo scientific

PRODUCT SPECIFICATIONS



Column:	Dionex IonPac CG20 + CS20 4 mm
Eluent:	2–4 mM MSA from 0–15 min 4–15 mM MSA from 15–20 min 15–50 mM MSA from 20–25 min 50 mM MSA from 25–37 min
Eluent Source:	Dionex EGC 500 MSA cartridge
Flow Rate:	1.2 mL/min
Inj. Volume:	10 µL
Temperature:	20 °C
Detection:	Suppressed Conductivity, Dionex CERS 500, 4 mm AutoSuppression, suppression recycle mode
Suppressor Current:	176 mA

Peaks:	mg/L		mg/L
1. Lithium	0.25	6. Dimethylamine	5.00
2. Sodium	1.00	7. Trimethylamine	10.0
3. Ammonium	1.25	8. Tetramethylammonium	5.00
4. Methylamine	1.25	9. Magnesium	1.25
5. Potassium	2.50	10. Calcium	2.50

Thermo Scientific™ Dionex™ IonPac™ CS20 cation-exchange column

Unique column chemistry for challenging amine separations

Benefits

- Elutes most amines away from matrix ions, which would otherwise make quantitation difficult
- Supports use of high temperatures for complex separations
- Solvent compatible

Keywords

Cation exchange chromatography, inorganic cations, amines, methylamines, ethylamines, ethanolamines, alkanolamines

The Thermo Scientific™ Dionex™ IonPac™ CS20 cation-exchange column has high capacity and moderate hydrophobicity, and is recommended for determination of inorganic cations and amines including methylamines, ethylamines, ethanolamines, and alkanolamines. The Dionex IonPac CS20 column is ideally used with a Reagent-Free™ Ion Chromatography (RFIC™) system for automatic methanesulfonic acid (MSA) eluent generation and electrolytic eluent suppression with conductivity detection. Available Dionex IonPac CS20 column formats include 0.4 × 250 mm, 2 × 250 mm, and 4 × 250 mm, allowing flow rates from 12 µL/min to 1.2 mL/min.

- Complementary selectivity to other Dionex IonPac cation-exchange columns.
- Compatible with temperatures ranging from 15 °C to 70 °C to improve some critical analyte pair separations.
- Compatible with 100% organic solvents such as acetonitrile and acetone (excluding alcohols) to enhance analyte solubility, modify column selectivity, and allow effective column cleanup.
- Dionex IonPac CS20 capillary and microbore columns offer reduced eluent consumption and reduced operating costs.

ThermoFisher SCIENTIFIC

- Use for a variety of samples, including power plant waters treated with ammonium, morpholine, or ethanolamine, chemical additives, chemical process solutions, refinery scrubber solutions, personal care products, and pharmaceuticals.

Novel triple-mode stationary phase

The Dionex IonPac CS20 column is a moderately hydrophobic, high capacity, cation-exchange column designed to separate polar and moderately hydrophobic amines along with the common inorganic cations using suppressed conductivity detection. The macroporous resin bead structure of the Dionex IonPac CS20 column is composed of a polymeric 5 µm substrate consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene. The raw resin bead is then grafted with a combination of sulfonic, phosphonic, and carboxylic acid groups as shown in Figure 1. This new material incorporates multiple types of ion exchange sites in the stationary phase to achieve improved selectivity for monovalent species while enabling facile elution of divalent species.

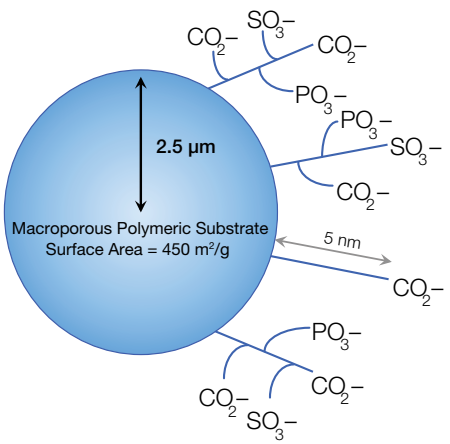


Figure 1. Structure of a Dionex IonPac CS20 column resin particle.

