

OnGuard® II Sample Pretreatment Cartridges and Workstation



The OnGuard II line of disposable sample pretreatment cartridges is designed to remove matrix interferences such as phenols, metals, cations, anions, or hydrophobic substances that are encountered in many ion chromatography applications. These cartridges have wide pH stability and allow low-level ion analysis.

Now sold under the
Thermo Scientific brand

Thermo
SCIENTIFIC

Solve Tough Applications Problems

- Facilitate better separations
- Increase lifetimes of analytical columns
- Solve major matrix problems
- Achieve reproducible trace-level determinations in concentrated matrices

Optimized Design and Manufacture

The OnGuard II hardware, illustrated in Figure 1, is designed with Luer inlets for easy and secure connections. The cartridge design eliminates leaks and channeling. The unique sample distribution frit maximizes complete resin bed usage. The cartridge hardware is optimized for the best possible performance in matrix removal or concentration applications.

Guaranteed Performance

All OnGuard II products are shipped with a Certificate of Analysis verifying product capacity, performance, and cleanliness.

Convenient and Easy to Use

Samples are easy to process. Samples can be passed through the cleanup cartridge directly into the LC injector valve loop using a Luer-style syringe. Alternatively, samples can be processed in parallel using the OnGuard Sample Prep Station shown in Figure 7.

Versatile Selection of Resins

- OnGuard II A
- OnGuard II Ag
- OnGuard II Ba
- OnGuard II H
- OnGuard II Na
- OnGuard II M
- OnGuard II P
- OnGuard II RP
- OnGuard II Ag/H
- OnGuard II II Ba/Ag/H



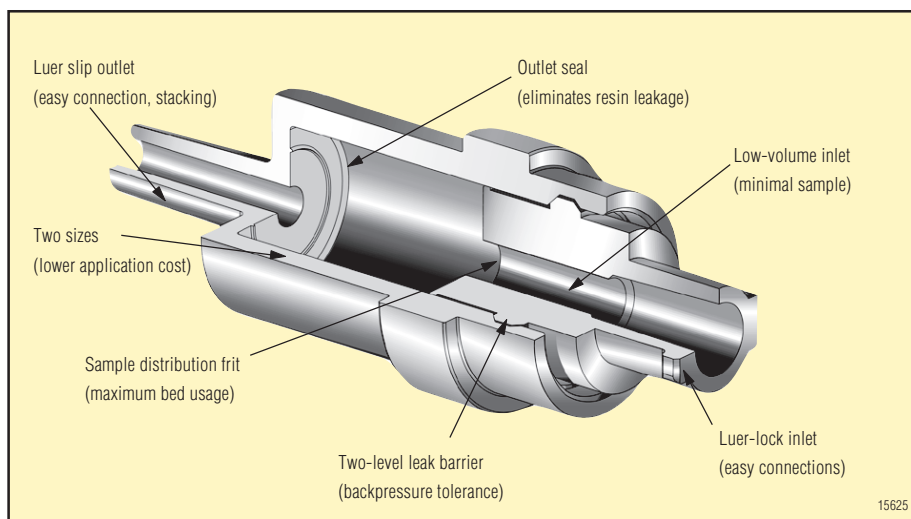


Figure 1. OnGuard II hardware design.

