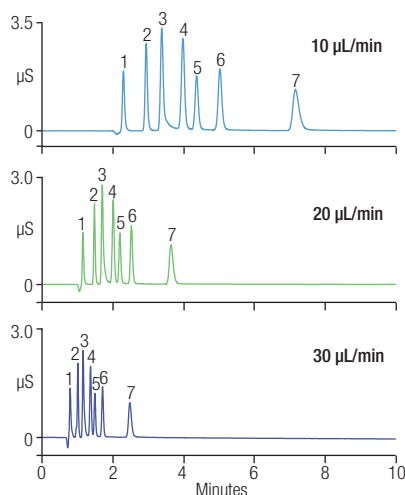


Thermo Scientific Dionex IonPac AS18-4 μ m Anion-Exchange Column

The Thermo Scientific™ Dionex™ IonPac™ AS18-4 μ m column is a hydroxide selective anion-exchange column designed for the determination of inorganic anions and low-molecular weight organic acids including fluoride, acetate, formate, chloride, nitrite, bromide, nitrate, sulfate, and phosphate. The Dionex IonPac AS18-4 μ m column can be used with isocratic hydroxide eluents or hydroxide gradients for determination of inorganic anions. This column is recommended for use in combination with an eluent generator, which automatically produces hydroxide eluents from water. The Dionex IonPac AS18-4 μ m anion-exchange column is available in 0.4 mm, 2 mm, and 4 mm i.d. formats, allowing flow rates from 10 μ L/min to 1.5 mL/min.

Isocratic Separation of Common Anions Using the Dionex IonPac AS18-4 μ m Capillary Column at Various Flow Rates



Column: Dionex IonPac AG18-4 μ m/AS18-4 μ m (0.4 \times 150 mm)
 Eluent: 30 mM Potassium Hydroxide
 Eluent Source: Thermo Scientific Dionex EGC-KOH (Capillary) Cartridge
 Flow Rate: See chromatograms
 Inj. Volume: 0.4 μ L
 Temperature: 30 $^{\circ}$ C
 Detection: Suppressed conductivity, Thermo Scientific™ Dionex™ ACES™ 300 Anion Capillary Electrolytic Suppressor, Thermo Scientific™ Dionex™ AutoSuppression™ device, recycle mode

Peaks:	
1. Fluoride	0.2 mg/L
2. Chloride	0.5
3. Nitrite	1.0
4. Sulfate	1.0
5. Bromide	1.0
6. Nitrate	1.0
7. Phosphate	2.0

Column Performance

The Dionex IonPac AS18-4 μ m column uses the same ion-exchange chemistry as the Dionex IonPac AS18 column line, but with smaller substrate particles. Existing methods using the Dionex IonPac AS18-Fast column can be easily transferred to the Dionex IonPac AS18-4 μ m column with the benefit of increased peak efficiencies and better resolution. In addition, higher flow rates can be used resulting in faster runs and increased productivity without sacrificing performance. The capacity and selectivity of the Dionex IonPac AS18-4 μ m column provides the flexibility to modify the eluent conditions for optimum separation of the anions of interest. The Dionex IonPac AS18-4 μ m column is ideal for use with isocratic hydroxide eluents for fast separation of the common inorganic anions in simple sample matrices. The high-capacity of the Dionex IonPac AS18-4 μ m column allows the use of hydroxide gradients and large-loop injections to determine low levels of inorganic anions in complex sample matrices, including drinking water and wastewater samples.

Using hydroxide eluents, the Dionex IonPac AS18-4 μ m column meets the performance requirements specified in U.S. EPA Method 300.0 (A). The U.S. EPA Office of Water has approved hydroxide eluents and hydroxide selective columns for compliance monitoring of inorganic anions in drinking water and wastewater samples in accordance with U.S. EPA Methods 300.0 and 300.1. The common inorganic anions can easily be separated in a variety of sample matrices, including drinking water, wastewater, process streams and scrubber solutions. The Dionex IonPac AS18-4 μ m column selectivity provides excellent retention of fluoride from the water dip and baseline resolution of fluoride, acetate, and formate. Solvent compatibility permits easy column cleanup after the analysis of samples with hydrophobic components.