The unique and robust triple-mode stationary phase can tolerate samples with up to 100 mM hydronium ion (pH 1.0) with minimum loss of performance. By comparison, other lower capacity carboxylic acid functionalized columns can tolerate only up to 20 mM acid. In addition, the Dionex IonPac CS20 column is fully compatible with organic solvents used in IC (acetonitrile and acetone), and allows the use of high temperature separations to resolve difficult analyte pairs.

Designed to separate amines

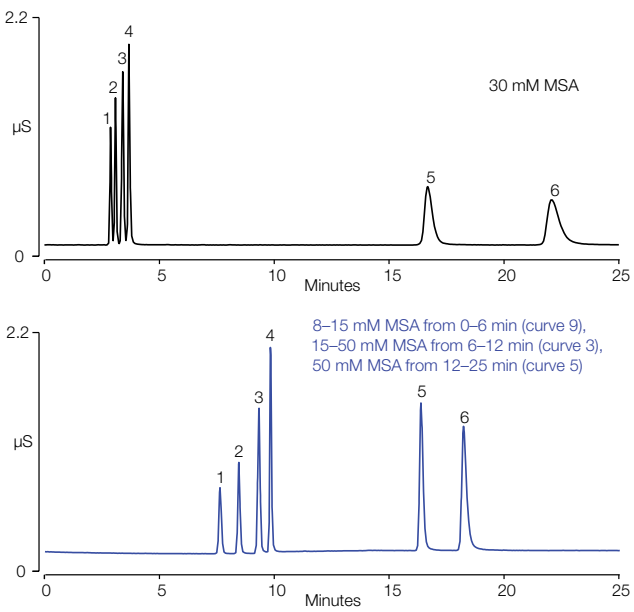
The Dionex IonPac CS20 features a large separation window between monovalent and divalent cations, making it ideal for eluting most amines between the alkali and alkaline earth metals. This large separation window is advantageous for samples that typically pose quantitation challenges, where amines are present at much lower concentrations than alkali metal matrix ions.

Economical capillary operation

The Dionex IonPac CS20 column is available in a 0.4 mm i.d. format for capillary operation, offering reduced operating costs as capillary IC systems use 100x less eluent than traditional IC systems. The capillary format is ideal for limited sample volumes due to its higher mass sensitivity. Applications developed on 4 mm columns can be directly transferred to 0.4 mm capillary columns by reducing flow rates 100-fold.

Common inorganic cations

The common inorganic cations are separated on the Dionex IonPac CS20 column with 30 mM MSA eluent in approximately 25 min, as shown in the top chromatogram of Figure 2. The bottom chromatogram in Figure 2 illustrates the use of a non-linear gradient to improve the separation and reduce run time. Note the large separation window between monovalent and divalent cations present in both chromatograms.