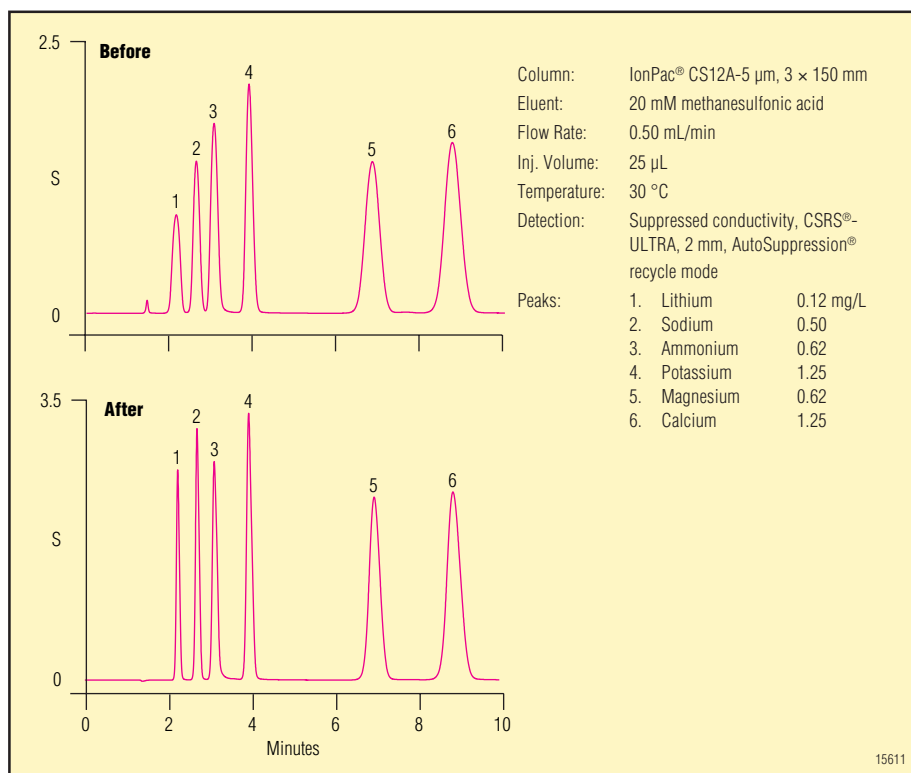


Figure 2. Pretreatment of low-pH samples for cation analysis using OnGuard II A.

The OnGuard II family of sample pretreatment cartridges is available in a wide range of packings and in two sizes (1-cc and 2.5-cc) to fit your sample pretreatment needs. In addition, resins are available in the Auto OnGuard™ syringe barrel format for robotic processing as custom order products. Table 1 summarizes the OnGuard products and their typical applications.

Cartridges can be used singly or in series depending on the matrix interferences to be removed. Figure 3 illustrates the OnGuard Ba, OnGuard Ag, and OnGuard H cartridges used in series to remove sulfate, chloride, and carbonate from a water sample prior to trace-level determination of bromate.

Solve Your Matrix Problems

OnGuard II A

For the removal of:

- Inorganic anions
- Strong organic acids
- Low pH

The OnGuard II A cartridge contains styrene-based strong anion-exchange resin in the bicarbonate form. This cartridge is ideal for the removal of anionic contaminants from sample matrices. It is also effective for the neutralization of highly acidic samples.

Figure 2 demonstrates the use of an OnGuard II A 1-cc cartridge for the neutralization of an acid-preserved water sample prior to determination of Group I and Group II cations and ammonium by cation-exchange chromatography with suppressed conductivity detection.

OnGuard II Ag

For the removal of:

- Chloride
- Bromide
- Iodide

The OnGuard II Ag resin is a styrene-based sulfonic acid resin in the silver form. This cartridge easily removes chloride, bromide, and iodide from concentrated sample matrices such as brines. Samples treated with the OnGuard II Ag cartridge should be passed through an OnGuard II H cartridge to remove silver counter ions. As an alternative, a MetRc™ CC1 chelating column (P/N 42156) can be used to remove silver counter ions online in an IC system.

OnGuard II H

For the removal of:

- Alkaline earth metals
- Transition metals
- High pH

The OnGuard II H contains 16% crosslinked, styrene-based, sulfonic acid resin in the hydrogen form. This resin is