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Recommended for Inorganic Anions in Diverse Sample Matrices

- Source water and drinking water
- Municipal and industrial wastewater
- Industrial cooling water
- Hazardous waste extracts and dumpsite leachates
- Acid rain
- Foods and beverages
- Anionic counterions in pharmaceutical preparations and synthetic peptides
- Polymers such as polyols and polysulfonates
- Scrubber solutions

Superior Chromatographic Performance

- Fast separation of the common inorganic anions in 4 min using the Dionex IonPac AS18-4 μ m Capillary column
- Isocratic separation of the common inorganic anions in 8 min using the Dionex IonPac AS18-4 μ m column
- Hydroxide gradients for inorganic anion and low-molecular-weight organic acids for optimum separations in complex sample matrices
- Superior retention and quantification of fluoride, acetate, and formate
- Meets performance requirements specified in U.S. EPA Method 300.0 (A)
- Simplified Reagent-Free™ IC (RFIC™) operation provided by an eluent generator (EG), which requires only a deionized water source to produce hydroxide eluent
- Eluent suppression using the Thermo Scientific™ Dionex™ AERS™ 500 Anion Electrolytically Regenerated Suppressor or the Thermo Scientific™ Dionex™ ACES™ 300 Anion Capillary Electrolytic Suppressor technology provides RFIC operation with low backgrounds and enhanced analyte sensitivity
- High-capacity: 174 μ eq for 4 \times 150 mm column
- Operate at ambient or elevated temperatures. Column selectivity is optimized for a 30 °C operating temperature to ensure reproducible retention times
- Compatible with organic solvents to enhance analyte solubility, modify column selectivity, or for effective column cleanup

High-Efficiency Particle Structure

The difference between the existing Dionex IonPac AS18 column line and the new Dionex IonPac AS18-4 μ m column is the reduction in particle size from 7 μ m to 4 μ m. Columns packed with smaller particles produce more efficient peaks and better resolution making analysis faster and more reliable. The smaller particles also create higher backpressure requiring the use of IC systems capable of operating up to 5000 psi for optimum performance.

The Dionex IonPac AS18-4 μ m column packing is a unique pellicular structure composed of a highly crosslinked core and a Thermo Scientific™ Dionex™ MicroBead™ latex anion-exchange layer attached to the surface, as shown in Figure 1. The substrate for the Dionex

IonPac AS18-4 μ m column is a 4 μ m diameter supermacroporous resin particle, consisting of ethylvinylbenzene cross linked with 55% divinylbenzene. The anion-exchange layer is functionalized with very hydrophilic quaternary ammonium groups. This latex bead anion-exchange layer has controlled thickness, which results in excellent mass transfer characteristics and consequently highly efficient peaks. Figure 2 shows the improvement in peak efficiencies when using smaller supermacroporous resin particles. The Dionex IonPac AS18-4 μ m column provides sharper peaks with similar responses, using only half the injection volume used on the Dionex IonPac AS18-Fast column.

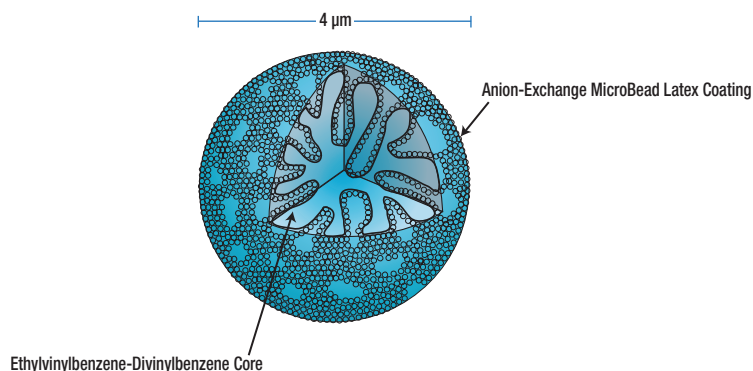


Figure 1. Structure of a Dionex IonPac AS18-4 μ m supermacroporous packing particle.