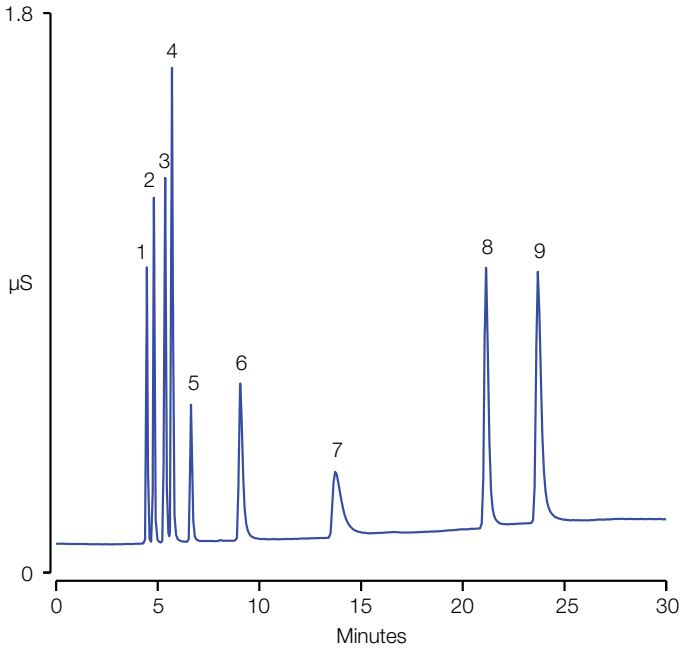
Column:	Dionex IonPac CG20 + CS20 4 mm
Eluent:	MSA
Eluent Source:	Dionex EGC 500 MSA cartridge
Flow Rate:	1.2 mL/min
Inj. Volume:	10 µL
Temperature:	30 °C
Detection:	Suppressed Conductivity, Dionex CERS 500, 4 mm AutoSuppression, recycle mode

Peaks:		mg/L
1.	Lithium	0.25
2.	Sodium	1.00
3.	Ammonium	1.25
4.	Potassium	2.50
5.	Magnesium	1.25
6.	Calcium	2.50

Figure 2. Comparison of isocratic and gradient separation of six common cations using the Dionex IonPac CS20 column (4 × 250 mm).

Determination of ethylamines and the common inorganic cations

Ethylamines are used to manufacture pharmaceuticals, dyes, rubber, corrosion inhibitors, pesticides, and other chemicals. Figure 3 illustrates the separation of common inorganic cations and ethylamines. Using an MSA gradient coupled with suppressed conductivity detection, these analytes can be determined in approximately 25 min.



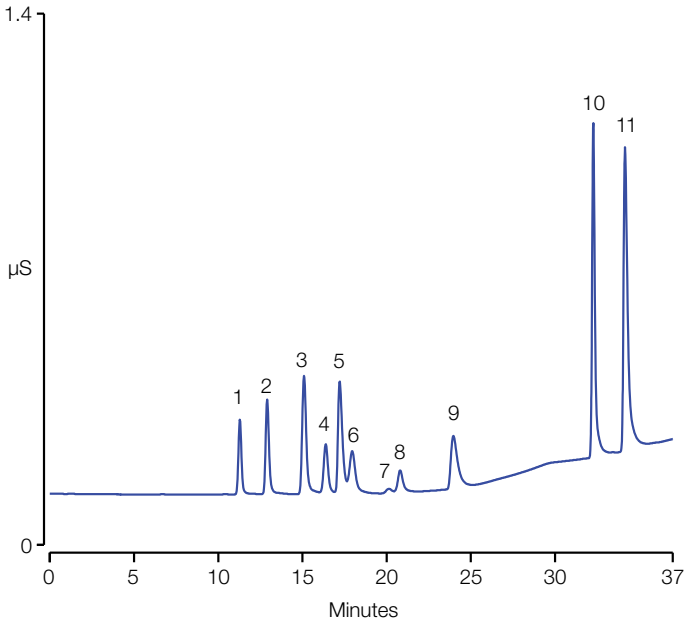
Column:	Dionex IonPac CG20 + CS20 4 mm
Eluent:	10–50 mM MSA from 0–30 min
Eluent Source:	Dionex EGC 500 MSA cartridge
Flow Rate:	1.2 mL/min
Inj. Volume:	10 µL
Temperature:	50 °C
Detection:	Suppressed Conductivity, Dionex CERS 500, 4 mm AutoSuppression, recycle mode
Suppressor current:	176 mA

Peaks:	mg/L		mg/L
1. Lithium	0.25	6. Diethylamine	5.00
2. Sodium	1.00	7. Triethylamine	5.00
3. Ammonium	1.25	8. Magnesium	1.25
4. Potassium	2.50	9. Calcium	2.50
5. Ethylamine	1.25		

Figure 3. Gradient elution of the six common cations and ethylamines using the Dionex IonPac CS20 column (4 × 250 mm).