TABLE 1 ONGUARD II CARTRIDGE CHEMISTRIES AND TYPICAL APPLICATIONS

Cartridge	Functionality	Capacity (meq/ cartridge)		Solvents	pH Stability	Mode of Use
		1-cc	2.5-cc			
OnGuard A	Anion-exchange Bicarbonate form	0.7	1.75	0–100% HPLC solvents	0–14	Removal of anions; pH adjustment of acidic samples
OnGuard Ag	Cation-exchange Silver form	2.0–2.2	5.0–5.5	0–100% HPLC solvents	0–14	Removal of chloride, bromide, iodide by precipitation
OnGuard Ba	Cation-exchange Barium form	2.0–2.2	5.0–5.5	0–100% HPLC solvents	0–14	Removal of sulfate by precipitation
OnGuard H	Cation-exchange Hydronium form	2.0–2.2	5.0–5.5	0–100% HPLC solvents	0–14	Removal of alkaline earth and transition metals; pH adjustment of basic samples
OnGuard Na	Cation-exchange sodium form	2.0–2.2	5.0–5.5	0–100% HPLC solvents	0–14	Removal of alkaline earth and transition metals
OnGuard M	Iminodiacetate Ammonium form	0.4	1.0	0–100% HPLC solvents	0–14*	Concentration of transition metals by chelation (2.5-cc format); removal of transition metals (1-cc format)
OnGuard P	Polyvinylpyrrolidone	6.0	Format not available	0–100% HPLC solvents	1–10	Removal of phenols, azo dyes, humic acids by complexation
OnGuard RP	Polydivinylbenzene	0.3 g resin	0.75 g resin	0–100% HPLC solvents	0–14	Removal of surfactants, high MW carboxylic acids, aromatic dyes by adsorption
OnGuard Ag/H	Cation-exchange silver form; cation-exchange hydronium form	Format not available	4.6 (Ag) 0.8 (H)	0–100% HPLC solvents	0–14	Removal of chloride, bromide, iodide by precipitation; removal of alkaline earth and transition metals; pH adjustment of basic samples
OnGuard Ba/Ag/H	Cation-exchange silver form; cation-exchange barium form; cation-exchange hydronium form	Format not available	2.2–2.6 (Ba) 2.2–2.6 (Ag) 0.8 (H)	0–100% HPLC solvents	0–14	Removal of chloride, bromide, iodide by precipitation; removal of alkaline earth and transition metals; pH adjustment of basic samples; Removal of sulfate by precipitation

* Resin shrinks in acid form.

designed to have very high selectivity for polyvalent cations such as calcium and transition metals. The cartridge is ideal for the removal of high levels of alkaline earth metals and transition metals from sample matrices. It is also used for the neutralization of highly alkaline samples such as sodium hydroxide or sodium carbonate. Carbonate can be reduced to very low levels following this pH reduction by sparging the sample.

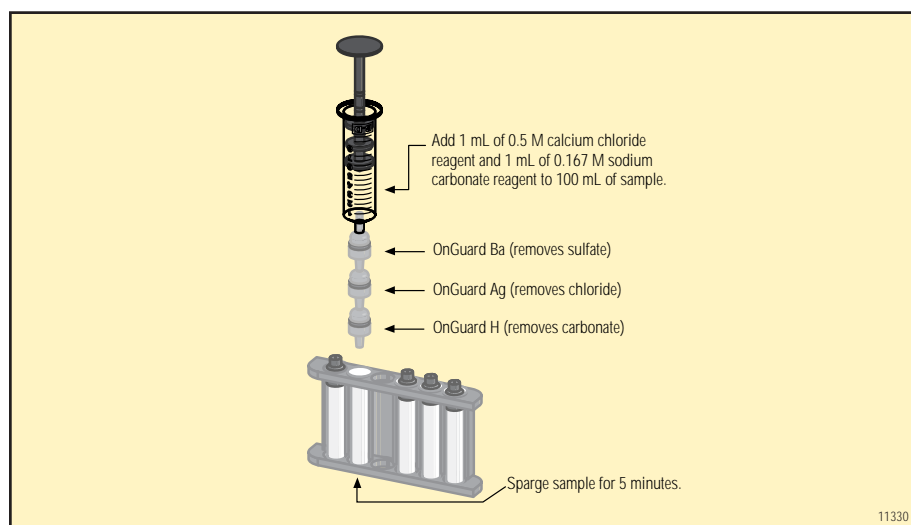


Figure 3. Used in series, the OnGuard Ba, OnGuard Ag, and OnGuard H cartridges successfully remove sulfate, chloride, and carbonate from a drinking water sample prior to the determination of bromate.