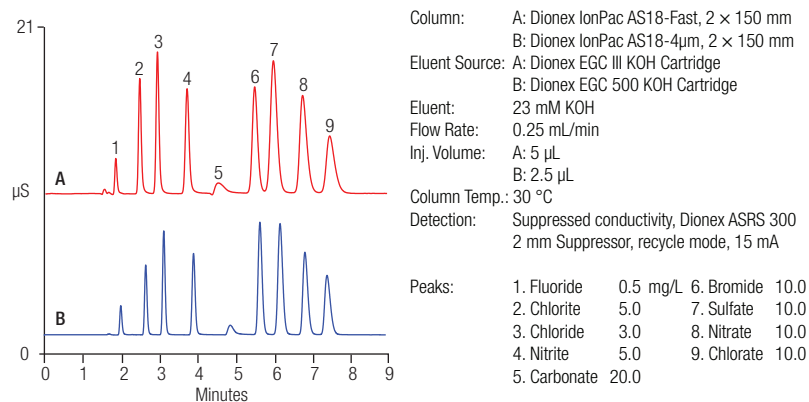


Figure 2. Comparison of Dionex IonPac AS18-Fast and Dionex IonPac AS18-4 μ m columns (2 \times 150 mm).

Fast IC

The Dionex IonPac AS18-4 μ m column is ideal for Fast IC as it is designed to have excellent peak efficiency to maintain resolution even in a short column format and at higher flow rates. Fast separations are achieved at higher flow rates on any Thermo Scientific Dionex IC system capable of operating at 5000 psi. In a short column format, backpressures produced at higher flow rates are reduced while allowing overall shorter run times. This combination of smaller particles and shorter columns allows for the determination of anions with high resolution even in drinking, surface, groundwater, and wastewater matrices in under 5 min. Laboratories can achieve higher productivity and increased throughput.

The Dionex IonPac AS18-4 μ m column is suitable for separations requiring higher flow rates for the fast analysis of inorganic anions as shown in Figure 3. The Dionex IonPac AS18-4 μ m column (4 \times 150 mm) was operated with the same eluent at 1.0 and 1.5 mL/min. Using a higher flow rate in a shorter column format, the overall run time was reduced to 5 minutes with optimal resolution of the common inorganic anions.

Using a Dionex IonPac AS18-4 μ m (2 \times 150 mm) column format allows greater linear velocities and reduced eluent consumption compared to a 4 \times 250 mm format. Figure 4 shows the excellent resolution of the common inorganic anions in drinking water and wastewater samples in less than 5 min using the maximum flow rate of 0.38 mL/min.

Reduced Operating Costs with the Dionex IonPac AS18-4 μ m Capillary Format

The Dionex IonPac AS18-4 μ m Capillary column (0.4 \times 150 mm) is packed with the same material as the equivalent analytical scale version, thus producing the same performance as the 4 mm column, but only requires 1/100th the eluent flow rate. With a reduced length of 150 mm, the Dionex IonPac AS18-4 μ m column can separate the seven common anions in significantly less time than a 250 mm length column. The capillary format offers the additional advantage of less eluent consumption providing reduced operating costs. Figure 5 illustrates the impact of increasing the flow rate to 30 μ L/min resulting in the separation of the common inorganic anions in less than 3 min using the Dionex IonPac AS18-4 μ m Capillary column.

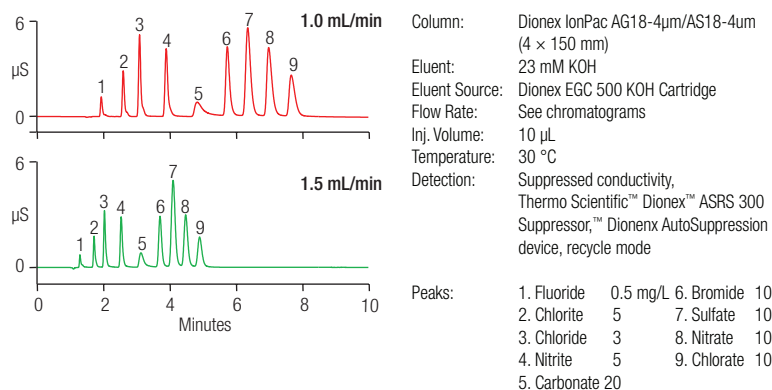


Figure 3. Isocratic separation of common anions using the Dionex IonPac AS18-4 μ m column (4 \times 150 mm) at standard and maximum flow rates.