Determination of alkanolamines and the common inorganic cations

Alkanolamines including monoethanolamine, diethanolamine, and triethanolamine are used to optimize scrubber treatment efficiency for specific chemical processes. They are also found in herbicides, surfactants, detergents, wood preservatives, and cement additives. The Dionex IonPac CS20 column has unique selectivity for alkanolamines and therefore can resolve alkanolamine mixtures using a gradient with suppressed conductivity detection, as illustrated in Figure 4.



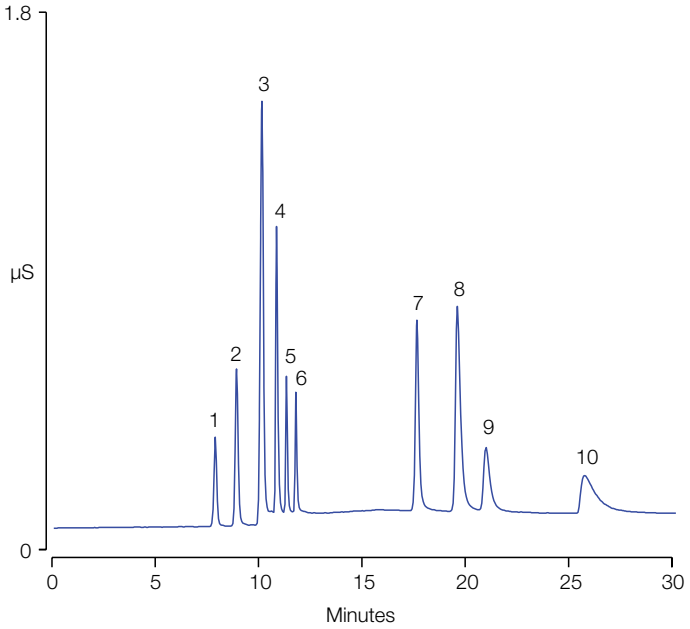
Column:	Dionex IonPac CG20 + CS20 0.4 mm
Eluent:	2–4 mM MSA from 0–15 min 4–15 mM MSA from 15–20 min 15–50 mM MSA from 20–25 min 50 mM MSA from 25–37 min
Eluent Source:	Dionex EGC-MSA (Capillary) cartridge
Flow Rate:	0.012 mL/min
Inj. Volume:	0.4 µL
Temperature:	30 °C
Detection:	Suppressed Conductivity, Dionex CCES 300, AutoSuppression, recycle mode
Suppressor Current:	15 mA

Peaks:	mg/L		mg/L
1. Lithium	0.06	7. Triethanolamine	0.50
2. Sodium	0.25	8. *N*-Methyldiethanolamine	1.25
3. Ammonium	0.32	9. Diisopropanolamine	1.25
4. Ethanolamine	0.32	10. Magnesium	0.32
5. Potassium	0.63	11. Calcium	0.63
6. Diethanolamine	0.50		

Figure 4. Separation of alkanolamines and the common inorganic cations using the Dionex IonPac CS20 capillary column (0.4 × 250 mm).

Determination of ammonium and the Group I and II cations

Ammonium and the Group I and II cations are separated and elute with excellent peak efficiencies when the Dionex IonPac CS20 column is run with a non-linear gradient, as illustrated in Figure 5.