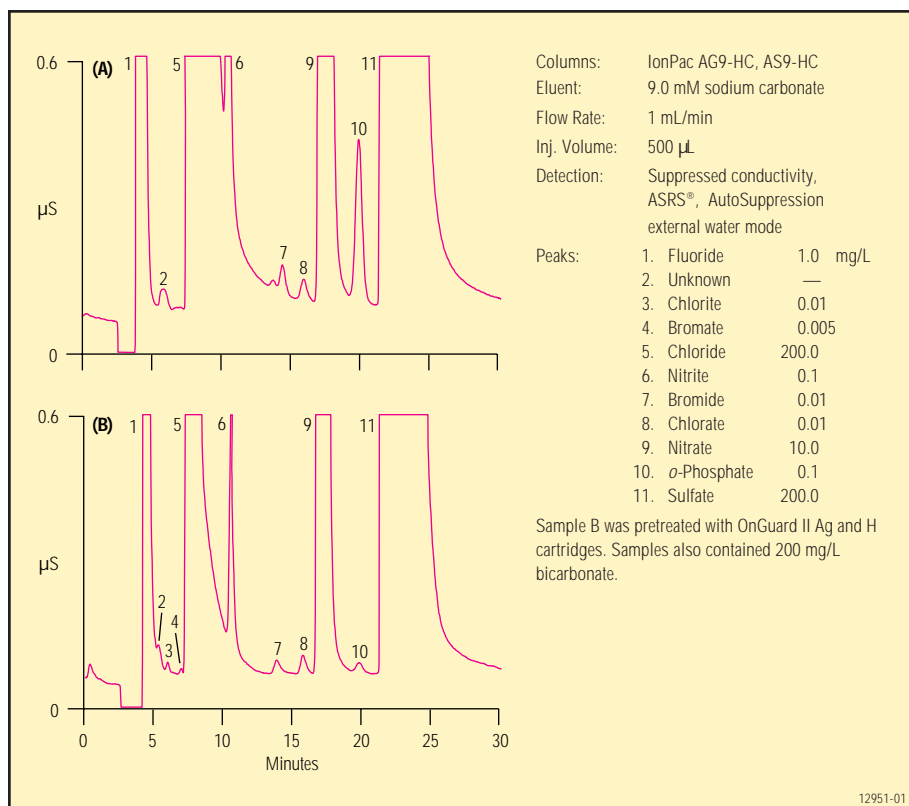


Figure 4. Following the OnGuard sample matrix removal shown in Figure 3, bromate can easily be quantified at 5 ppb.

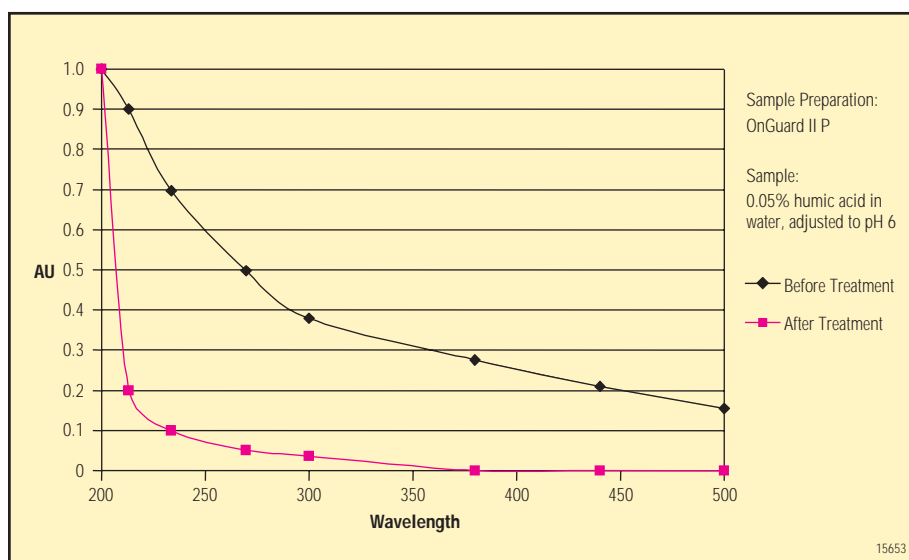


Figure 5. Use of the OnGuard II P to remove humic acid from water.

OnGuard II Na

For the removal of:

- Alkaline earth metals
- Transition metals

The OnGuard II Na contains 16% cross-linked, styrene-based, sulfonic acid in the sodium form. The OnGuard II Na is used in the removal of high

levels of alkaline earths and transition metals from sample matrices without acidifying the sample. This attribute ensures good recovery of acid labile analytes such as nitrite. This resin is designed to have very high selectivity for multivalent cations such as calcium, magnesium, and transition metals.