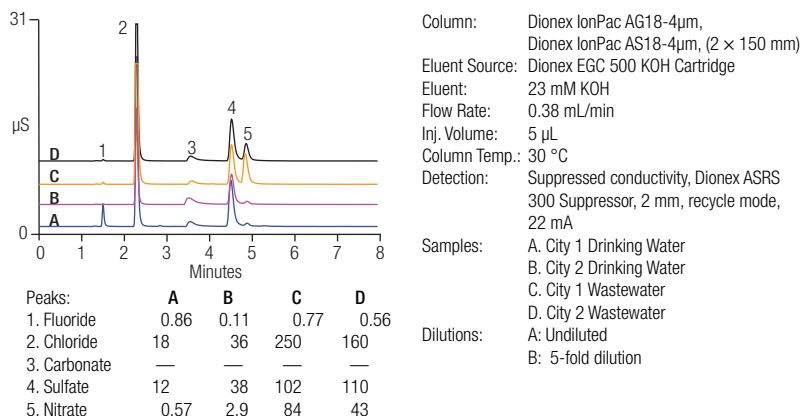


Figure 4. Determination of inorganic anions in municipal drinking and wastewater samples.

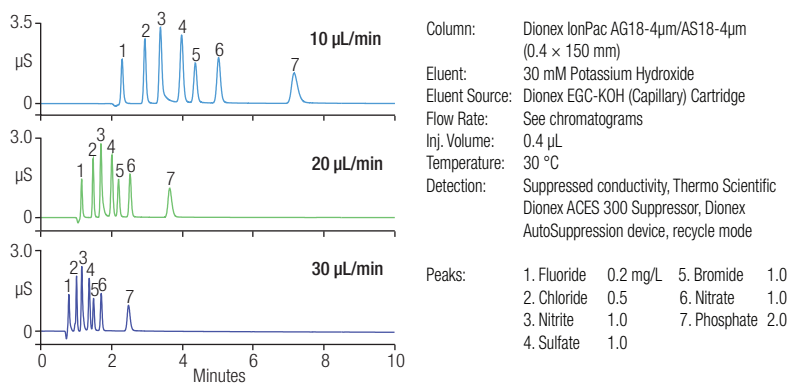
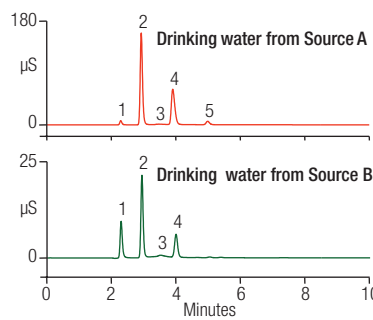


Figure 5. Isocratic separation of common anions using the Dionex IonPac AS18-4 μ m Capillary column at various flow rates.

Figure 6 shows the isocratic separation of inorganic anions in two drinking water sources using the Dionex IonPac AS18-4 μ m Capillary column at the standard flow rate of 10 μ L/min using a hydroxide eluent produced by an eluent generator. The five analytes are easily separated in about 5 min. Figure 7 shows the analysis of chlorite and chlorate spiked into drinking water using increasing flow rates with the Dionex IonPac AS18-4 μ m Capillary column.

Hydroxide Gradients for Complex Sample Matrices

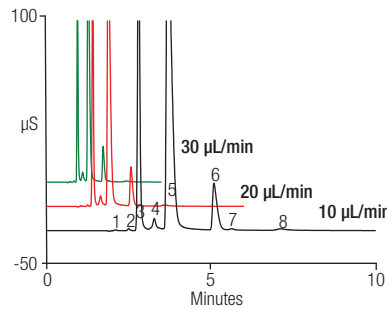
The Dionex IonPac AS18-4 μ m column can be operated with hydroxide gradients for optimum separation of inorganic anions in complex sample matrices. The Dionex IonPac AS18-4 μ m column is an ideal choice for compliance monitoring of drinking water and wastewater. The Dionex IonPac AS18-4 μ m column meets the requirements of U.S. EPA Method 300.0 Part A. Varying low levels of inorganic anions can be easily determined in drinking water using an optimized hydroxide gradient, as illustrated in Figure 8. Drinking water (Sample A) has much higher levels of chloride and sulfate compared to drinking water (Sample B), as indicated by the responses. Wastewater can be a more complex sample than drinking water; however, with the Dionex IonPac AS18-4 μ m column, inorganic anions in wastewater can easily be determined using a fast dual hydroxide gradient, as illustrated in Figure 9.



