



Environmental

Chromatography columns and consumables

# Environmental workflow solutions

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# Complete environmental workflow solutions

For environmental scientists pursuing lower detection limits and higher robustness in their analysis, selecting the correct workflow is imperative for success in delivering high-quality results.

and provide imperative environmental data faster and more consistently. The workflows in this brochure offer a sampling from Thermo Fisher Scientific.

We strive to create a better understanding of how to compose an optimal workflow allowing scientists to improve their throughput

## Pesticides and Per- and polyfluoroalkyl substances (PFAS)

- ▶ Thermo Scientific™ HyperSep™ SPE products
- ▶ Thermo Scientific™ Accucore™ (U)HPLC columns
- ▶ Thermo Scientific™ Hypersil GOLD™ (U)HPLC columns
- ▶ Thermo Scientific™ Acclaim™ (U)HPLC columns
- ▶ Thermo Scientific™ TraceGOLD™ GC columns
- ▶ Gas chromatography (GC) parts and accessories
- ▶ Thermo Scientific™ SureSTART™ vials and caps

## Volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC)

- ▶ Solid-phase extraction products
- ▶ TraceGOLD GC columns
- ▶ GC parts and accessories
- ▶ SureSTART vials and caps

## Persistent organic pollutants (POP)

- ▶ Solid-phase extraction products
- ▶ Accucore (U)HPLC columns
- ▶ TraceGOLD GC columns
- ▶ GC parts and accessories
- ▶ SureSTART vials and caps



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## Environmental workflow solutions

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# Pesticides workflow

## U.S. EPA Method 543 on Hypersil GOLD and automated online SPE

Traditionally, the United States Environmental Protection Agency (U.S. EPA) methods for drinking water analysis have required offline solid-phase extraction (SPE) to concentrate analytes to a level that can be detected using LC-MS instrumentation. This process requires the collection of large volumes of sample that are extracted using offline SPE. Online pre-concentration and solid-phase extraction (online SPE) avoids these disadvantages by utilizing a smaller sample volume collected in the field and eliminating the manual offline SPE step. Using the LC to conduct the SPE step eliminates intra-assay variability that can arise from manual processing of samples or inconsistencies between individual SPE cartridges. Samples can be loaded onto the autosampler prior to analysis, and the experimental batch can be run with little to no user intervention. Online SPE for pesticide workflows make the application easy and automated, and the separation on Thermo Scientific™ Hypersil GOLD™ aQ and mixed-mode polar C18 columns, provide the needed retention of the pesticides.



Vanquish Flex UHPLC system



TSQ Altis Plus triple quadrupole mass spectrometer



Hypersil GOLD aQ column



HyperSep Javelin direct-connect online SPE column



SureSTART vial and cap

### Workflow solution

Thermo Scientific instruments	Cat. no.
Thermo Scientific™ Vanquish™ Flex UHPLC system	—
Thermo Scientific™ TSQ Altis™ Plus Triple Quadrupole mass spectrometer	—
Thermo Scientific columns and guard columns	Cat. no.
Hypersil GOLD aQ column	10513795
Thermo Scientific™ HyperSep™ Javelin direct-connect online SPE column	10128044
Thermo Scientific vials and caps	Cat. no.
Thermo Scientific™ SureSTART™ 0.3 mL screw vial	17314073
Thermo Scientific™ SureSTART™ 9 mm screw cap	17324063
This workflow displays the newest recommended products	



# Semi-volatiles workflow

## SVOCs detection on Trace GOLD columns

Typically, SVOCs analysis starts with a solid-phase extraction of the water samples that will concentrate the sample up to 1000 times. They are traditionally run on a polar column. In this particular case we are looking at phenols, a semi-volatile organic chemical that belongs to nitrosamines, an emerging class of drinking water contaminants.

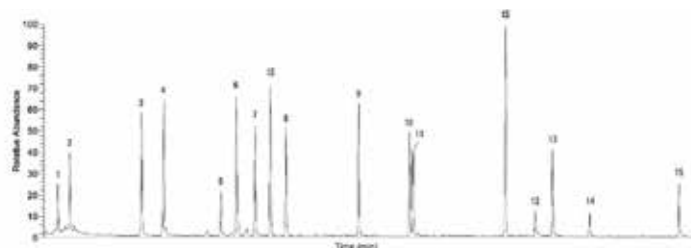


Figure 2. TIC chromatogram of 1 ng/μL of phenolic compounds separated on Thermo Scientific™ TraceGOLD™ TG-5SiIMS column