OnGuard II Ag/H

For the removal of:

- Chloride
- Bromide
- Iodide
- Alkaline earth metals
- Transition metals
- High pH

The OnGuard II Ag/H is a layered cartridge that contains OnGuard II Ag resin and OnGuard II H resin. The OnGuard II Ag/H Cartridge contains a styrene-based sulfonic acid resin in the silver form (OnGuard II Ag). The OnGuard Ag easily removes chloride, bromide, and iodide from concentrated sample matrices such as brines.

The OnGuard II Ag/H also contains a 16% cross-linked, styrene-based, sulfonic acid resin in the hydrogen form (OnGuard II H). The resin has a very high selectivity for polyvalent cations such as calcium and transition metals. The cartridge is ideal for the removal of high levels of alkaline earths and transition metals from sample matrices, for the neutralization of caustic samples, and for the removal of carbonate.

The OnGuard H resin is placed at the outlet of the two-layer cartridge to trap soluble silver and other cations in the sample. This two-layer cartridge can be used in place of two single cartridges used in series and has the added advantage of the higher silver-capacity.

OnGuard II Ba

For the removal of:

- High concentrations of sulfate from sample matrices
- Sample prep in analysis of trace-level bromate

The OnGuard II Ba resin is a styrene-based sulfonic acid resin in the barium form for the removal of high concentrations of sulfate from sample matrices. For reproducible, quantitative determinations in low-ionic-strength

samples, the OnGuard II Ba should be activated with a calcium chloride activating solution (U.S. Patent 5,571,725). Samples treated with a calcium chloride-activated OnGuard II Ba cartridge should be passed through an OnGuard II Ag cartridge to remove the chloride from the activating solution and then passed through an OnGuard II H cartridge or a MetPac-CC1 chelating column (P/N 42155) to remove silver counter ions.

Cartridges can be used in series to remove multiple matrix interferences. Figure 3 demonstrates the use of the OnGuard Ba, OnGuard Ag, and OnGuard H cartridges in series to remove sulfate, chloride, and carbonate (respectively) from a water sample prior to trace-level determination of bromate. Figure 4 illustrates the determination of trace-level bromate following OnGuard matrix elimination by using anion exchange chromatography with suppressed conductivity detection.

OnGuard II Ba/Ag/H

For the removal of:

- Chloride
- Bromide
- Iodide
- Alkaline earth metals
- Transition metals
- High pH
- High concentrations of sulfate from sample matrices
- Sample prep in analysis of trace-level bromate

The OnGuard II Ba/Ag/H is a layered cartridge that contains OnGuard II Ba resin, OnGuard II Ag resin and OnGuard II H resin. The OnGuard II Ba/Ag/H Cartridge contains a styrene-based sulfonic acid resin in the barium form (OnGuard II Ba) for the removal of high concentrations of sulfate from sample matrices. The OnGuard II Ba/Ag/H Cartridge also contains a styrene-based sulfonic acid resin in the silver form (OnGuard II Ag). The OnGuard Ag easily removes chloride, bromide, and iodide

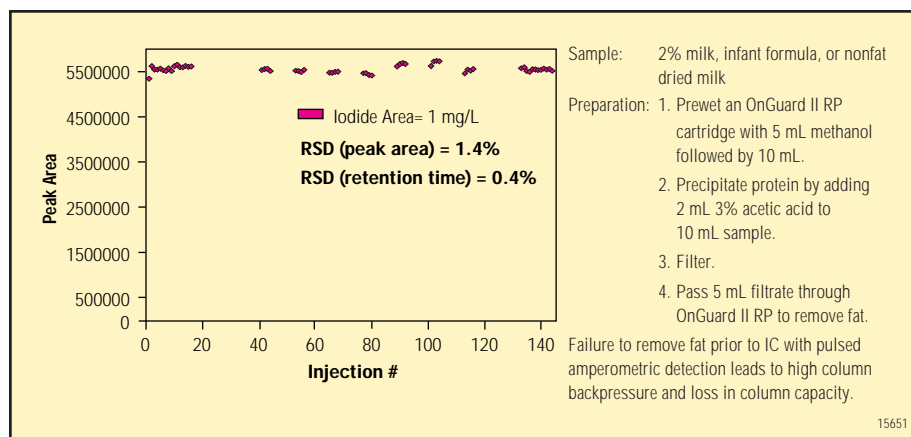


Figure 6. Use of OnGuard II RP for the removal of fat from milk.