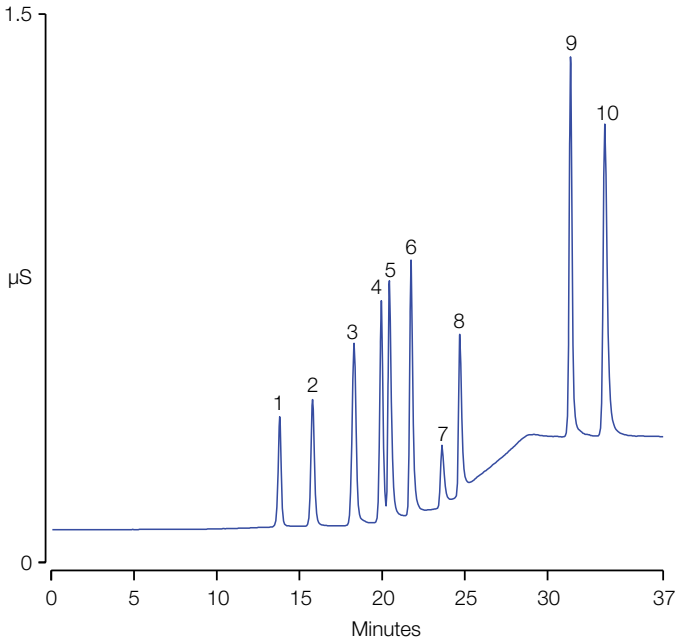
Column:	Dionex IonPac CG20 + CS20 2 mm
Eluent:	8–15 mM MSA from 0–6 min (curve 9) 15–50 mM MSA from 6–12 min (curve 3) 50 mM MSA from 12–25 min (curve 5)
Eluent Source:	Dionex EGC 500 MSA cartridge
Flow Rate:	0.3 mL/min
Inj. Volume:	2.5 µL
Temperature:	30 °C
Detection:	Suppressed Conductivity, Dionex CERS 500, 2 mm AutoSuppression, recycle mode
Suppressor Current:	44 mA

Peaks:	mg/L		mg/L
1. Lithium	0.25	6. Cesium	2.50
2. Sodium	1.00	7. Magnesium	1.25
3. Ammonium	1.25	8. Calcium	2.50
4. Potassium	2.50	9. Strontium	0.80
5. Rubidium	2.50	10. Barium	2.50

Figure 5. Separation of ammonium and the Group I and II inorganic cations on the Dionex IonPac CS20 column (2 × 250 mm).

Determination of methylamines and the common inorganic cations

Methylamine is widely used in the preparation of pharmaceuticals and dimethylamine is sometimes measured as a process impurity. As shown in Figure 6, the Dionex IonPac CS20 column can separate various methylamines and the common inorganic cations.



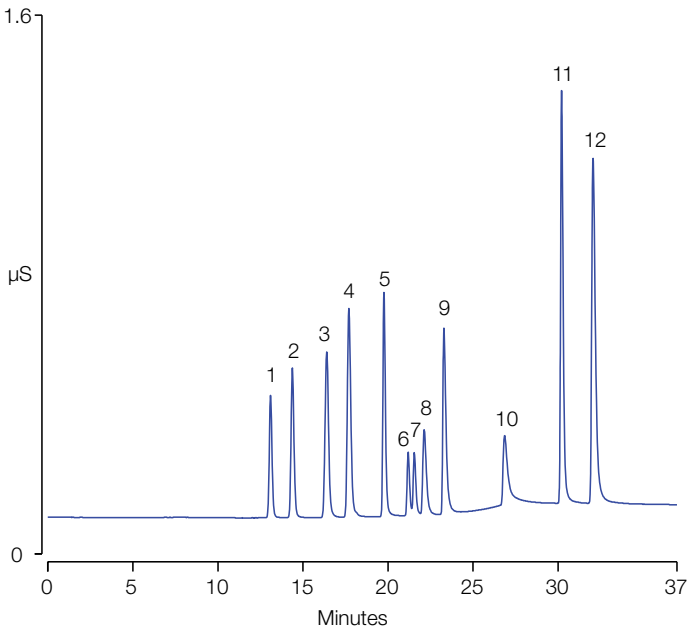
Column:	Dionex IonPac CG20 + CS20 2 mm
Eluent:	2–4 mM MSA from 0–15 min 4–15 mM MSA from 15–20 min 15–50 mM MSA from 20–25 min 50 mM MSA from 25–37 min
Eluent Source:	Dionex EGC 500 MSA cartridge
Flow Rate:	0.3 mL/min
Inj. Volume:	2.5 µL
Temperature:	20 °C
Detection:	Suppressed Conductivity, Dionex CERS 500, 2 mm AutoSuppression, recycle mode
Suppressor Current:	44 mA