AI/AS 1610 liquid autosampler



ISQ 7610 single quadrupole GC-MS system



TraceGOLD TG-5SiIMS GC column



Super Clean gas cartridge filter



SureSTART vial and cap

### Workflow solution

Thermo Scientific instruments	Cat. no.
Thermo Scientific™ AI/AS 1610 liquid autosampler	—
Thermo Scientific™ ISQ™ 7610 single quadrupole GC-MS system	—
Thermo Scientific column	Cat. no.
TraceGOLD TG-5SiIMS GC column	10177894
Thermo Scientific GC accessories	Cat. no.
Thermo Scientific™ LinerGOLD™ GC liner	15447990
Thermo Scientific™ GC liner sealing ring	15398384
Thermo Scientific™ septa	12683166
Thermo Scientific™ fixed-needle, gas-tight syringe	10781534
Thermo Scientific™ GC injection port base seal	10219174
Thermo Scientific™ Super Clean™ gas cartridge filter	10019682
Thermo Scientific™ nut	15125256
Thermo Scientific™ ferrule	10120513
Thermo Scientific™ spring loaded transfer line nut	15392155
Thermo Scientific vials and caps	Cat. no.
Thermo Scientific™ SureSTART™ 1.5 mL screw vial	17384083
Thermo Scientific™ SureSTART™ 9 mm screw cap	17334043
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# Polar pesticides workflow

## High sensitive method for EtS and EtG in urine

Despite cultural practice modifications and pesticide residue control efforts implemented in many countries, the European Food Safety Authority reports show that pesticide contamination remains present in many plant samples. Among the 25 most frequently encountered pesticides, anionic or cationic polar pesticides are broadly identified. Facing these results, routine analysis demand is increasing; however, analyzing polar pesticides presents a difficult analytical challenge. The high polarity does not allow the direct analysis by common pesticides approach like reversed-phase HPLC. A new analytical method based on the Thermo Scientific™ Acclaim™ Trinity P1 column was developed to overcome this challenge. By competing with zwitterionic technology, this column chemistry allowed cationic and anionic polar pesticides analysis in a single run.

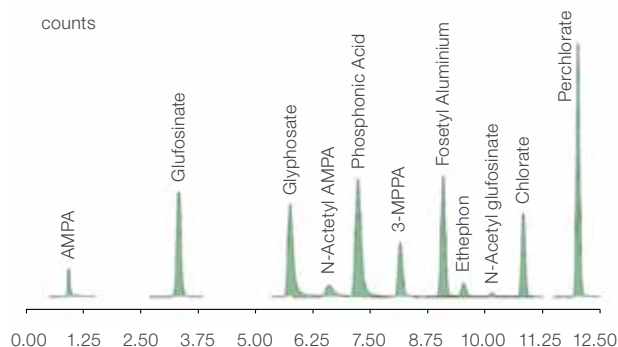


Figure 3. The typical chromatogram obtained after a 15 µL injection of 100 ppb standard solution on the Acclaim Trinity P1 column



Vanquish Flex UHPLC system



TSQ Altis Plus triple quadrupole mass spectrometer



Acclaim Trinity P1 column



Acclaim guard holder and coupler



SureSTART vial and cap

### Workflow solution

Thermo Scientific instruments	Cat. no.
Vanquish Flex UHPLC system	—
TSQ Altis Plus triple quadrupole mass spectrometer	—
Thermo Scientific columns and guard columns	Cat. no.
Acclaim Trinity P1 column	11391943
Acclaim Trinity P1 guard cartridge	11301953
Thermo Scientific™ Acclaim™ guard holder and coupler	11321933
Thermo Scientific vials and caps	Cat. no.
SureSTART 2 mL screw vial	17303923
SureSTART 9 mm screw cap	17334043
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# Volatiles workflow

## Increased separation of critical peaks

U.S. EPA Method 524.2 is widely used in routine environmental analysis laboratories to test water samples for volatile organic compounds (VOCs). The method tests for a wide range of VOCs, including the four trihalomethane disinfection by-products that have sufficiently high volatility and low water solubility, to be removed from water samples with purge and trap (P&T) procedures. Routine drinking water monitoring regulatory standards require contract testing labs to analyze for the presence of VOCs due to the potentially negative health effects associated with public water source contamination. This application represents a workflow for VOCs run on Thermo Scientific™ TraceGOLD™ TG-VMS column (20 m, 0.18 mm, 1 µm) with excellent separation of critical peaks in less than 12 min.