Figure 7. Samples can be processed in parallel using the OnGuard Sample Prep Station.

from concentrated sample matrices such as brines. The OnGuard II Ba/Ag/H also contains a 16% cross-linked, styrene-based, sulfonic acid resin in the hydrogen form (OnGuard II H). The resin has a very high selectivity for polyvalent cations such as calcium and transition metals. The cartridge is ideal for the removal of high levels of alkaline earths and transition metals from sample matrices, for the neutralization of caustic samples, and for the removal of carbonate. The OnGuard H resin is placed at the outlet of the three-

layer cartridge to trap soluble silver and other cations in the sample. This three-layer cartridge can be used in place of three single cartridges used in series and has the added advantage of the higher silver capacity.

OnGuard II M

For the removal of:

- Transition metals
- Matrix elimination of alkali and alkaline earth metals

The OnGuard M cartridge contains imino-diacetate resin in the ammonium form. This resin is designed to have very high selectivity for polyvalent cations such as transition metals. The cartridge is ideal for the removal or concentration of high levels of transition metals from sample matrices.

The OnGuard II M cartridges are shipped in the ammonium form, pH 5.5 and are ready to use for either matrix elimination or for transition metal concentration. For matrix elimination of transition metals, samples should be buffered to pH greater than 4. This technique allows the recovery of alkali and alkaline earth metals while retaining the transition metals on the OnGuard II M cartridge. The 1-cc cartridge is best suited for this application.

For concentration of transition metals, the transition metals are concentrated at pH greater than 4 and eluted at acidic pH 2. High purity 2.0 M nitric acid (P/N 033442) and 2.0 M ammonium acetate (P/N 033440) are available from Dionex for pH control. The 2.5-cc cartridge is ideal for concentrating transition metals for quantification by chelation IC or by ICP-MS. Metal chelating agents such as EDTA will interfere with transition metal concentration on the OnGuard II M cartridge. These samples must be digested using EPA Method 200.8 to achieve good recoveries of transition metals such as cadmium, copper, cobalt, iron, nickel, lead, titanium, vanadium, and zinc. Manganese and chromium (as chromate) are not recovered.

OnGuard II P

For the removal of:

- Phenols
- Humic acids
- Lignins
- Anthocyanins
- Azo dyes

OnGuard II P contains polyvinylpyrrolidone (PVP) polymer that has very high selectivity for phenolics, azo-containing compounds, aromatic carboxylic acids and aromatic aldehydes. The Dionex OnGuard II P is recommended for removing the phenolic fraction of humic acids, tannic acids, lignins, anthocyanins, and azo dyes from samples prior to analysis by anion or cation exchange. The OnGuard P resin has very high selectivity for iodine as the triiodide complex.

Figure 5 illustrates the decrease in absorbance of a ground water containing humic acids after treatment with an OnGuard II P.

OnGuard II RP

For the removal of:

- Surfactants
- Hydrocarbons
- High MW carboxylic acids
- Aromatic dyes
- Lipids

OnGuard II RP contains macroporous divinylbenzene resin that has a very high selectivity for hydrophobic substances, including unsaturated or aromatic organic substances. The OnGuard II RP cartridges can be used in the ion-pairing mode to remove high molecular weight ions such as surfactants. Surfactants such as sodium lauryl sulfate can be removed from samples by adding ammonium hydroxide or tetramethyl ammonium hydroxide to the sample. The OnGuard II RP is also ideal for the removal of lipids, which can foul ion-exchange columns, from food or physiological samples. Figure 6 illustrates the long-term performance of a method for the determination of iodide in milk using amperometric detection. The blank spaces in the graph correspond to injections of 2% milk and the data points show the reproducibility of iodide standards that were injected among the milk samples. The high reproducibility of

the iodide standards shows that electrode fouling was not a problem when sample pretreatment with OnGuard II RP was included in the method.

Failure to remove the fat in milk prior to anion exchange with pulsed amperometric detection also leads to high column backpressure and loss in column capacity.