Peaks:	mg/L		mg/L
1. Lithium	0.25	6. Dimethylamine	5.00
2. Sodium	1.00	7. Trimethylamine	10.0
3. Ammonium	1.25	8. Tetramethylammonium	5.00
4. Methylamine	1.25	9. Magnesium	1.25
5. Potassium	2.50	10. Calcium	2.50

Figure 6. Separation of methylamines and the common inorganic cations on the Dionex IonPac CS20 column (2 x 250 mm).

Determination of alkylamines and the common inorganic cations

Alkylamines are versatile intermediates used during the production of pharmaceuticals, explosives, rubber, pesticides, surfactants, and industrial solvents. They are also used to treat water and wastewater, and to improve agricultural yields. Figure 7 illustrates the separation of common inorganic cations and alkylamines on the Dionex IonPac CS20 column.



Column:	Dionex IonPac CG20 + CS20 4 mm
Eluent:	2–4 mM MSA from 0–15 min 4–15 mM MSA from 15–20 min 15–50 mM MSA from 20–25 min 50 mM MSA from 25–37 min
Eluent Source:	Dionex EGC 500 MSA cartridge
Flow Rate:	1.2 mL/min
Inj. Volume:	10 µL
Temperature:	50 °C
Detection:	Suppressed Conductivity, Dionex CERS 500, 4 mm AutoSuppression, recycle mode
Suppressor Current:	176 mA

Peaks:	mg/L		mg/L
1. Lithium	0.25	7. Ethylmethylamine	2.50
2. Sodium	1.00	8. Morpholine	5.00
3. Ammonium	1.25	9. Diethylamine	5.00
4. Potassium	2.50	10. Piperidine	5.00
5. Dimethylamine	5.00	11. Magnesium	1.25
6. Trimethylamine	5.00	12. Calcium	2.50

Figure 7. Separation of alkylamines and the common inorganic cations on the Dionex IonPac CS20 column (4 × 250 mm).

Fully solvent-compatible packing

The Dionex IonPac CS20 column is compatible with up to 100% organic solvents, such as acetonitrile and acetone. 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 CS20 columns are recommended for use with the Thermo Scientific™ Dionex™ ICS-5000⁺ HPIC™ system or Thermo Scientific™ Dionex™ Integrion™ HPIC™ system equipped with an eluent generator. These systems are capable of operating up to 5000 psi to support the back pressure generated by the Dionex IonPac CS20 column under standard operating conditions. Capillary columns (0.4 mm) require the use of a capillary system such as the Dionex ICS-5000⁺ capillary IC system or the Thermo Scientific™ Dionex™ ICS-4000 Integrated Capillary HPIC system. The eluent generator automatically produces methanesulfonic acid gradients from deionized water. For all systems, the use of Thermo Scientific™ Dionex™ IC PEEK Viper™ fittings is recommended to achieve consistent low dead volume connections and ensure optimum chromatographic performance.

Suppressor recommendations

For optimum ease of use and performance, Dionex IonPac CS20 analytical columns should be used with a Dionex CERS 500 Cation Electrolytically Regenerated Suppressor. Dionex IonPac CS20 capillary columns should be used with a Dionex CCES 300 Cation Capillary Electrolytic Suppressor. We recommend operating the Dionex IonPac CS20 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 Thermo Scientific™ Dionex™ CR-CTC 500 or CR-CTC 600 Continuously Regenerated Cation Trap Column to remove cationic contaminants from the eluent. The Dionex CR-CTC 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™ 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 Continuously Regenerated Cation Trap Column (Capillary) is used to reduce the background conductivity during gradient separations.