Column: Dionex IonPac AG18-4 μ m/AS18-4 μ m (0.4 \times 150 mm)
 Eluent: 30 mM Potassium Hydroxide
 Eluent Source: Dionex EGC-KOH (Capillary) Cartridge
 Flow Rate: 10 μ L/min
 Inj. Volume: 0.4 μ L
 Temperature: 30 $^{\circ}$ C
 Detection: Suppressed conductivity, Dionex ACES 300 Suppressor, Dionex AutoSuppression device, recycle mode

Peaks: 1. Fluoride 4. Sulfate
 2. Chloride 5. Nitrate
 3. Carbonate

Figure 6. Analysis of drinking water from two different sources using the Dionex IonPac AS18-4 μ m Capillary column.

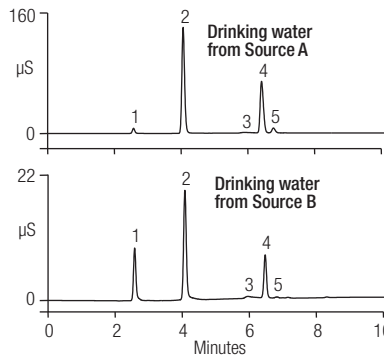


Column: Dionex IonPac AS18-4 μ m (0.4 \times 150 mm)
 Eluent Source: Dionex EGC-KOH (Capillary) Cartridge
 Eluent: 30 mM
 Temperature: 30 $^{\circ}$ C
 Inj. Volume: 0.4 μ L
 Detection: Suppressed conductivity, Dionex ACES 300 Suppressor

Sample: Municipal drinking water with spiked chlorite and chlorate

Peaks: 1. Fluoride 0.1 mg/L 5. Sulfate 118.9
 2. Chlorite 0.5 6. Nitrate 18.5
 3. Chloride 33.5 7. Chlorate 0.5
 4. Nitrite 2.4 8. Phosphate 1.0

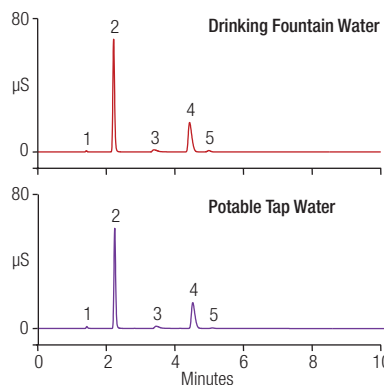
Figure 7. Determination of chlorite and chlorate in a municipal drinking water using the Dionex IonPac AS18-4 μ m Capillary column at different flow rates.



Column: Dionex IonPac AG18-4 μ m/AS18-4 μ m
 Eluent: 12-44 mM KOH (0-5 min), 44 mM (5-8 min), 44-52 mM (8-10 min)
 Eluent Source: Dionex EGC-KOH Capillary Cartridge
 Flow Rate: 10 μ L/min
 Inj. Volume: 0.4 μ L
 Temperature: 30 $^{\circ}$ C
 Detection: Suppressed conductivity, Dionex ACES 300 Suppressor, Dionex AutoSuppression device, recycle mode

Peaks: 1. Fluoride 4. Sulfate
 2. Chloride 5. Nitrate
 3. Carbonate

Figure 8. Gradient separations of drinking water from two different sources using the Dionex IonPac AS18-4 μ m Capillary column (0.4 \times 150 mm).



Column: Dionex IonPac AG18-4 μ m/AS18-4 μ m (0.4 \times 150 mm)
 Eluent: 30 mM Potassium Hydroxide
 Eluent Source: Dionex EGC-KOH (Capillary) Cartridge
 Flow Rate: 10 μ L/min
 Inj. Volume: 0.4 μ L
 Temperature: 30 $^{\circ}$ C
 Detection: Suppressed conductivity, Dionex ACES 300 Suppressor, AutoSuppression, recycle mode

Peaks: 1. Fluoride 4. Sulfate
 2. Chloride 5. Nitrate
 3. Carbonate

Figure 9. Fast analysis of drinking water and tap water using the Dionex IonPac AS18-4 μ m column (0.4 \times 150 mm).

Gradient Separations as Simple as Isocratic Runs with an Eluent Generator

The Dionex IonPac AS18-4 μ m column is recommended for use in combination with an eluent generator. An eluent generator electrolytically produces high-purity hydroxide eluent from water, eliminating the need for eluent preparation. The hydroxide eluent is free of carbonate contamination. Carbonate-free hydroxide eluents minimize baseline shifts during hydroxide gradients, which provide greater retention time reproducibility, lower background conductivity, and lower consistent detection limits for target analytes. Figure 10 illustrates the use of a hydroxide gradient with an eluent generator for eluent delivery to decrease the run time. The higher eluent strength elutes 10 anions including phosphate in less than 7 min. A Thermo Scientific™ Dionex™ CR-ATC Continuously Regenerated Anion Trap Column was used to remove carbonate from the source water to minimize the baseline shift during the gradient.