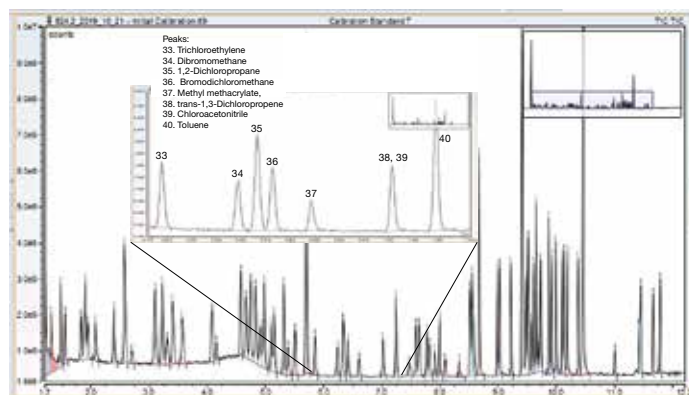


Figure 4. Total ion chromatogram (TIC) of a 5 ppb VOC standard (analyzed using the water method) with an inset indicating consistent peak shapes and separation with minimal water interference



Teledyne Tekmar Atomx XYZ automated purge and trap VOC sample preparation system



ISQ 7610 single quadrupole GC-MS system



TraceGOLD TG-VMS GC column



Super Clean gas cartridge filter



SureSTART vial and cap

### Workflow solution

Thermo Scientific instrument	Cat. no.
ISQ 7610 single quadrupole GC-MS system	—
Other instrument	Cat. no.
Teledyne Tekmar Atomx XYZ automated purge and trap VOC sample preparation system	—
Thermo Scientific column	Cat. no.
TraceGOLD TG-VMS GC column	11591154
Thermo Scientific GC accessories	Cat. no.
LinerGOLD GC liner	15438000
Septa	12683166
Fixed-needle, gas-tight syringe	10781534
GC injection port base seal	10219174
Super Clean gas cartridge filter	10019682
Nut	15125256
Ferrule	10120513
Spring loaded transfer line nut	15392155
Thermo Scientific vials and caps	Cat. no.
Thermo Scientific™ SureSTART™ EPA certified screw vial and cap kit	17363813
Thermo Scientific™ SureSTART™ 2 mL amber glass screw top vial	17303903
Thermo Scientific™ SureSTART™ 9 mm screw cap	17383863

This workflow displays the newest recommended products



# Dioxin and POPs workflow

## Very high-throughput analysis on persistent organic pollutants

To aim for high sensitivity analysis of dioxins and other POPs. The coupling of two gas chromatographs to one single mass spectrometer (MS) strongly increases its flexibility allowing for the maximum exploitation and optimum adaptation to laboratory application requirements of this high performance detection device. Dual column adapters enable the installation of two columns within one single gas chromatograph (GC). In combination with a dual GC setup two, three or a maximum of four columns can thus be connected to one single mass spectrometer. In this way the analytical system can be constantly prepared to perform different applications like PCDD/F, PCBs, PBDEs, etc. changing automatically between columns within a measurement sequence. In another approach, the latest technical developments, based on a dual GC configuration, enable to strongly increase sample throughput.

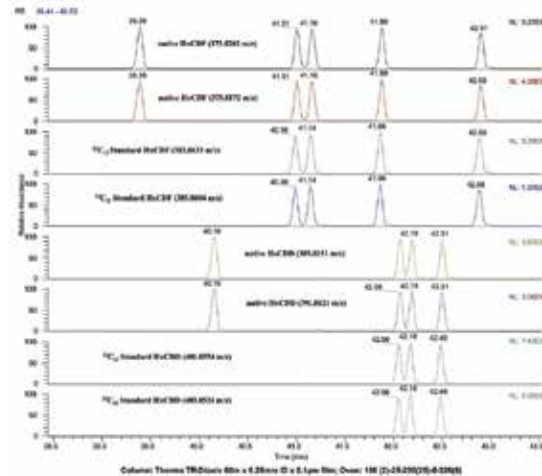


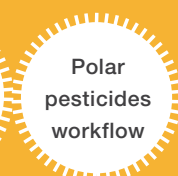
Figure 5. Example of peak integrity of dioxin trace analysis (Hexa CDD/F) using the DualData XL acquisition