Concentrator columns

For trace analysis work, use a Thermo Scientific™ Dionex™ IonPac™ Trace Cation Concentrator column (Dionex IonPac TCC-LP1, TCC-ULP1, or TCC-XLP1) when the sample is delivered via a syringe or autosampler. For concentrator work with a 0.4 mm capillary column, use the Thermo Scientific™ Dionex™ IonSwift™ MCC-100 concentrator column.

Dionex IonPac CS20 Specifications

Dimensions:	Dionex IonPac CS20 Analytical Columns: 2 × 250 mm and 4 × 250 mm Dionex IonPac CG20 Guard Columns: 2 × 50 mm and 4 × 50 mm Dionex IonPac CS20 Capillary Column: 0.4 × 250 mm Dionex IonPac CG20 Capillary Guard Column: 0.4 × 50 mm
Maximum operating pressure:	5000 psi (standard, microbore, and capillary)
Mobile phase compatibility:	Acidic eluents (pH 0–7), 100% HPLC solvents (acetone and acetonitrile), alcohols should be avoided.

Substrate Characteristics

Separator and Guard columns:	Macroporous Resin Particle Diameter: 5 µm Pore Size: 100 Å Crosslinking (%DVB): 55%
Functional group:	Triple Mode (combination of sulfonic, phosphonic, and carboxylic acid groups) Hydrophobicity: Medium
Capacity (µeq/column):	3000 µeq/column (4 × 250 mm) 600 µeq/column (4 × 50 mm) 750 µeq/column (2 × 250 mm) 150 µeq/column (2 × 50 mm) 30 µeq/column (0.4 × 250 mm) 6 µeq/column (0.4 × 50 mm)
Column construction:	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.

Description	Part Numbers
Analytical, Guard, and Capillary Columns	
Dionex IonPac CS20 Analytical Column (2 × 250 mm)	302606
Dionex IonPac CG20 Guard Column (2 × 50 mm)	302607
Dionex IonPac CS20 Analytical Column (4 × 250 mm)	302608
Dionex IonPac CG20 Guard Column (4 × 50 mm)	302609
Dionex IonPac CS20 Capillary Column (0.4 × 250 mm)	302610
Dionex IonPac CG20 Capillary Guard Column (0.4 × 50 mm)	302611
Dionex IC PEEK Viper Fittings Kits	
Dionex IC PEEK Viper Fittings Kit for Dionex Integrion systems with conductivity detectors	088798
Dionex IC PEEK Viper Fittings Kit for Dionex ICS-5000⁺ systems with conductivity detectors	088803
Dionex IC PEEK Viper Fittings Kit for Dionex ICS-5000⁺ capillary systems with conductivity detectors	088801
Dionex IC PEEK Viper Fittings Kit for Dionex ICS-4000 capillary systems with conductivity detectors	088799
Cation Trap Columns	
Dionex CR-CTC 500 Continuously Regenerated Cation Trap Column	075551
Dionex CR-CTC 600 Continuously Regenerated Cation Trap Column, for use with Dionex Integrion HPIC systems	088663
Dionex CR-CTC Continuously Regenerated Cation Trap Column (Capillary) for use with capillary cation columns	072079
Dionex CTC 500 Cation Trap Column (9 × 24 mm) for use with 4 mm columns and manually prepared eluents	075977
Dionex CTC 500 Cation Trap Column (4 × 35 mm) for use with 2 mm columns and manually prepared eluents	079019
Trace Cation Concentrator Columns	
Dionex TCC-LP1 Trace Cation Concentrator Low Pressure (4 × 35 mm)	046027
Dionex TCC-ULP1 Trace Cation Concentrator Ultralow Pressure (5 × 23 mm)	063783
Dionex TCC-XLP1 Trace Cation Concentrator Extremely Low Pressure (6 × 16 mm)	063889
Dionex MCC-100 Monolith Cation Concentrator Column (0.5 × 80 mm)	075462

Find out more at **thermofisher.com/IC**

ThermoFisher SCIENTIFIC