System Requirements

The Dionex IonPac AS18-4 μ m column is recommended for use with the Thermo Scientific™ Dionex™ ICS-5000+ HPIC or Dionex ICS-4000 Capillary HPIC system, capable of operating up to 5000 psi. The Dionex IonPac AS18-4 μ m column generates higher back pressure under standard operating conditions and therefore it cannot be used with older Thermo Scientific Dionex IC systems.

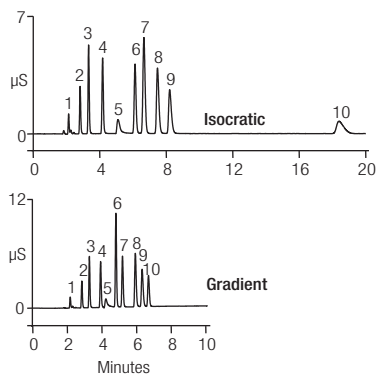


Figure 10. Comparison of isocratic and gradient separation of 10 anions using the Dionex IonPac AS18-4 μ m Column (2 \times 150 mm).

Column: Dionex IonPac AG18-4 μ m/AS18-4 μ m
 Eluent: Isocratic: 23 mM KOH
 Gradient: 12 to 44 mM 0-5.5 min
 Eluent Source: Dionex EGC-KOH III Cartridge
 Flow Rate: 0.25 mL/min
 Inj. Volume: 2.5 μ L
 Temperature: 30 $^{\circ}$ C
 Detection: Suppressed Conductivity,
 Dionex ASRS 300 Suppressor,
 Dionex AutoSuppression device,
 recycle mode

Peaks:	1. Fluoride	0.5 mg/L	6. Bromide	10
	2. Chlorite	5	7. Sulfate	10
	3. Chloride	3	8. Nitrate	10
	4. Nitrite	5	9. Chlorate	10
	5. Carbonate	20	10. Phosphate	20

Suppressor Recommendations

For optimum ease-of-use and performance, the Dionex IonPac AS18-4 μ m column should be used with the Dionex ASRS 300 Anion Self-Regenerating Suppressor or the Dionex ACES 300 Anion Capillary Electrolytic Suppressor.

Anion Trap Columns

When using the eluent generator for eluent delivery, a Dionex CR-ATC Continuously Regenerated Anion Trap Column should be installed between the eluent generator cartridge (EGC) and the degas module. As an alternative for 4 mm and 2 mm systems, a Dionex IonPac ATC-HC column can be installed between the pump outlet and the EGC inlet. Alternatively, when using a manually-prepared sodium hydroxide gradient with the Dionex IonPac AS18-4 μ m column, the Dionex IonPac ATC-3 Anion Trap Column should be installed between the gradient pump and the injection valve to remove anionic contaminants from the eluent.

Concentrator Columns

For concentrator work with a 2 mm or 4 mm Dionex IonPac AS18-4 μ m column, use Dionex IonPac Ultratrace Anion Concentrator Columns (Dionex IonPac UTAC-ULP1, UTAC-XLP1, UTAC-ULP2, or UTAC-XLP2) or Dionex IonPac Trace Anion Concentrator Column (Dionex IonPac TAC-ULP1) when a single piston pump such as the Thermo Scientific™ Dionex™ AXP Auxiliary Pump (pulse damper required) is used for sample delivery.

In addition to the concentrator columns listed above, use the Dionex IonPac UTAC-LP1, UTAC-LP2 or TAC-LP1 when the sample is delivered using a syringe or a low-pressure autosampler, e.g., the Thermo Scientific Dionex AS-DV Autosampler.

For concentrator work with a 0.4 mm capillary column, use the Dionex IonPac AG18-4 μ m capillary guard column or the Thermo Scientific™ Dionex™ IonSwift™ MAC-100 Concentrator Column.