### Workflow solution

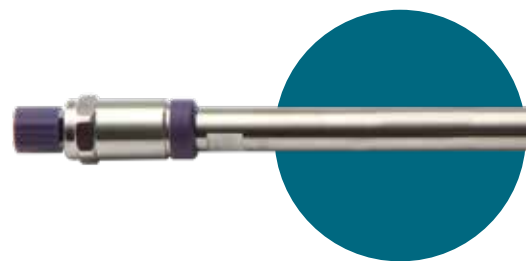
Thermo Scientific instruments	Cat. no.
Thermo Scientific™ TriPlus™ RSH SMART autosampler	—
Thermo Scientific™ TRACE™ 1600 series gas chromatograph	—
Thermo Scientific™ DFS Magnetic Sector GC-HRMS system	—
Thermo Scientific column	Cat. no.
Thermo Scientific™ TRACE™ GC column	10351335
Thermo Scientific GC accessories	Cat. no.
GC liner sealing ring	15398384
LinerGOLD GC liner	15447990
Septa	12683166
GC injection port base seal	10219174
Super Clean gas cartridge filter	10019682
Nut	15125256
Thermo Scientific™ 3-Port SilFlow™ device	15297508
Thermo Scientific™ GC SMART™ syringe	17697055
Thermo Scientific vials and caps	Cat. no.
Thermo Scientific™ SureSTART™ 0.3 mL screw vial	17314073
Thermo Scientific™ SureSTART™ 9 mm screw cap	17334063
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# HPLC columns and accessories



## Accucore RP-MS HPLC columns

Optimized for MS detection, Accucore RP-MS LC columns are an excellent combination of speed and quality of separation. Based on Core Enhanced Technology, Accucore columns provide fast, high-resolution separations—without the elevated backpressures required by sub-2  $\mu\text{m}$  particles.



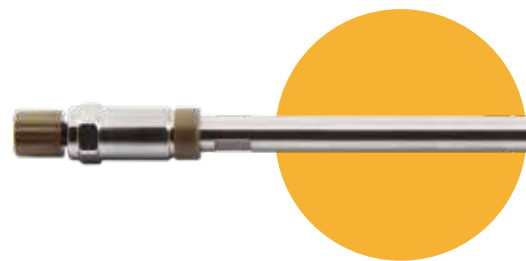
## Hypersil GOLD C18 selectivity HPLC columns

Achieve exceptional peak shape and resolution for your HPLC and LC-MS applications with Hypersil GOLD HPLC columns. These endcapped, ultrapure, silica-based columns deliver significant reduction in peak tailing using generic gradients with C18 selectivity.



## Hypersil GOLD aQ Polar Endcapped C18 columns

Retain and resolve polar analytes using Hypersil GOLD aQ Polar Endcapped C18 columns. These columns provide excellent peak shape, even with challenging reversed phase separations using highly aqueous mobile phases.



## HyperSep Javelin direct-connect online SPE columns

Clean-up and concentrate target analytes in minutes with HyperSep online SPE products. Available in several convenient formats, the columns utilize popular HyperSep SPE chemistries.



### Accucore RP-MS columns

Format	Length (metric)	Particle size	Cat. no.
HPLC column	100 mm	2.6 $\mu\text{m}$	11337531
Guard cartridge (4/pk)	10 mm	2.6 $\mu\text{m}$	11667701

### Hypersil GOLD columns

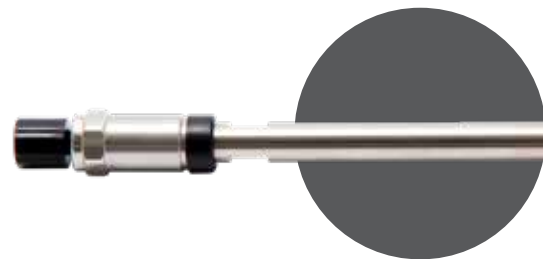
Description	Length (metric)	Particle size	Cat. no.
Hypersil GOLD C18 selectivity HPLC column	50 mm	3 $\mu\text{m}$	10424413
Hypersil GOLD aQ Polar Endcapped C18 column	50 mm	3 $\mu\text{m}$	10513795

### HyperSep Javelin direct-connect online SPE columns

Type	Unit size	Cat. no.
Online solid-phase extraction column	4	10128044

## Acclaim Trinity P1 HPLC columns

Simultaneously separate pharmaceutical drug substances and their counterions with high-efficiency Acclaim Trinity P1 LC columns. A unique trimodal surface chemistry provides concurrent reversed-phase, cation-exchange and anion-exchange functionalities for maximum flexibility in method development.