Syringe Loading

By using a standard Luer-tip syringe, samples can easily be treated individually. Samples can be injected through the cartridge directly into the LC injector loop or into autosampler vials.

OnGuard Sample Prep Station

The OnGuard Sample Prep Station, shown in Figure 7, is a vacuum-driven accessory for simultaneous pretreatment of multiple samples with the OnGuard sample pretreatment cartridges. The OnGuard Sample Prep Station has individual stopcock valves for each 5-cc sample reservoir to allow control of individual flow rates.

When used with Dionex 0.5-mL PolyVials and a vacuum source, the OnGuard Sample Prep Station permits semiautomated pretreatment of up to 12 samples. Samples can be transferred directly to the AS40 Autosampler. The station also allows you to use six 10-mL volumetric flasks as sample collection containers.

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OnGuard II RP

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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 part numbers below.

OnGuard Cartridges (1-cc)

- OnGuard II A, 1-cc, pkg of 48 P/N 057091
- OnGuard II Ag, 1-cc, pkg of 48 P/N 057089
- OnGuard II Ba, 1-cc, pkg of 48 P/N 057093
- OnGuard II H, 1-cc, pkg of 48 P/N 057085
- OnGuard II Na, 1-cc, pkg of 48 P/N 062948
- OnGuard II M, 1-cc, pkg of 48 P/N 057137
- OnGuard II P, 1-cc, pkg of 48 P/N 057087
- OnGuard II RP, 1-cc, pkg of 48 P/N 057083

OnGuard Cartridges (2.5-cc)

- OnGuard II A, 2.5-cc, pkg of 48 P/N 057092
- OnGuard II Ag, 2.5-cc, pkg of 48 P/N 057090
- OnGuard II Ba, 2.5-cc, pkg of 48 P/N 057094
- OnGuard II H, 2.5-cc, pkg of 48 P/N 057086
- OnGuard II Na, 2.55-cc, pkg of 48 P/N 062962
- OnGuard II M, 2.5-cc, pkg of 48 P/N 057095

- OnGuard II RP, 2.5-cc, pkg of 48 P/N 057084
 - OnGuard II Ag/H, 2.5-cc, pkg of 48 P/N 057410
 - OnGuard II Ba/Ag/H, 2.55-cc, pkg of 48 P/N 063955
 - OnGuard II Cartridges with Multiple Resin Layers Inquire
- All OnGuard resins are available custom packed with up to three different resin layers stacked in the 2.5-cc OnGuard format.

Auto OnGuard II Barrels

..... Inquire

All OnGuard resins are available custom packed in 3-mL or 6-mL syringe-style barrels. These configurations are ideal for robotic processing.

Bulk OnGuard Resins Inquire

All OnGuard resins are available as custom orders in bulk in 50 g quantities.

OnGuard Sample Prep Station

- OnGuard Sample Prep Station P/N 039599
- OnGuard Needle, 18-gauge, 1.25 Luer P/N 039996
- OnGuard Sample Reservoir, 5-cc, pkg of 250 P/N 041233
- OnGuard Valve, Luer stopcock P/N 040896



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Dionex Corporation
1228 Titan Way
P.O. Box 3603
Sunnyvale, CA
94088-3603
(408) 737-0700

Dionex Corporation
Salt Lake City Technical Center
1515 West 2200 South, Suite A
Salt Lake City, UT
84119-1484
(801) 972-9292

Dionex U.S. Regional Offices
Sunnyvale, CA (408) 737-8522
Westmont, IL (630) 789-3660
Houston, TX (281) 847-5652
Atlanta, GA (770) 432-8100
Marlton, NJ (856) 596-06009

Dionex International Subsidiaries
Australia (61) 2 9420 5233 Austria (01) 616 51 25 Belgium (03) 3-353 42 94 Canada (905) 844-9650 China (852) 2428 3282 Denmark 36 36 90 90 France 01 39 30 01 10 Germany 06126-991-0 India 91-22-28475235,72735 Italy (06) 66 51 50 52 Japan (06) 6885-1213 Korea 82 2 2653 2580 The Netherlands (0161) 43 43 03 Switzerland (062) 205 99 66 United Kingdom (01276) 691722
* Designed, developed, and manufactured under an NSAI registered ISO 9001 Quality System.