SPECIFICATIONS

Dimensions	Dionex IonPac AS18-4 μ m Analytical Column: (2 \times 150 mm) (4 \times 150 mm) Dionex IonPac AS18-4 μ m Capillary Column: (0.4 \times 150 mm) Dionex IonPac AG18-4 μ m Guard Column: (2 \times 30 mm) (4 \times 30 mm) Dionex IonPac AG18-4 μ m Capillary Guard Column: (0.4 \times 35 mm)
Maximum Operating Pressure	5000 psi
Mobile Phase Compatibility	pH 0–14; 0–100% HPLC solvents
Substrate Characteristics	2 \times 150 mm, 4 \times 150 mm, 0.4 \times 150 mm Super macroporous resin Bead Diameter: 4 μ m Pore Size: 2000 Å Crosslinking (%DVB): 55% 2 \times 30 mm, 4 \times 30 mm, 0.4 \times 35 mm Microporous resin Bead Diameter: 13 μ m Pore Size: < 10 Å Crosslinking (%DVB): 55%
Latex Characteristics	Functional Group: Alkanol quaternary ammonium ion Latex Crosslinking: Effective crosslinking after functionalization is 8% Latex Diameter: 65 nm Hydrophobicity: Low hydrophobic
Capacity	1.71 μ eq (0.4 \times 150 mm) 0.07 μ eq (0.4 \times 35 mm) 171 μ eq (4 \times 150 mm) 6 μ eq (4 \times 30 mm) 45 μ eq (2 \times 150 mm) 1.5 μ eq (2 \times 30 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.

Analytical, Capillary and Guard Columns	Part Numbers
Dionex IonPac AS18-4 μ m Capillary Column (0.4 \times 150 mm)	082314
Dionex IonPac AG18-4 μ m Capillary Guard Column (0.4 \times 35 mm)	076033
Dionex IonPac AS18-4 μ m Analytical Column (4 \times 150 mm)	076034
Dionex IonPac AG18-4 μ m Guard Column (4 \times 30mm)	076035
Dionex IonPac AS18-4 μ m Analytical Column (2 \times 150 mm)	076036
Dionex IonPac AG18-4 μ m Guard Column (2 \times 30 mm)	076037
Anion Trap Columns	Part Numbers
Dionex CR-ATC 500 Continuously Regenerated Anion Trap Column (for use with systems equipped with an eluent generator or Dionex RFC-30 Reagent-Free Control)	075550
Dionex CR-ATC Continuously Regenerated Anion Trap Column (for use with capillary anion columns)	072078
Dionex IonPac ATC-3 Anion Trap Column (9 \times 24 mm) (for use with 4 mm columns)	059660
Dionex IonPac ATC-3, 2 mm (4 \times 35 mm) Anion Trap Column (for use with 2 mm columns)	079932
Dionex IonPac ATC-HC (9 \times 75 mm) Anion Trap Column (for use with the Thermo Scientific Dionex EG40 Eluent Generator)	059604
Trace Anion Concentrator Columns	Part Numbers
Dionex IonPac TAC-2 Trace Anion Concentrator Column (3 \times 35 mm)	043101
Dionex IonPac TAC-LP1 Trace Anion Concentrator Column (4 \times 35 mm)	046026
Dionex IonSwift MAC-100 Monolith Anion Concentrator Column (0.5 \times 80 mm) (for use with Capillary IC)	074702
Dionex IonPac TAC-LP1 Trace Anion Concentrator Column (4 \times 35 mm)	046026
Dionex IonPac TAC-ULP1 Trace Anion Concentrator Column (5 \times 23 mm)	061400
Dionex IonPac UTAC-LP1 Ultra Trace Anion Concentrator Low Pressure Column (4 \times 35 mm)	063079
Dionex IonPac UTAC-ULP1 Ultra Trace Anion Concentrator Ultra Low Pressure Column (5 \times 23 mm)	063475
Dionex IonPac UTAC-XLP1 Ultra Trace Anion Concentrator Extremely Low Pressure Column (6 \times 16 mm)	063459
Dionex IonPac UTAC-LP2 Ultra Trace Anion Concentrator Low Pressure Column (4 \times 35 mm)	079917
Dionex IonPac UTAC-ULP2 Ultra Trace Anion Concentrator Ultra Low Pressure Column (5 \times 23 mm)	079918
Dionex IonPac UTAC-XLP2 Ultra Trace Anion Concentrator Extremely Low Pressure Column (6 \times 16 mm)	072781

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