## Acclaim guard holder and coupler

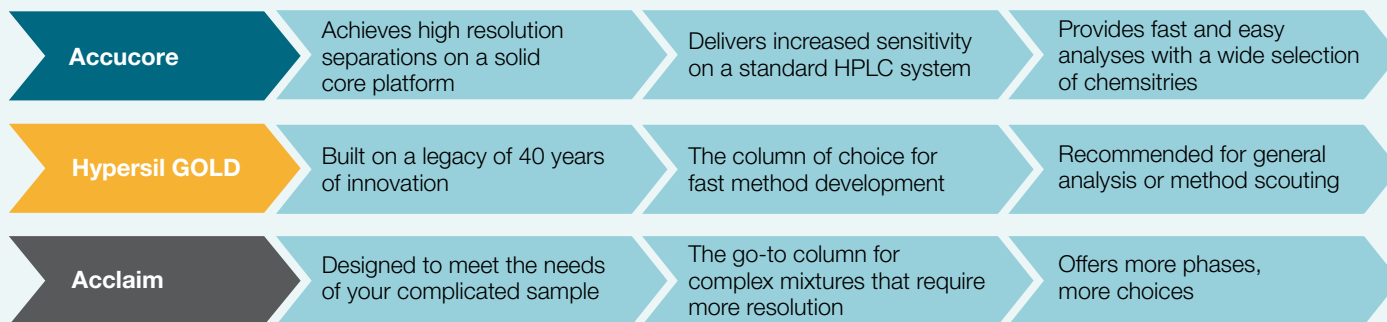
Use the Acclaim guard holder and coupler for your Acclaim guard columns. They can be purchased separately or as a kit.



### Acclaim Trinity P1 columns

Format	Length	Particle size	Cat. no.
HPLC column	100 mm	3 µm	11391943
Guard cartridge (2/pk)	10 mm	3 µm	11301953
Acclaim guard cartridge holder-coupler kit V-2			11321933

### Which Thermo Scientific columns meets your separation needs?



## TraceGOLD TG-5MS GC columns

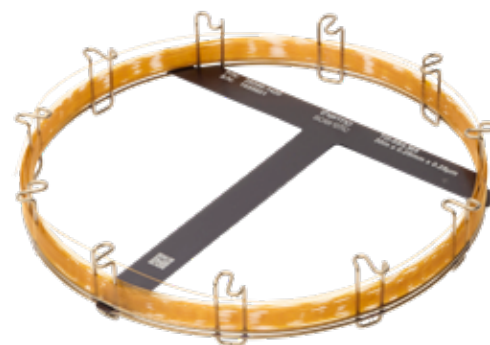
Employ the most widely used MS phase in gas chromatography with the 5% phenyl phase TraceGOLD TG-5MS GC column.

## TraceGOLD TG-5SiIMS GC columns

Thermo Scientific TraceGOLD TG-5SiIMS GC columns incorporate phenyl groups in the polymer backbone for improved thermal stability, reduced bleed, and reduced susceptibility to oxidation.

## TraceGOLD TG-VMS GC columns

Thermo Scientific TraceGOLD TG-VMS GC columns provide good resolution and fast analysis times for volatile compounds.



## TRACE GC columns for dioxin and PCB analysis

Analyze dioxins and polychlorinated biphenyls (PCBs) with custom-tailored TRACE GC columns for dioxin and PCB analysis for unsurpassed performance and reproducibility. Optimized to meet the requirements of high-resolution GC-MS methods, these columns deliver optimum performance with exceptional stability and very low bleed. These low-polarity columns provide wide coverage of the 17 congeners with the highest toxicological significance (2,3,7,8-chlorine substituted congeners).



### GC columns

Description	Length (metric)	Diameter	Film thickness	Cat. no.
TraceGOLD TG-5MS GC column	30 m	0.25 mm	0.5 $\mu\text{m}$	10408874
TraceGOLD TG-5SiIMS GC column	30 m	0.25 mm	0.25 $\mu\text{m}$	10177894
TraceGOLD TG-VMS GC column	20 m	0.18 mm	1 $\mu\text{m}$	11591154
TRACE GC column	60 m	0.25 mm	0.25 $\mu\text{m}$	10351335

# GC accessories

Semi-volatiles  
workflow

Volatiles  
workflow

Dioxin and  
POPs  
workflow

## Super Clean gas cartridge filters

Ensure high-purity (99.9999% or 6.0 grade) output gas for optimal GC performance using Super Clean gas cartridge filters. The baseplates can be configured to individual user needs, and there is no contamination during cartridge change. Easy-to-use and cost-effective, Super Clean gas cartridge filters enable fast, tool-free replacement.



## Fixed-needle, gas-tight syringes

Get durability, clarity and accuracy in GC sample introduction for confidence in analytical results, time-after-time. Thermo Scientific fixed-needle, gas-tight syringes offer an affixed needle and a plunger that creates a tight seal with the barrel.



## GC SMART syringes

Use the unique technology of GC SMART syringes as a traceable usage-based approach to GC syringe management, resulting in increased reliability, instrument up-time, confidence in the results, and full traceability.



## LinerGOLD GC liners

Use the gold standard in GC liner performance and consistency. Thermo Scientific LinerGOLD GC liners provide enhanced inertness, leading to increased accuracy, sensitivity, and precision in your GC analysis.



### GC accessories

Description	Unit size	Cat. no.
Super Clean gas cartridge filter	1	10019682
Fixed-needle, gas-tight syringe	1	10781534
GC SMART syringe	1	17627055
LinerGOLD GC liners	5	15447990 15408000

## Ferrules and nuts

Use ferrules and nuts to ensure optimal performance. They are available in different materials of various dimension to accommodate a range of instruments, columns and applications.



## GC liner sealing rings

Match the best sealing ring with the injection port liner.



## Septa

Ensure optimal performance of your GC instrument with bleed and temperature optimized Thermo Scientific™ BTO and TR-Green septa. Made of low-bleed silicone, these septa have excellent mechanical properties, are ideal for demanding GC-MS applications, and may be used reliably up to 400 °C.



## GC injection port base seals

Ensure optimal GC analysis by using exceptional sealing and inert properties of Thermo Scientific GC injection port base seals.



### GC accessories

Description	Unit size	Cat. no.
Ferrule	10	10120513
Nut	1	15392155
Retaining nut	5	15125256
GC liner sealing ring	1	15398384
Septa	50	12683166
GC injection port base seal	2	10219174

# Vials and caps



## SureSTART 0.3 mL glass screw vials

Choose SureSTART 0.3 mL glass screw top microvials, performance level 3, when you need to maximize the injection volume for <2 mL samples.



## SureSTART 1.5 mL total recovery glass snap vials and caps

Choose SureSTART 1.5 mL total recovery glass screw top microvials, performance level 3, when you need to maximize the injection volume for <2 mL samples.



## SureSTART 2 mL polypropylene screw vials

Use performance level 1 SureSTART 2 mL polypropylene screw top microvials for everyday chromatography analysis of <2 mL samples.



## SureSTART 2 mL amber glass screw vial

Choose SureSTART 2 mL glass screw top vials, performance level 2, to ensure high quality data with an uninterrupted workflow in high-throughput applications using GC, HPLC/UHPLC, and single or triple quadrupole MS systems.



## SureSTART EPA certified screw vial and cap kits

Ensure that your environmental analyses meet government regulations with our level 2 SureSTART EPA certified screw vial and cap kits.



## SureSTART 9 mm screw caps

Use SureSTART 9 mm screw caps with screw vials that have a 9 mm opening.



## 9 mm autosampler vial screw thread caps

Prevent septa push through and over- and under-tightening.



### SureSTART vials

Performance	Material	Diameter	Total volume	Usable volume	Cat. no.
Level 3	Clear glass	9 mm x 32 mm	0.3 mL	0.25 mL	17314073
Level 3	Clear glass	11 mm x 32 mm	1.5 mL	1.1 mL	17364033
Level 1	Polypropylene	9 mm x 32 mm	1.5 mL	1 mL	17303923
Level 2	Amber glass	9 mm x 32 mm	2 mL	1.5 mL	17303903
Level 2	Amber glass	24 mm x 95 mm	40 mL	—	17363813

### SureSTART caps and autosampler caps

Septum	Closure material	Thickness	Closure size	Cat. no.
Red PTFE/white silicone/red PTFE	Blue polypropylene	1 mm	9 mm	17334063
White silicone/red PTFE		1 mm	9 mm	17383863
Polypropylene	Polypropylene	—	9 mm	13246409

# Chromatography columns and consumables

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- **Buy** all your Thermo Scientific consumables in one place
- **View** account specific pricing and access web-only price promotions
- **Educational resources** available online with training courses and webinars for your applications

Find more information on SureStart products at [eu.fishersci.com/go/thermochrom](https://eu.fishersci.com/go/thermochrom)

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